THE ODISHA STATE COOPERATIVE MILK PRODUCERS' FEDERATION LTD.
D-2, SAHID NAGAR, BHUBANESWAR-751 007.
Ph No- 2546030/2540273/2540417, Fax No (0674)2540974
Web site : www.omfed.com

OMFED invites sealed Techno – Commercial offers in separate envelope from contractors having adequate experience in design, construction, fabrication, supply, erection, testing, commissioning and trial run of New Effluent Treatment Plant at the following location of OMFED on Turnkey execution basis.

SL. NO	NAME OF THE DAIRY AND LOCATION	CAPACITY OF ETP (CUM/DAY)
01.	**BHUBANESWAR DAIRY** **AT – CHANDRASEKHARPUR** **PO- MANCHESWAR RLY COLONY** **DIST - KHURDA**	600
02.	**SALAPADA DAIRY** **ANANDAPUR** **DIST - KEONJHAR**	200

Tender document can be down loaded from website www.omfed.com against payment of Rs.10,000/- + 5%VAT (or Rs.10,500/-) for each site in shape of Demand Draft drawn in favour of OMFED drawn on any Nationalized bank payable at Bhubaneswar. The tender document should be duly filled & submitted on due date along with the cost of tender paper. Bids with 1% EMD of the quoted value shall be received up to 1400 hours on 15.03.2016 & shall be opened **(Technical Bid)** on the same day at 1500 Hrs. at **above mentioned address** in presence of interested bidders . Bids without requisite EMD shall not be considered.

The pre bid meeting shall be held on dtd- **01.03.2016.** The **corrigendum/amendment** to this notice if required shall be published only in the OMFED web site and will not be published again in newspaper.

OMFED reserves the right to accept or reject any or all the tenders or part thereof without assigning any reason.

General Manager (P&D)

SECTION II

GENERAL CONDITION OF CONTRACT

DEFINITIONS & INTERPRETATIONS

1.0 In the Contract, as hereinafter defined, the following words and expressions shall have the meaning hereby assigned to them except where the context otherwise requires:

1.1 **OWNER** shall mean the client/Purchaser on whose behalf the enquiry is issued by THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR and shall include his successors and assignees, as well as his authorized representatives.

1.2 **PURCHASER** shall mean the organization who is purchasing the goods and services.

1.3 **CONSULTANT** shall mean THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR or the consultants appointed by THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR the Owner of the Project.

1.4 **OMFED** shall mean THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR.

1.5 **ENGINEER** shall mean the Engineers or any other authorized representative of the OMFED/Purchaser.

1.6 **Architect** shall mean the architect appointed by the OMFED.

1.7 **Structural Consultants** shall mean the Structural Consultants appointed by the OMFED.

1.8 **Bidder** shall mean the firm/party/individual who submits the bid against the Invitation to Bid.

1.9 **Contractor** shall mean the successful bidder whose Bid has been accepted by the OMFED and on whom a work order has been placed and shall include his heirs, legal representatives and assignees.

1.10 **Sub-Contractor** shall mean the person/firm/party named by the Contractor whom a part of the Contract has been sublet with the consent of OMFED and shall include his heirs, successors, legal representative, and assignees.

1.11 **Contract price/rate** shall mean the prices/rates of the accepted Bid.

1.12 **Contract** shall mean the articles of agreement, the conditions, the appendix, the schedule of quantities, and/or specifications attached herewith.

1.13 **Notice in writing** shall mean a notice in written, typed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered/ordinary post to the last known address or the registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

1.14 **Site** shall mean the actual place of the proposed project or any other place where work is to be executed under the Contract. It shall also include any other land allotted by the Owner for the Contractor's use.

1.15 **Month** shall mean from the beginning of a given date of a calendar month to the end of the preceding date of the next calendar month.

1.16 **Week** shall mean seven consecutive days.

1.17 **Day** shall mean a day from a midnight to midnight.

1.18 **Plant** shall mean the proposed Effluent Treatment Plant (ETP), its units, equipment, civil works, electrical works, and piping within the battery limit of the ETP under the contract.

1.19 **Award** shall mean the written acceptance of bid by the OMFED given to the successful bidder.

1.20 **Performance Security** shall mean the amount pledged with the OMFED while signing the agreement for faithful and satisfactory performance of the Contract.

1.21 **Constructional Plant** shall mean all appliances or things of whatsoever nature required in or about the execution and maintenance of the Works but does not include the materials or other things required/intended to from or forming part of the works.

1.22 **Specifications** shall mean the specification refereed to in the bid and any modification thereof or addition thereto as may from time to time be furnished or approved in writing by the OMFED.

1.23 **Drawings** shall mean drawings referred to in the specifications and any modification of such drawings approved in writing by the Engineer and such other drawings as may from time to time be furnished or approved in writing by the OMFED/Engineers/Owner.

1.24 **Temporary Works** shall mean temporary works of every kind required in or about the execution or maintenance of works.

1.25 **Permanent works** shall mean the permanent works to be executed and maintained in accordance with the Contract.

1.26 **Works** shall include both temporary works and permanent works with respect to the effluent treatment plant.

1.27 **E.T.P.** shall mean Effluent Treatment Plant covered under this tender document.

1.28 **Approved/Approval** shall mean approval in writing including subsequent written confirmation or previous verbal or written approval.

1.29 **I.S.S.** shall mean Indian Standard Specifications of Bureau of Indian standards.

1.30 **Government** shall mean the Government of India or any other State Government.

1.31 **Tender** shall mean the Bid.

1.32 **Headings and Marginal notes:**

All headings of clauses/sub clauses/ notes of these Conditions of Contract or to the Specifications or any other part of bid document are solely for the purpose of giving concise indication and not a summary of the contents thereof, and they shall never be deemed to be the part of the or be used in the interpretation or construction of the Contract.

1.33 **Singular and Plural.**

In this Contract document unless otherwise stated specifically the singular shall include the plural and vice versa wherever the context so requires.

1.34 **Cost**

The cost shall be deemed to include overhead costs whether on or off the site.

GENERAL

2.0 DUTIES AND POWER OF THE ENGINEER

2.1 The field management shall be the responsibility of the Engineer. The Engineer shall carry out such duties as taking decisions and issuing certificates and orders as specified in the Contract. The Engineer is empowered to take decisions on the following matters after approval from OMFED:

(a) Approval of subletting of any part of the works pursuant to clause 3.0 hereof:

(b) Certification of additional sums under sub-clause 24.2 hereof:

(c) Determination of an extension of time pursuant to clause 89.0 hereof:

(d) Issuance of a variation order pursuant to clause 23.0 hereof:

(e) Fixing rates or prices for the additional works executed under the Contract pursuant to clause 23.0 hereof.

CONTRACT DOCUMENT

3.0 LANGUAGE AND LAW OF CONTRACT

3.1 i) All written material and correspondence shall be in English

ii) The law to which the Contract is to be subjected and according to which the Contract is construed, shall be the law being in force in India and/or the state in India where the Contract shall be per formed.

3.2 **Documents mutually explanatory**

Except if and to the extent otherwise provided by the Contract, the provisions of the General Conditions and Special Conditions of the Contract shall prevail over those of any other documents forming part of the Contract. Several documents forming the Contract are to be taken as mutually explanatory. Should there be any discrepancy, inconsistency, error or omission in the Contracts or any of them the matter may be referred to Engineer who shall give his decisions and issue to the Contractor instructions, directing in what manner the work is to be carried out. The decision of the Engineer shall be final and conclusive and The Contractor shall carry out the work in accordance with this decision.

3.3 Works shown upon the drawing but not mentioned in the specifications or described in the specifications without being shown on the drawings shall nevertheless be held to be included in the same manner as if they had been specifically shown upon the drawings and described in the specifications.

4.0 DRAWINGS: THEIR PURPOSE AND THE CUSTODY

4.1 The contract drawings if issued shall be read together with the Contract specifications, are intended to show and explain the manner of executing the work and to indicate the type and the class of material to be used.

4.2 In case any feature of the work is not set forth in the drawings and specifications, the Contractor shall forthwith apply to the Engineer for further instructions, drawings or specifications.

4.3 The drawing shall remain in the sole custody of the Engineer, but two copies shall be issued to the Contractor free of charge. One copy of the drawings, furnished to the Contractor as aforesaid, shall be kept by the Contractor on the site and the same shall at all reasonable times be available for inspection and use by the Engineer or the Engineer's Representative and by any other person authorized by the Engineer in writing. On the completion of the Contract the Contractor shall return to the Engineer all drawings issued under the Contract.

4.4 The Contractor shall give written notice to the Engineer whenever planning or progress of the works is likely to be delayed unless any further drawings or instruction is issued by the OMFED/Engineers/Owner within a reasonable time. The notice shall include the detail of the drawings of instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

4.5 The contractor shall submit the following information, in triplicate, to the Engineer for approval within the time stipulated against each item below:

a) A general layout plan of construction plant and equipment for the execution of work within fourteen days from the date of notice to proceed with the work:

And

b) Drawings of prints showing the location of major plants and other facilities which he proposes to put up at the site, including any changes in the general layout, at least fourteen days prior to the commencement of the respective work.

5.0 FURTHER DRAWINGS AND INSTRUCTIONS

5.1 The Engineer may also authorize his representative to perform his duties and functions. The Contractor shall carry out and be bound by the same. The Engineers shall have full powers and authority to supply to the Contractor from time to time, during the progress of the works, such further drawings and instructions as shall be necessary for the proper execution of the project.

GENERAL OBLIGATIONS

6.0 CONTRACTOR'S GENERAL RESPONSIBILITIES

6.1 The Contractor shall, subject to the provisions of the Contract, and with due care and diligence, execute and maintain, and provide all labour including the supervision thereof, material, Construction Plant and all other things, whether of a temporary or permanent nature required in and for such execution and maintenance, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

6.2 The contractor shall take full responsibility for the adequate stability and safety of all site operations and methods of construction, provided that the contractor shall not be responsible, except as may be expressly provided in the Contract, for the design or specification of any Temporary Works/Permanent Works prepared by the Engineer.

7.0 CONTRACT AGREEMENT

7.1 The contractor shall be called upon so to enter into and execute Contract Agreement, in the form annexed with such modifications as may be necessary.

8.0 PERFORMANCE SECURITY

8.1 Within 30 days of the receipt of the notification of the Award of the Contract from the OMFED/Owner the successful bidder shall furnish to the OMFED/Purchaser/Owner a performance security for an amount of 5% of the Contract value, valid till the end of the warranty period.

8.2 The proceeds of the performance security shall be payable to the OMFED/Owner as compensation for any loss resulting from the Contractor's failure to complete his obligations under the Contract.

8.3 The performance security shall be denominated in Indian Rupees and shall be in any of the following forms:

a) A Demand draft drawn in favour of THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR DAIRY, payable at the place mentioned in the address of communication stated in the Invitation to Bid.
b) A Bank guarantee issued by a **Nationalized Indian Bank**. The acceptable form shall be strictly as provided in Section IX of the Bidding documents.

8.4 The bank guarantee (B.G.) shall be valid for the entire period of Contract including the Period of Maintenance. The B.G. can be initially accepted for a period of maximum 18(eighteen) months rather than completion period plus 12(twelve) months period of maintenance on written request of contractor/ bidder that this shall be extended as per terms of the contract. The validity of the bank guarantee is suitably extended in the event of extension of time of the Contract pursuant to clause no. 89 herein.

8.5 The performance security shall be released by the OMFED not later than 60 days following the date of delivery of the Maintenance certificate by the Engineer.

8.6 In the event of increase in the Contract value, in actual execution, proportionate additional performance security shall be paid by the Contractor or recovered from the subsequent payments due to the contractor.

8.7 In the event of decrease in the Contract value the performance security shall be proportionately adjusted on the completion of the work.

8.8 No interest shall be paid by OMFED for the amount deposited as Performance security with the OMFED.

9.0 SUFFICIENCY OF TENDER

9.1 The contractor shall be deemed to have satisfied himself before tendering as to correctness and sufficiency of his Tender for the Works and of the rates and prices stated in the Priced Schedule of Quantities and the Schedule of rates and prices, if any, which shall, except insofar, as it is otherwise provided in the contract, cover all his obligations under the contract and all matters and things necessary for the proper execution and maintenance of works.

10.0 CONTRACTOR'S SUPERINTENDENCE

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

representative shall receive, on behalf of the Contractor, direction and instructions from the Engineer.

11.0 CONTRACTOR'S EMPLOYEES

11.1 The Contractor shall provide and employ on the Site in connection with the execution and maintenance of the Works:

a) Only such technical assistants as are skilled and experienced in their respective fields and sub agents, foremen and leading hands as are competent to give proper supervision to the work they are required to supervise, and

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

11.2 It shall be the liability of the Contractor to remove forthwith from the works any personnel engaged by the Contractor, in or about the execution or maintenance of the works, who, misconducts himself or is incompetent or negligent in the proper performance of his duties or whose engagement is otherwise considered to be undesirable and such person shall not be again engaged upon the work. Any person so removed, by the Contractor, from the works shall be replaced, by the Contractor, as soon as possible by a competent substitute.

12.0 PATENT RIGHT AND ROYALTIES

12.1 The Contractor shall save harmless and indemnify the OMFED/Owner from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark of name or other protected rights in respect of any Constructional Plant, machine work, or material and in connection with the Works or any of them and from and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Except where otherwise specified, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other material required for the works or any of them.

LABOUR

13.0 ENGAGEMENT OF LABOUR

13.1 The Contractor shall make his own arrangements for the engagements of all labour, local or otherwise, and save insofar as the Contract otherwise provides, for the transport, housing, feeding and payment thereof. The Contractor to the extent possible and reasonable will employ staff and labour with required qualifications and experiences from sources within India.

13.2 The Owner/OMFED may at their own discretion and convenience make available at the site, land for Contractor's labour hutments, field office, godowns, workshop and assembly yard required for the execution for the Contract. The Contractor shall at his own cost construct all these temporary buildings and provide suitable water supply and sanitary arrangement approved by the Engineer.

13.3 The personnel so engaged by the Contractor shall be the employees of the Contractor and there shall exist no privities of Contract between the personnel so engaged and the OMFED/Owner.

13.4 On completion of the works undertaken by the Contractor, he shall remove all temporary buildings erected by him and have the site cleared as directed by the Engineer. If the Contractor shall fail to comply with these requirements, the Engineer may at the expenses of the Contractor remove such surplus and rubbish materials and dispose off the same as he deems fit and get the site cleared as aforesaid; the Contractor shall forthwith pay an amount of all expenses so incurred and shall have no claim in respect of any such surplus material disposed off as aforesaid. The owner reserves the right to ask the Contractor any time during the pendency of the Contract to vacate the land by giving 7 days notice without giving any reason.

13.5 Land for residential accommodation for staff and labour may be made available at the discretion of the OMFED/Engineer/owner.

13.6 The Contractor shall, so far as is reasonably practicable, having regard to local conditions, provide on the Site, to the satisfaction of the Engineers an adequate supply of drinking and other water for the use of the Contractor's staff and work people.

13.7 The contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give barter or otherwise dispose of any alcoholic liquor, or drugs or permit any such importation, sale, gift, barter or disposal by his sub contractors, agents or employees.

13.8 The Contractor shall not give, barter or otherwise dispose of to any person or person, any arms or ammunitions of any kind or permit the same as aforesaid.

13.9 The contractor shall in all dealings with labour in his employment have due regard to all recognized festivals, days of rest and religious or other customs.

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

13.11 The contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighborhood of the Works against the same. The Contractor shall be responsible to comply with the various labour laws such as Contract Labour Act (R&A), 1970, Minimum wages Act, Provident Fund Act & Rules, for the payment of wages in respect of the persons engaged by him.

13.12 The Contractor shall be responsible for observance by his sub-contractor of the foregoing provisions.

14.0 RETURNS OF LABOUR, ETC.

14.1 The contractor shall submit to the OMFED/Owner copies of the license under the Contract Labour Act, if required and obtained by the Contractor and his Provident Fund no. The Contractor shall, if required by the Engineer, also deliver to the Engineer a return in detail in such form and at such intervals as the Engineer may prescribe showing the supervisory staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information in respect of the Constructional Plant as the Engineers may require.

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

14.3 The Contractor shall in respect of labour employed by him comply with or cause to be complied with the provision of the various labour laws and rules and regulations such as Contract labour (R&A) Act, 1970, Payment of Wages Act, Minimum Wages Act, Provident Fund Act & Rules etc. applicable to them in regard to all matters provided therein and shall indemnify the OMFED/Owner in respect of all claims that may be made against the OMFED/Owner for noncompliance thereof by the Contractor.

14.4 Notwithstanding anything contained herein, the Engineer may take such actions as may be necessary for compliance of the various labour laws and recover the costs thereof from the Contractor.

14.5 In the event of the Contractor committing a default or breach of any the provisions of labour laws and rules and regulations as applicable, shall pay penalties as imposed by the statutory Authorities and shall indemnify and keep indemnified the OMFED/Owner from all such penalties and compensations.

MATERIALS AND WORKMANSHIP

15.0 MATERIALS AND WORKMANSHIP

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

15.2 All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

15.3 The cost of conducting any test ordered by the Engineer to ascertain the quality of the material and the workmanship shall be borne by the Contractor.

16.0 INSPECTION OF OPERATIONS

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

COMMENCEMENT TIME AND DELAYS

17.0 COMMENCEMENT OF WORKS

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

18.0 POSSESSION OF SITE

18.1 Save insofar as the Contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time and the order in which such portions shall be made available to him and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the OMFED/Owner will, with the Engineer's written order to commence the works, give to the Contractor possession of so much of the Site as may be required to enable the contractor to commence and proceed with the execution of the work in accordance with the programme referred to in Clause 46 hereof, if any, and otherwise in accordance with such reasonable proposals of the Contractor as he shall, by written notice to the Engineer, make and will, from time to time as the work proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the works with due dispatch in accordance with the said programme of proposals, as the case may be. If the Contractor suffers delay from the failure on the part of the OMFED/Owner to give possession in accordance with the terms of this Clause, the Engineers shall grant an extension of time for the completion of the works as, in his opinion shall be fair and the price escalation pursuant to clause 100.0 hereof provided the extended time period including the original Contract period exceeds 12 months.

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

19.0 NO NIGHT WORK

19.1 Subject to any provision to the contrary contained in the Contract, none of the Permanent Works shall, save as hereinafter provided, be carried on during the night without the permission in writing of the Engineer except when the work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the works, in which case the Contractor shall immediately advise the

Engineer. Provided always that the provisions of this Clause shall not be applicable in the case of any work, which it is customary to carry out by rotary or double shifts.

20.0 RATE OF PROGRESS

20.1 If for any reason which does not entitle the Contractor to an extension of time, the rate of progress of the works or any section is at any time, in the opinion of the Engineer, too slow to ensure completion by the prescribed time or extended time for completion, the Engineer shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary as the Engineer may approve to expedite progress so as to complete the works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer's permission to do any work at night, such permission shall not be unreasonably refused.

21.0 CERTIFICATION OF COMPLETION OF WORKS

21.1 When the whole of the Works have been virtually completed and have satisfactorily passed any final test as may be prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer accompanied by an undertaking to finish any outstanding work during the period of maintenance. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Engineer to issue a Certificate of Completion in respect of the Works. The Engineer shall on receipt of such notice either issue to the Contractor, with a copy to the OMFED/Owner, a Certificate of Completion stating the date on which, in his opinion, the Works were virtually completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the work which, in the Engineer's opinion, required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting virtual completion that may appear after such instructions and before completion of the works specified therein. The Contractor shall be entitle to receive such Certificate of Completion, or on the completion, to the satisfaction of the Engineer, of the works so specified and making good any defects so notified.

21.2 Similarly in accordance with the procedure set out in sub clause (1) of this Clause, the Contractor may request and the Engineer shall issue a certificate of Completion in respect:

a) Any section of the permanent Works in respect of which a separate time for completion is provided in the Contract and

b) Any substantial part of the Permanent Works, which has been both, completed to the satisfaction of the Engineer and occupied by the OMFED/Owner.

21.3 If any part of the Permanent Works shall have been virtually completed and shall have satisfactorily passed any final test that may be prescribed by the Contract, the Engineer may issue a Certificate of completion in respect of that part of the permanent works before completion of the whole of the Works and, upon the

issue of such Certificate, the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the Works during the Period of Maintenance.

21.4 Provided always that a Certificate of Completion given in respect of any section or part of the Permanent Works before completion of the whole shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Certificate shall expressly so state.

22.0 CONTRACTOR TO SEARCH

22.1 The Contractor shall, if required by the Engineer in writing, search under the direction of the Engineer for the cause of any defect, imperfection or fault appearing during the progress of the Works or in the Period of Maintenance. Unless such defect, imperfection fault shall be one for which the Contractor is liable under the Contract, the cost of the work carried out by the Contractor in searching as aforesaid shall be borne by the OMFED/Owner. If such defect, imperfection of fault shall be one for which the Contractor is liable as aforesaid, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case repair, rectify and make good such defect, imperfection or fault at his own expense in accordance with the provisions of Clause 66 hereof.

ALTERATIONS, ADDITIONS AND OMISSIONS

23.0 VARIATIONS

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

a) Increase or decrease the quantity of any work included in the Contract.

b) Omit any such work,

c) Change the character or quality or kind of any such work,

d) Change the levels, lines, position and dimensions of any part of the Works, and

e) Execute additional work of any kind necessary for the completion of the work,

f) Change any specified sequence, method or timing of contract or any part 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.

23.2 No such variations shall be made by the Contractor without an order in writing of the Engineer. 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 Schedule of Quantities. Provided also that if for any reason the Engineer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order and any confirmations in writing of such verbal order given by the Engineer, 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 Contractor shall within seven days confirm in writing to the Engineer and such confirmation shall not be contradicted in writing within fourteen days by the Engineer, it shall be deemed to be an order in writing by the Engineer.

24.0 VALUATION OF VARIATIONS

24.1 All extra or additional work done or work omitted by order of the Engineer shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, 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 Engineer and the contractor and in the event of non-agreement, the Engineer shall fix such rates or prices as shall, in his opinion, be reasonable and proper.

24.2 Provided that if the nature or amount of any omission or addition relative to the nature or amount of the whole of works or to any part thereof shall be such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the works is, by reason of such omission or addition, rendered inapplicable, then a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In case of disagreement the Engineer shall work out and fix the rate or the price.

24.3 In case of any class of work for which there is no such specification supplied by the Owner/OMFED as is mentioned in the tender documents such work shall be carried out in accordance with Indian Standard Specifications and if the I.S.S. do no cover the same the work should be carried out as per the standard Engineering practice subject to the approval of the Engineer.

Provided also that no increase of decrease under clause 24.1 or variation of rate or price under clause 24.2 hereof 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:-

a) By the Contractor to the Engineer of his intention to claim extra payment or a varied rate or price or

b) By the Engineer to the Contractor of his intention to vary a rate or price.

24.4 If, on certified completion of the whole of the works it shall be found that reduction or increase is greater than 25 percent of the sum named in the Letter or Acceptance, results from:

a) The aggregate effect of all Variation Orders, and

b) All adjustments upon measurement of the estimated quantities set out in the Schedule of Quantities, excluding the adjustment of price made under Clause 100.0 hereof but not from any other cause, the amount of the Contract Price shall be adjusted by such sum as may be agreed between the Contractor and the Engineer or failing agreement, fixed by the Engineer having regard to all material and relevant factor, including the Contractor's site and general overhead costs of the Contract.

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

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

PLANT, TEMPORARY WORKS AND MATERIALS

25.0 PLANT, ETC., EXCLUSIVE USE FOR THE WORKS

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

25.2 Upon completion of the Works the Contractor shall remove from the Site all the said Constructional Plant and Temporary Works remaining thereon and any unused materials provided by the Contractor.

25.3 The OMFED/Owner shall not at any time be liable for the loss of or damage to any of the said Constructional Plant. Temporary Works or material save as mentioned in Clause 50 and 92 hereof.

26.0 APPROVAL OF MATERIALS, ETC., NOT IMPLIED

26.1 The operation of Clause 25 hereof shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer.

27.0 PROGRESS

27.1 The progress of work shall be monitored in accordance with the approved work programme. The work programme drawn out soon after the award of the

Contract shall be reviewed every month and bottlenecks, if any, identified and remedial action planned and the Engineer informed accordingly.

28.0 ASSESSMENT OF WORK

28.1 The Engineer shall except as otherwise stated, ascertain and determine the quantum of work done in accordance with the approved construction drawings when he requires any part or parts to be assessed, give notice to the Contractor's authorized agent or representative who shall forthwith attend or send a qualified agent to assist the Engineer in making such assessment and shall furnish all particulars required by them. Should the Contractor not attend, or neglect or omit to send such agent, then the assessment made by the Engineer or approved by him shall be taken to be the correct assessment of work. For the purpose of quantifying such permanent work as is to be assessed by records and drawings, the Engineer shall prepare records and drawings of such work and the Contractor, as and when called upon to do so in writing, shall within fourteen days attend to examine and agree such records and drawing with the Engineer and shall sign the same when so agreed. If the Contractor does not so attend to examine and agree to such records and drawings, they shall be taken to be correct. If, after examination of such records and drawings, the Contractor does not agree to the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor shall, within fourteen days of such examination, lodge with the Engineer, for decision by the Engineer, notice in writing of the respect in which such records and drawings are claimed by him to be incorrect.

29.0 MODE OF ASSESSMENT

29.1 The works shall be assessed unit-wise, as prescribed in the specification of works notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. Wherever not specifically mentioned in the Contract, the relevant IS codes shall be applicable and binding to the Contract. Only the latest editions of all the codes of practices including all latest official amendments and revisions shall be applicable.

NOMINATED SUB-CONTRACTORS

30.0 DEFINITIONS OF "NOMINATED SUB-CONTRACTOR

30.1 All specialists, merchants, tradesmen and others executing any work or supply of goods, materials or services, who may have been or been nominated or selected or approved by the OMFED/Owner or the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to sub-let any work shall, in the execution of such work or the supply of such goods, materials or services, be deemed to be sub-Contractor employed by the Contractor and are referred to in this Contract as "nominated Sub-Contractors".

30.2 The contractor shall not be required by the OMFED/Owner or the Engineer or be deemed to be under any obligation to employ any nominated Sub-Contractor against whom the Contractor may raise reasonable objection, or who shall decline to enter into a sub- contract with the Contractor containing provisions: -

a) That in respect of the work, goods, materials or services the subject of the sub-contract, the nominated Sub-Contractor will undertake towards the Contractor the like obligations and liabilities as are imposed on the Contractor towards the OMFED/Owner by the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising in connection with any failure to perform such obligations or to fulfill such liabilities, and

b) That the nominated Sub-Contractor will save harmless and indemnify the Contractor from and against any negligence by the nominated Sub-Contractor, his agents, workmen and servants and from and against any misuse by him or them of any Constructional Plant or Temporary Works provided by the Contractor for the purpose of the Contract and from all claims as aforesaid.

30.3 If in any connection with any Provisional Sum the services to be provided include any matter of design or specification of any part of the permanent works or of any equipment or plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Sub-Contract. The nominated Sub-Contract shall specify that the nominated sub-Contractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities.

30.4 For all works executed or goods, materials, or services supplied by any nominated Sub-Contractor, they shall be included in the contract Price: -

a) The actual price paid or due to be paid by the Contractor, on the direction of the Engineer, and in accordance with the Sub- Contract;

b) The sum, if any, entered in the Schedule of Quantities for labour supplied by the Contractor in connection therewith, or if ordered by the Engineer as may be determined in accordance with Clause 24 hereof;

c) In respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provision for such is made in a special item provided in the Schedule of Quantities for such purpose.

30.5 Before issuing, under Clause 91 hereof, any certificate, which includes any payment in respect of work done or goods, materials or services supplied by any nominated Sub-Contractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials or services of such nominated Sub-Contractor have been paid or discharged by the Contractor, in default whereof unless the Contractor shall.

a) Inform the Engineer in writing that he has reasonable cause for withholding or refusing to make such payments and

b) Produce to the Engineer reasonable proof that he has so informed such nominated sub-contractor in writing.

The OMFED/Owner shall be entitled to pay to such nominated sub-contractor directly, upon the certificate of the Engineer, all payments, less retentions, provided for in the sub-contract, which the Contractor has failed to make to such nominated sub-contractor and to deduct by way of set off the amount so paid by the OMFED/Owner from any sums due or which may become due to the Contractor.

Provided always that, where the Engineer has certified and the OMFED/Owner has paid direct as aforesaid, the Engineer shall in issuing any further certificate in favour of the Contractor deduct from the amount thereof the amount so paid, direct as aforesaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

30.6 In the event of a nominated sub-contractor, as herein before defined, having undertaken towards the Contractor in respect of the work executed, or the goods, materials or services supplied by such nominated sub-contractor, any continuing obligation extending for a period exceeding that of the Period of Maintenance under the Contractor, the Contractor shall at any time, after the expiry of the Period of Maintenance, assign to the OMFED/Owner, at its request and cost the benefit of such obligation for the unexpired duration thereof.

31.0 APPROVAL ONLY BY MAINTENANCE CERTIFICATE

31.1 No certificate other than the Maintenance Certificate referred to in Clause 32 hereof shall be deemed to constitute approval of the works.

32.0 MAINTENANCE CERTIFICATE

32.1 The Contract shall not be considered as completed until a Maintenance Certificate shall have been signed by the Engineer and delivered to the OMFED/Owner stating that the Works have been completed and maintained to his satisfaction. The Maintenance Certificate shall be given by the Engineer after the expiry of the Period of Maintenance, or, if different periods of maintenance shall become applicable to different section or parts of the works, the expiry of the latest such period, of as soon thereafter as any works ordered during such period, pursuant to Clause 66 and 22 hereof, shall have been completed to the satisfaction of the Engineer and full effect shall be given to this Clause, notwithstanding any previous entry on the works or the taking possession, working or using thereof or any part thereof by the OMFED/Owner.

32.2 The OMFED/Owner shall not be liable to the Contractor for any matter or thing arising out of in connection with the Contract or the execution of the works, unless the Contractor shall have made a claim in writing in respect thereof before the issuance of the Maintenance Certificate under this Clause.

32.3 Notwithstanding the issue of the Maintenance Certificate the Contractor and, subject to clause 32.2 the OMFED/Owner shall remain liable for the fulfillment of

any obligation incurred under the provisions of the Contract prior to the issue of the Maintenance Certificate which remains unperformed at the time such Certificate is issued and, for the purpose of determining the nature and extent of any of such obligation, the Contract shall be deemed to remain in force between the parties here to.

REMEDIES AND POWERS

33.0 DEFAULT OF CONTRACTOR

33.1 If the Contractor shall become bankrupt, or have a receiving order made against him, or shall present his petition in execution levied on his goods, or if the Engineer shall certify in writing to the OMFED/Owner that in his opinion the Contractor: -

a) Has abandoned the Contract, or

b) Without reasonable excuse has failed to commence the works or has suspended the progress of the works for 28 days receiving from the Engineer written notice to proceed, or

c) Has failed to remove materials from the site or pull down and replace work for 30 days after receiving from the Engineer written notice that the said materials or work had been condemned and rejected by the Engineer under these conditions, or

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

e) Has, to the detriment of good workmanship, or in defiance of the Engineer's instruction to the contrary, sub-let any part of the Contract then the OMFED/Owner may, after giving 15 days notice in writing to the Contractor, enter upon the site and the works and expel the Contractor therefrom and without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the OMFED/Owner or the Engineer by the Contract, and may himself complete the works or may employ any other Contractor to complete the works. The OMFED/Owner or such other Contractor may use for such completion so much of the Constructional plant, temporary works and materials, which have deemed to be reserved exclusively for the execution of the works, under the provisions of the Contract, as he or they may think proper, and the OMFED/Owner may at any time, sell any of the said Constructional Plant temporary works and unused materials including invocation of bank guarantees and apply the proceeds of sale in or towards the satisfaction of any sum(s) due or which may become due to him from the Contractor under the Contract.

33.2 The Engineer shall, as soon as may be practicable after any such entry and expulsion by the OMFED/Owner, fix and determine ex-parte or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of

such entry and expulsion been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract and the value of any of the said unused or partially used materials, any Constructional Plant and any temporary works.

33.3 If the OMFED/Owner shall enter and expel the Contractor under this clause, it shall not be liable to pay to the Contractor any money on account of the Contract until the expiry of Period of Maintenance and thereafter until the costs of execution and maintenance, damages for delay in completion, if any, and all other expenses incurred by the OMFED/Owner have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum(s), if any, as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the contractor on due completion by him, then the Contractor shall, upon demand, pay to the OMFED/Owner the amount of such excess and it shall be deemed a debt due by the Contractor to the OMFED/Owner and shall be recoverable accordingly.

33.4 In such event, the OMFED/Owner shall charge 15% overhead to cover the departmental charges and the same shall be recovered from the Contractor.

33.5 No credit shall be allowed to the Contractor in case the amount spent by the OMFED/Owner for a particular item, which shall be less than the amount payable as per the tender amount.

34.0 URGENT REPAIRS

34.1 If, by reason of any accident, or failure, or other event occurring to in or in connection with the works, or any part thereof, either during the execution of works, or during the Period of Maintenance, any remedial or other work or repair shall, in the opinion of the Engineer, be urgently necessary for the safety of the works and the Contractor is unable or unwilling at once to do such work or repair, the OMFED/Owner may employ and pay other persons to carry out such work or repair as the Engineer may consider necessary. If the work or repair so done by the OMFED/Owner is work which, in the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, all expenses properly incurred by the OMFED/Owner in so doing shall be recoverable from the Contractor by the OMFED/Owner or may become due from the Contractor. Provided always that the Engineer, as the case may be, shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.

SPECIAL RISKS

35.0 NO LIABILITY FOR WAR ETC. SUBJECT TO COVERAGE OF INSURANCE.

35.1 Notwithstanding anything in the Contract contained: -

The Contractor shall be under no liability whatsoever, whether by way of indemnity or otherwise for or in respect of destruction of or damage to the works, save to work condemned under the provisions of Clause 64 hereof prior to the occurrence of any special risk hereinafter mentioned, or to property whether of the OMFED/Owner or of third parties, or for or in respect of injury or loss of life which is the consequence of any special risk as hereinafter defined. The OMFED/Owner shall indemnify and save harmless the Contractor against and from the same and against and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising there out or in connection therewith.

35.2 If the works or any material on the site, or any other property of the Contractor used or intended to be used for the purpose of the works, shall sustain destruction or damage by reason of any the said special risks the Contractor shall be entitled to payment for: -

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

b) Replacing or making good any such destruction or damage of the works:

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

35.3 Destruction, damage, injury or loss of life caused by the explosion or impact whenever and wherever occurring of any mine, bomb, shell, grenade or other projectile, missile, munitions or explosive of war, shall be deemed to be a consequence of the said special risks.

35.4 The OMFED/Owner shall repay to the Contractor any increased cost of or incidental to the execution of the work, other than such as may be attributable to the cost of reconstruction work condemned under the provisions of Clause 64 hereof, prior to the occurrence of any special risk, which is however, attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subjected however to the provisions in this clause hereinafter contained in regard to outbreak of war, but Contractor shall as soon as any such increase of cost shall come to his knowledge forthwith notify the Engineer thereof in writing.

35.5 The Special Risks are unprecedented flood, earthquake or other convulsion of nature, war, hostilities (whether war be declared or not) invasion, act of foreign enemies, the nuclear and the pressure wave risk described in clause 50 hereof, or in so far as it relates to the country in which the works are being or are to be executed or maintained, rebellion, revolution, insurrection, military or usurped power, civil work, or unless solely restricted to the employees of the Contractor or of his Sub-Contractors and arising from the Conduct of the works, riot, commotion or disorder.

35.6 If, during the currency of the Contract, there shall be an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the works, the Contractor shall,

until and unless the Contract is terminated under the provision of this Clause, continue to use best endeavors to complete the execution of the works. Provided always that the OMFED/Owner shall be entitle at any time after such outbreak of war to terminate the Contract by giving written notice to the Contractor and, upon such notice being given, this Contract shall, except as to the rights of the parties under this clause and to the operation of clause 35.8 hereof, terminate, but without prejudice to the right of either party in respect of any antecedent breach thereof.

35.7 If the Contract shall be terminated under the provision of the last preceding sub-clause the Contractor shall, with all reasonable dispatch, remove from the site all constructional plant and shall give similar facilities to his sub-Contractors to do so.

35.8 If the Contract shall be terminated as aforesaid, the Contractor shall be paid by the OMFED/Owner, as in so far as much amount or items shall not have already been covered by payments on account made to the Contractor, for all works executed prior to the date of termination at the rates and prices provided in the Contract and in addition: -

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

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

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

d) Any additional sum payable under the provision of the clauses 35.1, 35.2 and 35.4.

e) The reasonable cost of removal of construction plant under clause 35.7 and, if required by the Contractor, return thereof to the Contractor's main plant yard in his country of registration or to any other destination, at no greater cost.

f) The reasonable cost of repatriation of all the Contractor's staff and workmen employed in or in connection with the works at the time of such termination. Provided always that against any payments due from the OMFED/Owner under this sub-clause, the OMFED/Owner shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of constructional Plant and materials and any other sums which at the date of termination were recoverable by the OMFED/Owner from the Contractor under the terms of the Contract.

DESIGN, MANUFACTURE & SUPPLY OF EQUIPMENT

36.0 INSPECTION AND TESTS:

a. The OMFED/Owner or its representative shall have the right to inspect and/or test the Goods to confirm their conformity to the Contract and/or the Technical Specifications shall specify what inspections and tests the OMFED/Owner required and where they are to be conducted. The OMFED/Owner shall notify the Contractor in writing of the identity of any representatives, if retained for this purpose.

b. The inspections and test may be conducted on the premises of the Contractor or his Sub-Contractors at point of delivery and/or at the Goods final destination. Where conducted on the premises of the Contractor or his sub-Contractor(s), all reasonable facilities and assistance including access to drawings and production data shall be furnished to the inspectors at no charge to the OMFED/Owner. In case of any defects or deficiency notified by the OMFED/Owner's inspection authority, the Contractor will rectify and make good the same without delay and not proceed with further processing of such item(s) of goods without obtaining approval from the inspection authority.

c. Should any inspected or tested goods fail to conform to the Specification, the OMFED/Owner may reject them and the Contractor shall either replace the rejected goods or make all alterations necessary to meet specification requirements free of cost to the OMFED/Owner.

d. The OMFED/Owner's right to inspect, test and, where necessary, reject the Goods after the Good's arrival at the destination shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the OMFED/Owner or its representative prior to the Goods despatch.

e. Nothing in this Clause shall in any way release the Contractor from any warranty or other obligations or test upon completion under this Contract.

f. Tests upon completion

   i. The Contractor shall give to the OMFED/Owner 10 days notice of the date after which he will be ready to make the tests of completion (the Test). Unless otherwise agreed, the Tests shall take place within 10 days after the said date on such day or days, as the OMFED/Owner shall notify the Contractor.

   ii. If the OMFED/Owner fails to appoint a time after having been asked to do so, or does not attend at the time and place appointed, the Contractor shall be entitled to proceed with the Tests in his absence. The Tests shall then be deemed to have been made in the presence of the OMFED/Owner and the results of the Tests shall be accepted as accurate.

iii. If the Tests are being unreasonably delayed by the Contractor, the OMFED/Owner may give notice requiring the Supplier to make the tests within 14 days after the receipt of such notice. The Contractor shall make the test on such days within that period as the Contractor may fix and of which he shall give notice to the OMFED/Owner.

If the Contractor fails to make the Tests within 21 days the OMFED/Owner may proceed with the Tests. All tests so made by OMFED/Owner shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the Contractor's price. The test shall then be deemed to have been made in the presence of the Contractor and results of the tests shall be accepted as accurate.

iv. If the goods or any section fails to pass the test, the contractor may require such tests to be repeated on the same terms and conditions. All costs, to which the OMFED may be put to by repetition of the tests under this sub clause or subsequent sub clauses, shall be deducted from the contract price.

v. If the OMFED/Owner and the Contractor disagree on the interpretation of the test results each shall give a statement of his views to the other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence. The OMFED/Owner will review both the statements and render a final decision within a further period of Seven (7) days, which shall be binding on the Supplier.

vi. If the goods/works or any Section fails to pass the Test on the repetition thereof under sub-clause 36.iv the OMFED/Owner after due consultation with the Supplier, shall be entitled to:

- Order one further repetition of Tests under the conditions of sub-clause 36.f.iv.

- Reject the goods or a section thereof in which event the OMFED shall have the same remedies against the supplier as are provided under sub clause 36.f.xii.

- Issue a taking over certificate, if the OMFED/Owner so wishes, notwithstanding that the goods are not complete. The Contractor's price shall then be reduced by such amount as may be agreed to by the OMFED/Owner and the Contractor or failing an agreement, as may be determined by arbitration.

vii. In considering the results of tests carried out under sub- Clause xi and xiv hereof and the OMFED/Owner shall make allowances for the effect of any use of the Goods by him on the performance or other characteristics of the Goods.

viii. As soon as the Goods/works or any section thereof has passed the tests, the OMFED/Owner shall issue a certificate to that effect.

ix. The Goods/works shall be accepted by the OMFED/Owner when they have been completed in accordance with the Contract, except in minor respects that do not affect the use of the Goods for their intended purposes and having passed the tests on completion and a taking over certificate has been issued or deemed to have been issued in accordance with sub clause x hereof.

x. The Contractor may apply by notice to the OMFED/Owner for a taking over certificate not earlier than 10 days before the goods will in the Contractor's opinion be complete and ready for taking over under sub clause ix hereof.

The OMFED/Owner shall within 28 days after the receipt of the Contractor's application either;

a. Issue the taking over certificate to the Contractor stating the date on which the works were complete and ready for taking over, or

b. Reject the application giving his reasons and specifying the work required to be done by the Contractor to enable the taking over certificate to be issued.

If the OMFED/Owner fails either to issue the taking over certificate or to reject the Contractor's application within the period of 28 days it shall be deemed to have issued the taking over certificate on the last day of that period.

If the works are divided by the Contract into sections the Contractor shall be entitled to apply for separate taking over certificate for each such section.

xi. OMFED/Owner shall not use any part of the goods unless taking over certificate has been issued in respect thereof.

If nevertheless, OMFED/Owner uses any part of the Goods that part which is used shall be deemed to have been taken over at the date of such use. OMFED/Owner shall on request of the Contractor issue a taking over certificate accordingly. If OMFED/Owner uses any part of the goods before taking over, the Contractor shall be give the earliest opportunity of taking such steps as may be necessary to carry out the tests on completion.

xii. If the Contractor fails to remedy a defect or damage pointed out by the OMFED/Owner within a reasonable time the OMFED/Owner may fix a final time for remedying the defect or damage.

If the Contractor fails to do so, OMFED/Owner may:

a. Carry out the work itself or by others at the Contractor's risk and cost, provided that he does so in a reasonable manner. The costs properly incurred by the OMFED/Owner in remedying the defect or

damage shall be deducted from the contract price, but the Contractor shall have no responsibility for such work, or

b. Require the Contractor to grant the OMFED/Owner a reasonable reduction in the Contract price to be agreed or fixed by arbitration or

c. If the defect or damage is such that the OMFED/Owner has been deprived of substantially the whole of the benefits of the goods or a part thereof, it may terminate the contract, in respect of such parts of the goods as can not be put to intended use. The OMFED/ Owner shall, to the exclusion of any remedy be entitled to recover all sums paid in respect of such parts of the goods together with the cost of dismantling the same, clearing the site and returning plant to the Contractor or otherwise disposing it in accordance with the Contractor's instructions.

xiii. If the defect or damage is such that repairs can not be expeditiously carried out on the site, the Contractor may with the consent of OMFED/Owner remove from the site for the purpose of repair any part of the works which is defective or damaged, after furnishing suitable guarantee as may be prescribed by the OMFED/Owner.

xiv. If the replacement or renewals are such that they may affect the performance of the works, the OMFED/Owner may request that the test on completion be repeated to the extent necessary. The request shall be made by notice within 28 days after the replacement or renewal. The tests shall be carried out in accordance with sub-clauses i & iii hereof.

xv. Until the final certificate of commissioning has been issued, the Contractor shall have the right of access to all part of the Goods and to the records of the working and performance of the Goods/works.

Such right of access shall be during the normal working hours of OMFED/Owner at the Contractor's risk and cost. Access shall also be granted to any duly authorized representative of the Contractor whose name has been communicated in the writing to the Contractor.

Subject to OMFED/Owner approval, the Contractor may also at his own risk and cost make any test, which he considers desirable.

xvi. The Contractor shall not be liable for any defect resulting from designs furnished or specified by the OMFED/Owner.

xvii. The Contractor shall, if required by the OMFED/Owner in writing, search for the cause of any defect, under the directions of the OMFED/Owner. Unless the defect is one for which the Contractor is liable under this clause, the cost of the work carried out by the Contractor in searching for the cause of the defect shall be added to the Contract Price.

Nothing in the clause shall in any way relieve the Contractor from any warranty or any other obligations under this contract.

37.0 PACKING AND FORWARDING

37.1 The Contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to temperature, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods final destination and the absence of heavy handling facilities at all points in transit.

37.2 The packing, marking and documents within and outside the package shall comply strictly with such special requirements as shall be expressly provided for in the Contract and, subject to Clause 37.3, and any subsequent instructions give by the OMFED/Owner.

37.3 Each package shall be marked to indicate:

a) Name of The Contractor
b) Details of items in the
c) Name of the Consignee
d) Purchase Order number
e) Gross, net and tare package. Weights of the item
f) Destination

38.0 DELIVERY AND DOCUMENTS

38.1 Delivery of the Goods shall be made by the Contractor in accordance with the terms specified by the OMFED/Owner in the Schedule of Requirements and the Special Conditions of Contract.

39.0 INSURANCE

39.1 The contractor shall be entirely responsible for insurance as per clause 14.0 of Section - III (Special conditions of contract).

39.2 The contractor shall provide a copy of the insurance policy.

39.3 In the event of any losses or damages, the Contractor shall,

a. Initiate and pursue claim till settlement, and

b. Promptly make arrangements for repairs and/or replacement of any damaged item/s irrespective of settlement of claim by the underwriters.

40.0 TRANSPORTATION:

40.1 The Contractor is required under the Contract to deliver the Goods at Project site, as specified in the Section - I (Instruction to the bidders). Transport of the Goods to the destination shall be arranged and paid for by the Contractor, and the cost thereof shall be included in the Contract Price.

40.2 Where the Contractor is required to effect delivery under other terms, for example, by post or to another address in the country, the Contractor shall be required to meet all transport and storage expenses until delivery.

41.0 INCIDENTAL SERVICES

41.1 As specified in the Special Conditions of Contract and the Schedule of Requirement, the Contractor may be required to provide any or all of the following services;

a. Performance or supervision of on site assembly and/or start up the supplied Goods;

b. Furnishing of tools required for assembly and/or maintenance of the supplied goods;

c. Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;

d. Operation or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Contractor of any **Warranty obligations** under this Contract:

e. Conduct training of the OMFED/Owner's personnel, at the Contractor's plant and/or site, in assembly, start up operation, maintenance and/or repair of the supplied Goods.

42.0 SPARE PARTS

42.1 As specified in the Special Condition of Contract, the Contractor may be required to provide any or all of the following materials and notifications pertaining to spare parts manufactured or distributed by the Contractor:

a. Such spare parts as the OMFED/Owner may select to purchase from the Contractor provided that this selection shall not relieve the Contractor of any Warranty obligations under the contract: and

b. In the event of termination of production of the spare parts:

i. Advance notification to the OMFED/Owner of the pending termination, in sufficient time to the OMFED/Owner to procure his needed requirements; and

ii. Following such termination, furnishing at no cost to the OMFED/Owner, the blueprints, drawings and specifications of the spare parts, if and when requested.

43.0 WARRANTY/GUARANTEE FOR GOODS

43.1 The Contractor warrants that the Goods supplied under the Contract are new, unused, of the most recent or current models and incorporate all recent

improvements in design and materials unless provided otherwise in the Contract. The Contractor further warrants that the Goods supplied and services performed under this Contract shall have no defect arising from design, materials or workmanship (except insofar as the design or material is required by the OMFED/Owner's specifications) or from any act or omission of the Contractor, that may develop under normal use of the supplied Goods in the conditions obtaining in the country of final destination. The Contractor also guarantees that the Goods supplied shall perform satisfactorily as per the designed/rated/installed capacity as provided for in the Contract.

43.2 This warranty/guarantee shall remain valid for the entire defects liability period.

43.3 The OMFED/Owner promptly notify the Contractor in writing of any claims arising under this warranty.

43.4 Upon receipt of such notice, the Contractor shall, with all reasonable speed, repair or replace the defective Goods or parts thereof, without costs to the OMFED/Owner.

43.5 If the contractor, having been notified, fails to remedy the defect(s) within a reasonable period, the OMFED/Owner may proceed to take such remedial action as may be necessary, at the contractor's risk and expense and without prejudice to any other rights which the OMFED/Owner may have against the Contractor under the Contract.

43.6 This warranty/guarantee shall not cover any damage/s resulting from normal wear and tear or improper handling by the OMFED/Owner or his authorized representatives.

CIVIL WORKS

44.0 INSPECTION OF SITE

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

45.0 WORK TO BE TO THE SATISFACTION OF ENGINEER

45.1 The Contractor shall execute and maintain the Works in strict accordance with the Contract to the satisfaction of the Engineer and shall comply with and adhere strictly to the Engineer's instructions and directions on any matter whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions and directions only from the Engineer.

46.0 PROGRAMME TO BE FURNISHED

46.1 The Contractor shall after the acceptance of his Tender, submit to the Engineer for his approval a programme showing the order of procedure in which he proposes to carry out the Works. The Contractor shall whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of works.

46.2 If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the approved programme referred to in sub-clause 46.1 of this Clause, the Contractor shall produce, at the request of the Engineer, a revised program showing the modifications to the approved programme necessary to ensure completion of the Works within the time for completion as defined in Clause 88 hereof.

46.3 The submission to and approval by the Engineer of such programme or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

46.4 The programme shall be reviewed every 15 days, revised and shall include a chart of the principal quantities of work forecast for execution fortnightly and a schedule of payments expected to be made to the Contractor by the OMFED/Owner.

47.0 SETTING-OUT

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

48.0 BORE HOLES AND EXPLORATORY EXCAVATION

48.1 If, at any time during the execution of the Works, the Engineer shall require the Contractor to make bore holes or to carry out exploratory excavation, such requirement shall be ordered in writing and shall be deemed to be an addition ordered under the provision of Clause 23 hereof, unless a provisional sum in respect of such anticipated works shall have been included in Schedule of Quantities.

49.0 WATCHING AND LIGHTING

49.1 The Contractor shall in connection with the works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or required by the Engineer, for the protection of the Works, or for the safety and convenience of the public or others.

50.0 CARE OF WORKS

50.1 From the commencement of the Works until the date stated in the Certificate of Completion for the whole of the Works pursuant to Clause 21 hereof the Contractor shall take full responsibility for the care thereof. Provided that if the Engineer shall issue a Certificate of Completion in respect of any part of the Permanent Works the Contractor shall cease to be liable for the care of that part of the Permanent Works from the date stated in the Certificate of Completion in respect of that part and responsibility for the care of that part should pass to the Owner/OMFED. Provided further that the Contractor shall take the full responsibility for the care of any outstanding work, which he shall have undertaken to finish during the Period of maintenance until such outstanding work is completed. In case any damage, loss or injury shall happen to the Works, or to any part thereof, from any cause whatsoever, save and except the excepted risks as defined in clause 50.3 while the Contractor shall be responsible for the care thereof the Contractor shall, at his own cost, repair and make good the same, so that at completion the Permanent Works shall be in good order and condition and in conformity in every respect with the requirements of the Contract and the Engineer's instructions. In the event of any such damage, loss or injury happening from any of the excepted risks, the Contractor shall, if and to the extent required by the Engineer and subject always to the provision of Clause 65 hereof, repair and make good the same as aforesaid at the cost of the OMFED/Owner. The Contractor shall also be liable for any damage to the works occasioned by him in the course of any operation carried out by him for the purpose of completing any outstanding work or complying with his obligations under Clause 66 or 22 hereof.

50.2 The Contractor shall not demolish, remove or alter the structures, trees or other facilities on the site without the prior approval of the Engineer.

50.3 **Excepted Risks**

The "excepted risks" are war, hostilities (whether war be declared or not), invasion, act of foreign enemies, rebellion, revolution insurrection or military or usurped power, civil war, or unless solely restricted to employees of the Contractor or of his sub-contractors and arising from the conduct of the Works, riot, commotion or disorder, or a cause solely due to the Engineer's design of the Works, or ionizing radiations or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive, nuclear assembly or nuclear component thereof, pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds, or any such operation of the forces of nature as an experienced Contractor could not foresee, or reasonably make provision for or insure against all of which are herein collectively referred to as "the excepted risks".

51.0 INSURANCE OF WORKS

51.1 Without limiting his obligations and responsibilities under Clause 50 hereof, the Contractor shall prior to the commencement of the Works insure in the joint names of the OMFED/Owner and the Contractor against all loss or damage from whatever cause arising, other than the excepted risks, for which he is responsible under the terms of the Contract and in such manner that the OMFED/Owner and the Contractor are covered for the period stipulated in Clause 50.1 hereof and are also covered during the Period of Maintenance for loss or damage arising from a cause, occurring prior to the commencement of the Period of maintenance, and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clause 66 and 22 hereof :-

a) The Works for the time being executed to the estimated current Contract value thereof plus 10 percent thereon to allow for any additional costs and professional fees resulting from the loss or damage.

b) The Constructional Plant and other things brought on to the Site by the Contractor to the replacement value of such Constructional Plant and other things.

c) It shall be the responsibility of the Contractor to notify the insurer of any change in nature and extent of the Works and to ensure the adequacy of the insurance cover at all times in accordance with the provisions of this Clause.

Such insurance shall be effected with an insurer and the Contractor shall, produce to the Engineer/OMFED the policy or policies of insurance and the receipts for payments of the current premiums.

52.0 DAMAGE TO PERSONS AND PROPERTY

52.1 The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the OMFED/Owner against all losses and claims in respect of injuries or damage to any person or materials or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance of the Works and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation or damages for or with respect to :

a) The permanent use or occupation of land by the works or any part thereof.

b) The right of the OMFED/Owner to execute the Works or any part thereof on over, under or through any land.

c) Injuries or damage to persons or property which are the unavoidable result of the execution or maintenance of the Works in accordance with the Contract.

d) Injuries or damage to persons or property directly resulting from any act or neglect of the Engineer or other Contractors, not being employed by the Contractor, or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the

injury or damage was contributed to by the Contractor, his servants or agents such part of compensation as may be just and equitable having regard to the extent of the responsibility of the Engineer or other Contractors for the damage or injury.

52.2 The OMFED/Owner shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the proviso to sub-clause (1) of this Clause.

53.0 THIRD PARTY INSURANCE

53.1 Before commencing the execution of the Works the Contractor, but without limiting his obligations and responsibilities under Clause 52 hereof, shall insure against to liability for any material or physical damage, loss or injury which may occur to any property, including that of the owner/OMFED or to any person, including any employee of the owner/OMFED, or by arising out of the execution of Works or in the carrying out of the Contract, otherwise than due to the matters referred to in the proviso to Clause 52.1 hereof.

53.2 Such insurance shall be effected with an insurer for at least the amount stated in the Appendix to the Tender. The Contractor shall, produce to the Engineer/OMFED the policy or policies of insurance and receipts for payment of the current premiums.

53.3 The terms shall include a provision whereby, in the event of any claim in respect of which the Contractor would be entitle to receive indemnity under the policy being brought or made against the OMFED/Owner, the insurer will indemnify the OMFED/Owner against such claims and any costs, charges and expenses in respect thereof.

53.4 Such insurance shall be for an amount not less than Rs.1,00,000/- per occurrence, with the number of occurrences unlimited.

54.0 ACCIDENT OR INJURY TO WORKMEN

54.1 The OMFED/Owner shall not be liable for or in respect of any damages or compensation payable at law in respect of or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub- Contractor. The Contractor shall indemnify and keep indemnified the OMFED/Owner 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. Where any case is instituted against the OMFED/Owner, the Contractor shall imply himself as a party as if the case has been instituted against the Contractor.

54.2 The Contractor shall insure against such liability with an insurer and shall continue such insurance during the whole of the time that any persons are employed by him on the Works and shall, produce to the Engineer/OMFED such policy of insurance and the receipts for the payment of the current premium. Provided always that, in respect of any persons employed by any sub-contractor, the Contractor's obligation to insure as aforesaid under this sub-clause shall be

satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that the OMFED/Owner is indemnified under the policy, but the Contractor, shall require such sub-contractor to produce to the Engineer/OMFED such policy of insurance and receipt for the payment of the current premium.

54.3 **Employee State Insurance (ESI) Act**

The Contractor shall accept full and exclusive liabilities for the compliance with all obligations imposed by the ESI Act 1948, and the Contractor shall further defend indemnify and hold the owner/OMFED harmless from any liabilities or penalties which may be imposed by the Central, state or local authorities by reason of any asserted violation by the Contractor or sub- contractor of the ESI Act, 1948 and also from all claims, suits or proceedings that may be brought against the Owner/OMFED arising under, growing up or by reason of the work provided for by this Contract whether brought by the employees of the Contractor, by the third parties, or by Central or State Govt. authorities or any political subdivision thereof. The Contractor shall fill in with the ESI the declaration form and all other forms which may be required in respect of the Contractor's or sub contractor's employees, who are employed for the works provided for or those covered by ESI from time to time under the agreement. The Contractor shall deduct and secure the agreement of the sub- contractor and deduct the employee's contribution as per the first schedule of the ESI Act from wages and affix the employee's contribution cards at wages payment intervals. The Contractor shall remit and secure that agreement of the sub-contractor to remit, the employees contribution as required by the Act. The Contractor shall maintain all codes and records as required under Act in respect of the employees and payment and the Contractor shall secure the agreement of the sub-contractor to maintain such records. Any expense incurred for the contribution or maintaining records shall be to the Contractor's account.

The Owner/OMFED shall retain such amount as may be necessary from the total Contract value until the Contractor shall furnish satisfactory proof that the whole contribution as required by the ESI Act have been paid.

54.4 Providend Fund & Misc. Provisions Act

The contractor shall discharge liabilities under the Employees Providend Fund & Misc. Provisions Act, 1952 & Rules made there under in respect of its establishment for fulfillment of contractual obligations with OMFED. In the event of failure of the contractor or to discharge the liabilities under the above said Act, then the contractor shall defend the proceedings, if any, so brought out against OMFED and consequently bear the cost of such litigation and penalties imposed for such failure by the contractor.

55.0 REMEDY ON CONTRACTOR'S FAILURE TO INSURE

55.1 If the Contractor shall fail to effect and keep in force the insurances referred to in Clauses 51, 53 and 54 hereof, or any other insurance which he may be required

to effect under the terms of the Contract, then and in any such case the OMFED/Owner may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the OMFED/Owner as aforesaid fro any payment due or which may become due to the Contractor, or recover the same as a debt to the Contractor, or recover the same as a debt due from the Contractor.

56.0 GIVING OF NOTICES AND PAYMENT OF FEES

56.1 The Contractor shall give all notices and pay all fees required to be given or paid by any National or State Statute, Ordinance, or Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution of the Works and by the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works.

56.2 The Contractor shall conform in all respects with the provision of any such Statute, Ordinance or Law as aforesaid and the regulations or bye laws of any local or other duly constituted authority which may be applicable to the Works and with such rules and regulations of public bodies and companies as aforesaid and shall keep the OMFED/Owner indemnified against all penalties and liability of every kind for breach of any such Statute, Ordinance, Law, regulation or bye law.

56.3 The OMFED/Owner will repay or allow to the Contractor all such sums as the Engineer/OMFED shall certify to have been properly payable and paid by the Contractor in respect of such fees.

57.0 FOSSILS ETC.

57.1 All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site of the Works shall as between the OMFED/Owner and the Contractor be deemed to be the absolute property of the OMFED/Owner. The Contractor shall take precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall immediately upon discovery thereof and, before removal, acquaint the Engineer of such discovery and carry out the Engineer's orders as to the disposal of the same.

58.0 INTERFERENCE WITH TRAFFIC AND ADJOINING PROPERTIES

58.1 All operations necessary for the execution of the Works shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with the convenience of the public, or the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the OMFED/Owner or of any other person. The Contractor shall save harmless and indemnify the OMFED/Owner in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters in so far as the Contractor is responsible therefore.

59.0 EXTRAORDINARY TRAFFIC

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

59.2 Should it be found necessary for the Contractor to move one or more loads of Constructional Plant, machinery or pre constructed units or parts of units of work over a part of a highway or bridge, the moving whereof is likely to damage any highway or bridge unless special protection or strengthening is carried out, then the Contractor shall before moving the load on to such highway or bridge give notice to the concerned authority of the weight and other particulars of the load to be moved and his proposals for protecting or strengthening the said highway or bridge and obtain approval from that concerned authority at his own cost. He shall keep the Engineer informed of the action taken.

59.3 If during the execution of the Works or at any time thereafter the Contractor shall receive any claim arising out of the execution of the Works in respect of damage or injury to highways or bridges he shall immediately report the same to the Engineer and thereafter shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the OMFED/Owner in respect thereof and in respect of all claims, proceeding, damages, costs, charges and expenses in relation thereto.

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

60.0 OPPORTUNITIES FOR OTHER CONTRACTORS

60.1 The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to any other Contractors employed by the OMFED/Owner and their workmen and to the workmen of the OMFED/Owner and of any other duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract of any Contractor which the OMFED/Owner may enter into in connection with or ancillary to the Works. If, however, the Contractor shall, on the written request of the Engineer, make available to any such other Contractor, or to the OMFED/Owner or any such authority, any roads or ways for the maintenance of which the Contractor is responsible, or permit the use by any of the Contractor's scaffolding or other plant on the Site, or provide any other service of whatsoever nature, the OMFED/Owner shall pay to the Contractor in respect of such use or service such sum or sums as shall, in the opinion of the Engineer, be reasonable.

61.0 CONTRACTOR TO KEEP SITE CLEAR

61.1 During the progress of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstructions and shall store or dispose off any Constructional Plant and surplus materials and clear away and remove from site any wreckage, rubbish or temporary works no longer required.

62.0 CLEARANCE OF SITE ON COMPLETION

62.1 On the completion of the Works the Contractor shall clear away and remove from the Site all Constructional Plant surplus materials, rubbish and temporary Works of every kind, and leave the whole of the Site and Works clean and in a workman like condition to the satisfaction of the Engineer.

63.0 EXAMINATION OF WORK BEFORE COVERING UP

63.1 No work shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The Contractor shall give due notice to the Engineer whenever such work or foundation is or are ready and the Engineer shall, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

63.2 The Contractor shall uncover any part or parts of the Works or make openings in or through the same as the Engineer may from time to time direct and shall reinstate and make good such part or parts to the satisfaction of the Engineer. If any such part or parts have been put out of view after compliance with the requirement of clause 63.1 and are found to be executed in accordance with the Contract, the expenses of uncovering, making opening in or through, reinstating and making good the same shall be borne by the OMFED/Owner, but in any other case all costs shall be borne by the Contractor.

64.0 REMOVAL OF IMPROPER WORK AND MATERIALS

64.1 The Engineer shall during the progress of the Works have power to order in writing from time to time.

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

b) The substitution of proper and suitable materials

And

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

64.2 In case of default on the part of the Contractor in carrying out such order, the OMFED/Owner shall be entitle to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the OMFED/Owner or may be deducted by the OMFED/Owner from any payment due or which may become due to the Contractor.

65.0 SUSPENSION OF WORK

65.1 The Contractor shall, on the written order of the Engineer, suspend the progress of the works or any part thereof for such time or times and in such manner as the Engineer may consider necessary and shall during such suspension properly protect and secure the work, so far as is necessary in the opinion of the Engineer. The extra cost incurred by the Contractor in giving effect to the Engineer's instructions under this Clause shall be borne and paid by the OMFED/Owner unless such suspension is:

a) Otherwise provided for in the Contract, or

b) Necessary by reasons of some default on the part of the Contractor, or

c) Necessary by reason of climatic conditions on the Site, or

d) Necessary for the proper execution of the works or for the safety of the Works or any part thereof insofar as such necessity does not arise from any act or default by the Engineer or the OMFED/Owner or from any of the excepted risks defined in Clause 50 hereof.

Provided that the Contractor shall not be entitled to recover any such extra cost unless he gives written notice of his intention to claim to the Engineer within fifteen days of the Engineer's order. The Engineer shall settle and determine such extra payment and/or extension of time under Clause 44 hereof to be made to the Contractor in respect of such claim as shall, in the opinion of the Engineer, be fair and reasonable.

65.2 If the progress of the Works or any part thereof is suspended on the written order of the Engineer and if permission to resume work is not given by the Engineer within a period of ninety days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) or sub-clause 39.1 of this contract, the Contractor may serve a written notice on the Engineer requiring permission within twenty-eight days from the receipt thereof to proceed with the Works, or that part thereof in regard to which progress is suspended and, if such permission is not granted within the time, the Contractor by a further written notice so served may, but is bound to, elect or treat the suspension where it affects only part of the Works as an omission of such part under Clause 22 hereof, or, where it affects the whole Works, as an abandonment of the Contract by the OMFED/Owner.

MAINTENANCE AND DEFECTS
(DEFECT LIABILITY)

66.0 DEFINITION OF PERIOD OF MAINTENANCE

66.1 In these Conditions the expression "Period of Maintenance" shall mean the period of maintenance named in the Appendix to the tender, calculated from the date of the completion of the Works, certified by the Engineer in accordance with Clause 21 hereof, or, in the event of more than one certificate having been issued by the Engineer under the said Clause, from the respective dates so certified and in relation to the Period of Maintenance the expression "the Works" shall be construed accordingly.

66.2 To the intent that the Works shall at or as soon as practicable after the expiry of the period of Maintenance be delivered to the OMFED/Owner in the Condition required by the contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall finish the work, if any, outstanding at the date of completion, as certified under the clause 21 hereof, as soon as practicable after which date and shall execute all such work of repair, amendment, reconstruction, rectification and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Engineer during the Period of Maintenance, or within fifteen days after its expiry as a result of an inspection made by or in behalf of the Engineer prior to its expiry.

66.3 All such work shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer, be due to the use of materials or workmanship not in accordance with the Contract, or to neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.

66.4 If the Contractor shall fail to do any such work as aforesaid required by the Engineer, the OMFED/Owner shall be entitled to employ and pay other persons to carry out the same and if such work is work which in the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the OMFED/Owner or may be deducted by the OMFED/Owner from any payment due or which may become due to the Contractor.

67.0 INSPECTION & TESTS

a. The Owner/OMFED and his representatives shall have full power and authority to inspect the works at any time wherever the work is in progress either on the site or at the Contractor's premises/workshop wherever situated, premises/workshop of any person, firm or corporation where the work in connection with the Contract may be in hand or wherefrom materials are being produced or are to be supplied, and the Contractor shall afford or procure for the Engineer every facility and assistance to carry out such inspection. The Contractor shall at all times during usual working hours and at all other times at which reasonable notice of the intention of the Engineer or the Engineer's Representative to visit the works shall have been given to the Contractor, either himself be present to receive the orders and instructions, or have a responsible agent/representative duly accredited in writing present for the purpose. Orders given to the Contractor's agent/representative shall be considered to have the same force as if they had been given to the Contractor himself. The Contractor shall give not less

than three days notice in writing to the Engineer's Representative before covering up or otherwise placing beyond the reach of inspection and measurement, any work in order that the same may be inspected and measured. In the event of breach of the above the same shall be uncovered at the Contractor's expenses for carrying out such measurement or inspection.

b. No materials shall be removed from the Site before obtaining the approval in writing of the Engineer. The Contractor is to provide at all times during the progress of the work and the maintenance period proper means of access with ladders, gang ways, etc. and the necessary attendance to move and adopt as directed for inspection or measurement of the works by the Engineer's Representative.

c. The Contractor shall make available to the Engineer's Representative free of cost all necessary instruments and assistance in checking of setting out of works and checking of any works made by the Contractor for the purpose of setting out and taking measurements of works.

ERECTION & COMMISSIONING OF EQUIPMENT

68.0 SUFFICIENCY OF TENDER

The Contractor 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 works, as to the general labour position at site and to have determined the prices accordingly.

69.0 PROGRAMME OF INSTALLATION AND COMMISSIONING

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

70.0 PREPARATION OF DRAWINGS FOR APPROVAL

The Contractor 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 civil construction works involved in the project.

The Contractor shall submit to the OMFED/Owner for approval:

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

b) During the progress of works and within such reasonable times as the OMFED/Owner may require such drawings of the general arrangement and details of the works as the OMFED/Owner may require.

The specifications/conditions concerning the submission of drawings by the Contractor are detailed as under:

a. Within four weeks from the date of receipt of the order, Contractor shall furnish a list of all necessary drawings as briefly described below which the Contractor shall submit for approval, identifying each drawings by a serial number and descriptive title and expected date of submission. This list shall be revised and extended if necessary, during the progress of work depending on the nature of the contract.

   The OMFED/Owner shall signify his approval or disapproval of all drawings or such drawings that would affect progress of the contract as per the agreed programme.

Brief list of drawings:

i. Equipment drawings for fabricated items.

ii. Architectural & structural drawings for all civil structures.

iii. Interconnecting piping & valve layouts for different ETP units.

iv. Electrical cables, conduit/cable tray, push button station layout.

v. Other miscellaneous drawing as required for erection work.

vi. Site plan showing all units & pathway details.

vii. Hydraulic flow diagram.

viii. Any other drawing as per requirement of the engineer.

Drawings showing fabrication details dimensions, layouts and bill of materials submitted for approval shall be signed by responsible representative of Contractor 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 Contractor's name:

i. Name of the Consultant
ii. Name of the Owner
iii. Project title
iv. Title of drawing
v. Scale
vi. Date of drawing
vii. Drawing 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 up-dated.

All dimensions on drawings shall be in metric units.

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

Drawings prepared by the Contractor and approved by the OMFED/Owner shall be considered as a part of the specifications. However, the examination of the drawings by the OMFED/Owner shall not relieve the Contractor 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 Contractor 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 then the date of submission of the revised drawings would be considered as the date of submission for approval.

The contractor shall furnish to the OMFED/Owner before the works are taken over, Operation and Maintenance instructions together with Drawings of the

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

71.0 CONTRACTOR'S SUPERINTENDENCE AND DEPLOYMENT OF ERECTION TEAM AND CONDUCT OF PERSONNEL

The Contractor shall employ one or more competent representatives, whose name or names shall have previously been communicated in writing to the OMFED/Owner by the Contractor to superintend and carrying out 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 OMFED/Owner may give to the said representative of the Contractor shall be deemed to have given to the Contractor.

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 Contractor shall, execute the works with due care and diligence with the time for completion and employ Contractor team comprising qualified and experienced engineers together with adequate skilled, semi skilled and unskilled workmen on the site for carrying out the works.

The Contractor shall ensure adequate work force to keep the required pace at all times as per the schedule of the completion. The Contractor 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 Contractor 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 Contractor or his 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 OMFED/Owner and shall be received and observed by the supervisors or foremen who may have charge of the particular part of work in reference to which orders are given. Any such instructions, directions or notices given by the OMFED/Owner shall be deemed to have been given to the Contractor.

The Contractor shall furnish to the OMFED/Owner a fort nightly labour force report showing by classifications the number of employees engaged in the work. The Contractor's employment records shall include any reasonable information as may be required by the OMFED/Owner. The Contractor should also display necessary information as may be required by statutory regulations.

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

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

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

72.0 OMFED/OWNER'S INSTRUCTIONS

The OMFED/Owner may in his absolute discretion, issue from time to time drawings and/or instructions, directions and clarifications which are collectively referred to as OMFED/Owner'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 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 Contractor, which are unacceptable to the OMFED/Owner and the substitution of any other material thereof.

Removal and/or re-execution of any work erected by the Contractor, which are unacceptable to the OMFED/Owner.

Dismissal from the work of any persons employed there upon who shall in the opinion of the OMFED/Owner, misconduct him, or be incompetent or negligent.

Opening up for inspection of any work covered up.

Amending and making good of any defects.

73.0 RIGHTS OF THE OMFED/OWNER

73.1 **Rights to direct works:**

The OMFED/Owner shall have the right to direct the manner in which all works under this contract shall be conducted, insofar 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 OMFED/Owner.

Whenever in the opinion of the OMFED/Owner. The Contractor has made marked departures from the schedule of completion or when circumstances or requirement force such a departure from the said schedule, the OMFED/Owner, 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 Contractor.

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

73.2 **Right to order modifications of methods and equipment**

If at any time the Contractor's methods, materials or equipment appear to the OMFED/Owner to be unsafe, inefficient or inadequate for securing the safety or workmen or the public, the quality of work or the rate of progress required, the OMFED/Owner may direct the Contractor to ensure safety, and increase their efficiency and adequacy and the Contractor shall promptly comply with such directives. If at any time the Contractor's working force and equipment are inadequate in the opinion of the OMFED/Owner, for securing the necessary progress as stipulated, the Contractor 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 OMFED/Owner shall not relieve the Contractor of his obligations to secure the quality, the safe conducting of the work and the rate of progress required by the contract. The Contractor alone shall be and remain liable and responsible for the safety, efficiency and adequacy of Contractor's methods, materials, working force and equipment, irrespective of whether or not the Contractor makes any changes as a result of any order or orders received from the OMFED/Owner.

73.3 **Right to inspect the work**

The OMFED/Owner representative shall be given full assistance in the form of the necessary tools, instruments, equipment and qualified operators to facilitate inspection.

The OMFED/Owner reserves the right to call for the original test certificates for all the materials used in the erection work.

In the event, the OMFED/Owner's inspection reveals poor quality of work/materials, the OMFED/Owner shall be at liberty to specify additional inspection procedures if required, to ascertain Contractor's compliance with the specifications of erection work.

Even though inspection is carried out by the OMFED/Owner or their representatives, such inspection shall not, however, relieve the Contractor of any

or all responsibilities as per the contract, nor prejudice any claim, right or privilege which the OMFED/Owner may have because of the use of defective or unsatisfactory materials or bad workmanship.

74.0 CONTRACTOR'S FUNCTIONS

The Contractor shall provide everything necessary for proper execution of the works, according to the drawings, schedule of quantities and specifications taken together whether the same may or may not be particularly shown or described therein, provided that the same can reasonably be inferred therefrom and if the Contractor finds any discrepancy therein, he shall immediately refer the same to the OMFED/Owner whose decision shall be final and binding on the Contractor.

The Contractor 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 OMFED/Owner.

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

Night work will be permitted only with prior approval of the OMFED/Owner. The OMFED/Owner may also direct the Contractor 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 Contractor at no extra cost. The Contractor should employ qualified electricians and wire men for theses facilities. In case of OMFED/Owner's failure to provide these facilities and personnel, the OMFED/Owner has the right to arrange such facilities and personnel and to charge the cost thereof to the Contractor.

The Contractor shall have to arrange for insurance of all the items brought by him to the site for use during the execution of the contract, till handing over of the complete job.

The OMFED/Owner shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub-Contractor, save and except an accident or injury resulting from any act or default of the OMFED/Owner, his agents, or servants. The Contractor shall indemnify and keep indemnified the OMFED/Owner against all such damages and compensation, save and except as aforesaid and against all claims, proceedings, cost, charges and expenses whatsoever in respect thereof or in relation thereto.

The Contractor shall insure against such liability with an insurer approved by the OMFED/Owner, 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

OMFED/Owner or OMFED/Owner'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-Contractor, the Contractor's obligations to insure as aforesaid under this sub-clause shall be satisfied if the sub-Contractor shall have insured against the liability in respect of such persons in such manner that the OMFED/Owner is indemnified under the policy, but the Contractor shall required such sub-Contractor to produce the OMFED/Owner's representative, when required, such policy of insurance and 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 Contractor, in such cases the Contractor should inspect all such erection and installation jobs and report to the OMFED/Owner regarding any defects or discrepancies. The contractor's failure to do so shall constitute as acceptance of the other contractor's installation /jobs as fit & proper for the reception of the contractor's works except those defects which may develop after execution.

The Contractor should also report any discrepancy between the executed work and the drawings.

The Contractor shall extend all necessary help/co- operation to other Contractor's working at the site in the interest of the work.

The Contractor shall keep a check on deliveries of the equipment covered in the scope of erection work and shall advise the OMFED/Owner well in advance regarding possible hold up in the contactor's work due to the likely delay in delivery of such equipment/components to enable him to take remedial actions.

75.0 DUTIES OF THE CONTRACTOR VIS-A-VIS OMFED/OWNER

The equipment and the items, if any, to be supplied by the OMFED/Owner for erection, testing and commissioning by the Contractor, shall be as listed in the Contract.

76.0 SUPPLY OF TOOLS, TACKLES AND MATERIALS

The Contractor 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.

77.0 PROTECTION OF PLANT

The OMFED/Owner 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 Contractor or any of his sub Contractor's even though such tools and equipment may be furnished, rented or loaned to the Contractor or any of his sub-Contractors. The acceptance and/or use of any such tools and equipment by the Contractor or his sub Contractor shall be construed to mean that the Contractor accepts all responsibility for and agrees to indemnify and save the OMFED/Owner from any and all claims for said

damages resulting from the said use, misuse or failure of such tools and equipments.

The Contractor or his sub-Contractor shall be responsible, during the works, for protection of work, which has been completed by the other Contractors. Necessary care must be taken to see that no damage to the same is caused by the Contractor's men 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 Contractor's work shall be protected by the Contractor and protection shall remain and be maintained until its removal is directed by the OMFED/Owner. The Contractor 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 contractor shall carry out the work without damage to any work and property adjacent to the area of the Contractor'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 Contractor at his cost. The Contractor should adequately light the work area during nighttime also. The Contractor should also engage adequate electricians/wire men, helper etc. to carry out and maintain these lighting facilities. If the Contractor fails in this regard, the OMFED/Owner may provide lighting facilities as it may deem necessary and charge the cost thereof to the Contractor.

The Contractor 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 whatsoever, the same shall be made good by at the sole cost of the Contractor and to the satisfaction of the OMFED/Owner. The Contractor shall also be liable for any loss or damage to the works occasioned by the Contractor or his sub-Contractor in the course of any operations carried out by the contractor or his sub-Contractors for the purpose of completing any outstanding work or complying with the Contractor's obligations.

78.0 UNLOADING, TRANSPORTATION AND INSPECTION

The Contractor shall be required to unload all the materials/equipment from the carriers, those received at site after Contractor's team arrives at site. If any of contractor’s equipment/material reaches site prior to contractor’s site team reaches site, the unloading and shifting of equipment shall be arranged by OMFED/Owner and all expenditure for the same shall be debited to the contractor on actual. The Contractor shall plan in advance, based on the information received from the OMFED/Owner, Contractor's requirement of various tools, tackles, jacks, cranes, sleepers etc, required to unload the material/equipment promptly and efficiently. The Contractor 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 carrier shall be charged to the Contractor's account.

The Contractor shall be responsible for the reception on site of all plant and contractor's equipment delivered for the purpose of the contract.

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

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

All the information and observations by the Contractor shall be furnished in the form of 'INSPECTION REPORT' to the OMFED/Owner with specific mention/suggestions, which in the opinion of the Contractor should be given due consideration and immediate necessary actions. The contractor shall 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 protection, safety and security of the materials shall be the responsibility of the contractor, until they are handed over to the OMFED/Owner after erection, commissioning and testing as per the terms of the Contract.

79.0 STORAGE OF EQUIPMENT

The Contractor shall be responsible for the proper storage and maintenance of all materials/equipment under the Contractor's custody. The Contractor shall take all required steps to carry out frequent inspection of equipment/materials stored as well as erected until the same are taken over by the OMFED/Owner. The following procedure shall apply for the same:

The Contractor'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 Contractor 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 OMFED/Owner and OMFED/Owner's advice taken regarding such repairs/rectifications. The Contractor shall there upon carry out such repairs/rectifications at his own cost. In case the Contractor is not competent to carry out such repairs/rectifications, the OMFED/Owner reserves the right to get this done by other competent agencies at the Contractor's responsibility and risk and the entire cost for the same shall be recovered from the Contractor's bills.

The Contractor'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 Contractor shall carry out all protective measures suggested by the OMFED/Owner during such period.

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

Suitable grease recommended for protection of surface against rusting (refined from the petroleum oil with lanolin minimum (70 DEG. CENT.) 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.

All the necessary items/good required for protection as described above shall be arranged by the Contractor and such cost shall be included in the Contract price.

80.0 APPROVALS

The Contractor shall obtain the necessary **Approval & Consent of the State Pollution Control Board** and any other state and local authorities as may be required and the cost of obtaining such approvals shall be included in the contract price. However any statutory fees paid shall be reimbursed by the owner on the production of **Documentary evidence**.

All necessary details, drawings, submission of application and proformas will be furnished by the Contractor to the OMFED/Owner for verification/ signature.

81.0 REVIEW AND CO-ORDINATION OF ERECTION WORK

The Contractor shall depute senior and competent personnel to attend the site co-ordination meetings that would generally be held at the site every month. The Contractor shall take necessary action to implement the decision arrived at such meetings and shall also update the erection schedule.

82.0 MECHANICAL INSTALLATION

The installation work would comprise of:

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

b) Supply and installation of structural platform and tables.

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

e) Interconnections of services and electrical with equipment.

f) Guide line for expansion work.

g) Clean up of work site.

h) Supply of all cleaning chemicals and lubricants.

i) Testing, commissioning and start-up.

j) Painting including supply of paints as approved by the OMFED/Owner.

Detailed specifications are given in the subsequent clauses.

83.0 GENERAL INSTALLATION

83.1 Position of Equipment

The work involves preparation of access for moving of the plant and equipment including their fittings from the work site godown or from the place within the site where they have been unloaded to the place of erection, decrating and placing on the foundation wherever required. All the civil foundations as per the manufacturer's drawings shall also be carried out by the Contractor. The Contractor shall place the equipment and carry out final adjustment of the foundations including alignment and dressing of foundation surface, embedding and grouting of anchor bolts and bedplates. The contractor shall be responsible for obtaining correct reference lines for purpose of fixing the alignment of various equipment from master benchmarks provided by the OMFED/Owner. Tolerances shall be as specified in equipment manufacturers drawings or as stipulated by the Engineer. No equipment shall be permanently bolted down to foundations or structure until the alignment has been checked by the Contractor and witnessed by the OMFED/Owner. The Contractor 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 Contractor shall supply all the necessary foundation/anchor bolts and bedplates if required without extra cost.

The Contractor 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 Contractor 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 OMFED/Owner. The Contractor shall be paid no additional amount for the above.

84.0 INTERCONNECTION OF SERVICE AND ELECTRICAL WITH EQUIPMENT

The Contractor shall lay service piping and provide connection with the equipment complying strictly with the equipment manufacturer's instructions. The Contractor 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 & controls supplied with the equipment.

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

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 manufacturer's drawings & instructions.

85.0 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 Contractor from the site of work for proper disposal.

The Contractor 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 Contractor 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.

If the Contractor fails to comply with these requirements in spite of written instructions from the OMFED/Owner, the OMFED/Owner will proceed to clear these areas and the expenses incurred by the OMFED/Owner in this regard shall be payable by the Contractor. Before completion of the work, the Contractor shall remove or dispose off in a satisfactory manner all scaffolding, temporary structures, waste and debris and leave the premises in a condition satisfactory to the OMFED/Owner. Any packing materials received with the equipment shall remain as the property of the OMFED/Owner and may be used by the Contractor on payment of standard charges to the OMFED/Owner and with prior approval of the OMFED/Owner. At the completion of his work and before final payment, the Contractor shall remove and shall restore the site to neat workman like conditions at his cost.

86.0 TESTING, COMMISSIONING AND START-UP

Before plant start-up, all concrete water retaining structures shall be tested for water tightness and after ensuring that they satisfactorily hold water without any leakages further start-up action shall be initiated after obtaining clearance of the Engineer in this regard.

The Contractor shall operate, maintain and give satisfactory trial run of the plant for a period of one month at the rated output. All rectification of damages/defects and routine trouble shooting should be carried out by the Contractor. During this period, 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 OMFED/Owner. The Contractor shall suggest recommended log sheet proformas for recording necessary operating data and pass it on to the OMFED/Owner in proof of satisfactory rated output and performance of the equipment/plant.

The commissioning shall also include the following for each equipment:

Field dis-assembly and assembly.

Clean out of lubrication system.

Clean out and check out of all the interconnecting piping and service lines.

Check out and commissioning of instruments and equipment.

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

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 Engineer and the same should be duly recorded.

After satisfactory commissioning and start-up the Contractor shall keep his representative under whose supervision the OMFED/Owner staff shall be operating and maintaining the plant and equipment for a minimum period of one month. 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.

87.0 PAINTING

All exposed concrete and masonary structures shall be painted with approved quality cement paint with a shade approved by the Engineer.

The entire factory manufactured equipment/machineries like motors, pumps, electrical panel, starters, junction boxes, isolators, storage tanks etc. Supplied and installed by the ETP contractor shall be given one coat of paint of approved shade after testing and commissioning irrespective of the condition of original paint of equipment/machineries. All the steel structure, supports and piping etc. fabricated / assembled at site by the contractor shall be given one coat of anti corrosion primer and one coat of approved synthetic enamel paint immediately after fabrication/assembly. After testing and commissioning one more coat of approved synthetic enamel paint for these site fabricated items. Wherever required due to special weather conditions, epoxy / rubberized paint to be provided instead of synthetic enamel paint. 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, starters, motors, isolators and wherever else necessary, as directed and as per the standard practice of installation after testing and commissioning. The colour codes and colour charts based on IS 2378- 1963 for the relevant services are given below:

	Untreated water	Drainage
Application	Raw water line	All drains
Ground colour	Sea green Black	
Shade no.	As per ISI 217	
First band	White	

Supply of all paints and all other materials required is included in the scope of supply of the Contractor under this Contract/order.

OTHERS

88.0 TIME FOR COMPLETION

88.1 Time of completion shall be as per Section - I Instruction to the bidders clause 1.5. Subject to any requirement in the Contract as to completion of any section of the Works before completion of the whole, the whole of the works shall be completed, in accordance with the provisions of Clause 21 hereof, within the time stated in the Contract or such extended time as may be allowed under Clause 90 hereof.

89.0 EXTENSION OF TIME OF COMPLETION

89.1 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 king whatsoever which may occur, other than through a default of the Contractor, be such as fairly to entitle the Contractor to

an extension of time for the completion of the Works, the Engineer shall determine the amount of such extension and shall notify the OMFED/Owner and the Contractor accordingly. Provided that the Engineer is not bound to take in account any extra or additional work or other special circumstances unless the Contractor has within thirty days after such work has been commenced, or such circumstances have arisen, or as soon thereafter as is practicable, submitted to the Engineer full and detailed particulars of any extension of time to which he may consider himself entitled in order that submission may be investigated at the time.

90.0 LIQUIDATED DAMAGES FOR DELAY

90.1 If the Contractor shall fail to achieve completion of the Works within the time prescribed in the Appendix to the Form of Bid, then the Contractor shall pay to the OMFED/Owner the sum at the rate 0.5% (point five percent) of the amended upto date contract value as liquidated damages for such default and not as a penalty for every week or part of the week which shall elapse between the time prescribed by clause 88 hereof and the date of certified completion of the particular Works. The OMFED/Owner may without prejudice to any other method of recovery, deduct the amount of such damages from any payment in its hands, due or which may become due to the Contract. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

90.2 The aggregate maximum of the liquidated damages payable to the OMFED/Owner under this clause shall be subject to a maximum of 10% of the Contract valve.

90.3 If, before the completion of the whole of the Works any part or section of the Work has been certified by the Engineer as completed, pursuant to Clause 21 hereof, and occupied by the OMFED/Owner, the liquidated damages for delay shall, for any period of delay after such certificate be reduced in the proportion which the value of the part or section so certified bears to the value of the whole of the Works.

90.4 The criteria for deriving the liquidate damage shall be the actual value of works executed and the amended time of completion.

PAYMENT

91.0 TERMS OF PAYMENT

91.1 **Payment for mechanical and electrical equipment supply, installation and commissioning**:

i) **On progress of work:**

60% of the mechanical and electrical equipment price components shall be paid on delivery of the Goods at the destination.

ii) **On Progressive Erection**:

25% of the mechanical and electrical price components shall be paid on the value of the progressive erection work completed for individual components.

iii) **On Commissioning**:

Remaining 15% after successful commissioning of the entire plant after obtaining necessary statutory approvals and obtaining desired treated effluent parameters as per schedule.

91.2 **Payment for Civil and inter connecting piping works:**

i) **On Progressive Erection**:

85% of the civil and interconnecting piping price component of the contract value will be paid on the value of the progressive work based on percentage fixed for each activity as detailed separately and after it is certified by the Engineer.

ii) **On Commissioning**:

15% of the civil and inter connecting piping price component of the contract value on completion of satisfactory commissioning of the entire plant.

91.3 Payment for testing, commissioning and co-ordination for statutory approvals

i) Advance payment – No advance payment shall be done for this portion.

ii) 100% payment shall be released after testing, commissioning and obtaining statutory approvals.

91.4 **Retention Money**

a. A retention amount equivalent to 7.5% of the progressive bill value limited to a maximum of 5% of the total Contract value shall be made from the RA bills from i. mechanical and Electrical equipment supply, installation and commissioning and ii. Civil and Interconnecting piping works. This amount shall be released within 60 days of settlement of Final Bill.

b. If the Contractor so requests, the OMFED/Owner may pay the cumulative amount of retention money to the Contractor upon lodgment with the OMFED/Owner of a Bank Guarantee issued by Nationalized Bank or a foreign bank operating in India, valid till the settlement of final bill plus 60 days. The acceptable form of the bank guarantee shall be strictly as given in Section IX of the Bidding Documents.
c. No interest shall be paid by the OMFED/Owner to the Contractor for the amount withheld as Retention Money with the OMFED/Owner.

91.4 Contract valued at Rs. 10 lakh and below are not eligible for advance payment.

92.0 PAYMENT IN THE EVENT OF FRUSTRATION

92.1 If a war or other circumstances outside the Control of both parties, arises after the Contract is made so that either party is prevented from fulfilling his Contractual obligation, or under the law governing the Contract, the parties are released from further performance, then the sum payable by the OMFED/Owner to the Contractor in respect of the work executed shall be the same as that which would have been payable under clause 35 hereof if the Contract had been terminated under the provisions of clause 35 hereof.

93.0 SETTLEMENT OF DISPUTES

93.1 If the Contractor considers any work demanded of him to be outside the requirements of the Contract, or considers any drawings, record or ruling of the Engineer on any matter in connection with or arising out of the Contract or the carrying out of the work to be unacceptable, he shall promptly ask the Engineer in writing, for written instructions of decision. There upon the Engineer shall give his written instructions or decision within a period of thirty days of such request.

93.2 Upon the receipt of the written instructions or decisions the Contractor shall promptly proceed without delay to comply with such instructions or decisions.

93.3 If the Engineer fails to give his instructions or decisions in writing within a period of thirty days after being requested, or if the Contractor is dissatisfied with the instructions and decisions appeal to the OMFED/Owner, which shall offer an opportunity to the Contractor to be heard and to offer an evidence in support of his appeal. The OMFED/Owner shall give a decision within a period of thirty days after the Contractor has given the said evidence in support of his appeal.

93.4 If the Contractor is dissatisfied with this decision, the Contractor within a period of thirty days from the receipt of the decision shall indicate his intention to refer the dispute to Arbitration, failing which the said decision shall be final and conclusive.

94.0 ARBITRATION

94.1 All disputes or differences whatsoever which shall at any time arise between the parties hereto on the construction of this agreement or any clause herein contained or any matter in any way connected therewith or the rights, duties, obligations of the parties hereto shall within 3 months of the written notice of such difference(s) being given by one party to the other be finally referred to the adjudication of the Sole Arbitrator to be appointed by the Project Authority/OMFED. The Project Authority/OMFED shall then finalize a panel of three arbitrators and the intimation shall be sent to the Contractor to enable the Contractor to choose and confirm his acceptance to the appointment of one arbitrator from the panel. If the Contractor fails to communicate his selection of the name, within the stipulated period, the Project Authority/ OMFED shall select one arbitrator from the list and appoint him as the sole arbitrator. If the Project Authority/ OMFED fails to send such a list within thirty days, as stipulated, the Contractor shall send a similar list to the Project Authority/ OMFED within fifteen days. The Project Authority/ OMFED shall then select one arbitrator from the list and appoint him as the sole arbitrator within fifteen days. If the Project Authority/ OMFED fails to do so the Contractor shall communicate to the Project Authority/

OMFED the name of one officer from the panel who shall then be the Sole Arbitrator. The appointment of the Sole Arbitrator so made shall be final and conclusive.

94.2 If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another Sole Arbitrator shall be appointed as aforesaid.

94.3 The Arbitrator shall be deemed to have entered in the reference on the date he issues notices to both the parties fixing the date of the first hearing.

94.4 The Arbitrator from time to time, with the consent of the parties enlarges the time for making and publishing the award.

94.5 The venue of the Arbitration shall be Bhubaneswar only and jurisdiction for any matter/ dispute arising out of or concerning or connected with such Arbitration shall be of Bhubaneswar court only as the case may be.

94.6 The fees, if any, of the Arbitration shall, if required to be paid before the award is made and published, be paid at half by each of the parties. The costs of the reference and the award including the fees, if any, of the Arbitrator shall be in the discretion of the Arbitrator who may direct to and by whom and in what manner, such costs or any part thereof shall be paid and may fix and settle the amount of costs to be so paid.

94.7 The award of the Arbitrator shall be final and binding on both the parties.

94.8 The Arbitration proceedings shall be governed under the provision of the Indian Arbitration & Conciliation Act, 1996 and the rules made there under or any statutory modification thereof for the time being in force. Performance under the Contract, shall, if reasonably possible, continue during the Arbitration proceedings and the payments due to the Contractor by the Project Authority/ OMFED shall not be withheld, unless they are the subjects of the Arbitration proceedings.

95.0 NOTICES

95.1 All certificates, notices or written orders to be given by the OMFED/Owner or by the Engineer to the contractor under the terms of the contract shall be in writing or by telegram or telex/cable and confirmed in writing to the contractor's principal place of business, or such other address as the contractor shall nominate for this purpose.

95.2 All notices to be given to the OMFED/Owner or to the engineer under the terms of the contract shall be served by sending by post or delivering the same to the respective addresses nominated for the purpose.

95.3 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

95.4 Either party may change a nominated address to another address in the country where the works are being executed by prior written notice to the other party and the engineer may do so by prior written notice to both parties.

96.0 DEFAULT OF OMFED/OWNER

96.1 In the event of the OMFED/Owner:

a) Failing to pay to the contractor the amount due under any certificate of the engineer within 60 days after the same shall have become due under the terms of the contract, subject to any deduction that the OMFED/Owner is entitled to make under the contract, or

b) Interfering with or obstructing or refusing any required approval to the issue of any such certificate, or

c) Giving to the contractor a formal notice that for any unforeseen reasons, it is impossible for OMFED/Owner to meet its contractual obligations the contractor shall be entitled to terminate his employment under the contract after giving thirty days prior written notice to the OMFED/Owner, with a copy to the Engineer.

96.2 Upon the expiry of the fourteen days notice referred to in clause 96.1, the contractor shall, notwithstanding the provision of clause 25.1 hereof, with all reasonable despatch, remove from the site all constructional plant brought by him thereon.

96.3 In the event of such termination the OMFED/Owner shall be under the obligations to the Contractor in regard to payment arising out of or in connection with or by consequence of such termination, as are deemed reasonable & fair.

97.0 TAXATION

97.1 The Contractor shall be entirely responsible for all taxes duties, license fees etc. incurred until delivery of contracted goods including installation and commissioning to the OMFED/Owner.

97.2 The Contractor shall be liable to pay all prevailing taxes, duties, work contract tax, turnover tax, income tax and other taxes that shall be levied according to the laws and regulations applicable from time to time in India and the price bid by the Contractor shall include all such taxes. Wherever the laws and regulations require deduction of such taxes at the source of payment, the OMFED/Owner shall effect such deductions from the payment due to the Contractor. The remittance of amounts so deducted and issuance of certificate for such deductions shall be made by the OMFED/Owner as per the laws and regulations in force. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in India on income and profits made by the Contractor in respect of the Contract

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The Contractor's staff, personnel and labour will be liable to pay personal income taxes in India in respect of their salaries and wages as are chargeable under the

laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations.

98.0 BRIBERY AND COLLUSION

98.1 The OMFED/Owner shall be entitled to terminate the Contract and recover from the Contractor the amount of any loss resulting from such termination if the Contractor shall have offered or given to any person any gift or consideration of any kind as an inducement or reward for doing, or for bearing to do any action in relation to obtaining, or in the execution of Contract or any other Contract with the OMFED/Owner, or if any of the like acts shall have been done by any person employed by the Contractor or acting on his behalf (whether with or without the knowledge of the Contractor), or if the Contractor shall have come in to any agreement with another Contractor(s) whereby an agreed quotation or estimate shall be offered as a bid to the OMFED/Owner by one or more Contractors.

98.2 In the event of such termination, the Contractor shall:

a) Proceed as provided in sub clause 35.7 hereof, and

b) Be paid by the OMFED/Owner as provided in sub-clause 35.8 hereof, provided that any loss referred herein shall first be deducted.

99.0 TERMINATION OF CONTRACT FOR OMFED/OWNER'S CONVENIENCE

99.1 The OMFED/Owner shall be entitled to terminate this Contract at any time for its own convenience after giving 60 days prior notice to the Contractor, with a copy to the Engineer.

99.2 In the event of such termination the Contractor:

a) Shall proceed as provided in sub clause 35.7 hereof, and

b) Shall be paid by the OMFED/Owner as provided in sub clause 35.8 hereof.

100.0 PRICES

100.1 Prices charged by the Contractor for goods delivered and services performed under the Contract shall not, , vary from the prices quoted by the Contractor in his bid.

101.0 DELAY IN CONTRACTOR'S PERFORMANCE

101.1 Delivery of the Goods and performance of Service shall be made by the Contractor in accordance with the time schedule specified by the OMFED/Owner in his Schedule of Requirements.

101.2 An unexcused delay by the Contractor in the performance of his delivery obligations shall render the contractor liable to any or all of the following sanctions/forfeiture of his performance security, imposition of liquidated damages, and/or termination of the Contract for default.

101.3 If at any time during the performance of the Contract, the Contractor or his sub-contractor(s) should encounter conditions impending timely delivery of Goods and performance of Services, the Contractor shall promptly notify the OMFED/Owner in writing of the fact of the delay, its likely duration and its cause(s), as soon as practicable after the receipt of the contractor's notice the OMFED/Owner shall evaluate the situation and may at its discretion extend the Contractor's time for performance, in which case the extension shall be ratified by the parties by amendment of the Contract.

102.0 TERMINATION FOR DEFAULT

102.1 The OMFED/Owner may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Contractor, terminate the contract in whole or part:

(a) If the Contractor fails to deliver any or all of the Goods within the period(s) specified in the Contract, or any extension thereof granted by the OMFED/Owner pursuant to Clause 101.0; or

(b) If the Contractor fails to perform any other obligations(s) under the Contract.

102.2 In the event the OMFED/Owner terminates the Contract in whole or part, pursuant to Para 102.1, the OMFED/Owner may procure, upon such terms and in such manner, as it deems appropriate, Goods similar to those undelivered, and the Contractor shall be liable to the OMFED/Owner for any excess costs for similar Goods. However, the Contractor shall continue performance of the Contract to the extent not terminated.

102.3 Consequent to such termination of Contract, the OMFED/Owner shall recover the advance paid, if any, to the contractor along with interest @ 18% per annum compounded quarterly on the last day of March, June, September and December on the advance paid for the entire period for which the advance was retained by the Contractor.

103.0 FORCE MAJEURE

103.1 Notwithstanding the provision of Clauses 91,101 & 102 the contractor shall not be liable for forfeiture of his performance security, liquidated damages or termination for default, if and to the extent that, his delay in performance or other failure to perform his obligations under the Contract is the result of an event of Force Majeure.

103.2 For any purposes of this clause, "Force Majeure" means an event beyond the control of the Contractor and not involving the Contractor's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the OMFED/Owner either in its sovereign or contractual capacity, wars or

revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.

103.3 If a Force Majeure situation arises, the Contractor shall promptly notify the OMFED/Owner in writing of such conditions and the cause thereof. Unless otherwise directed by the OMFED/Owner in writing, the Contractor shall continue to perform his obligations under the contract as far as it is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

103.4 In the event of Force Majeure continues for a period of 6 months, all the parties shall discuss regarding mutually agreed line of action & discuss the performance of the contract.

104.0 CHANGE ORDERS

104.1 The OMFED/Owner may, at any time, by a written order given to the Contractor pursuant to Clause 95, make changes within the general scope of the Contractor in any more of the following:

a. Drawings, designs or specifications, where Goods to be furnished under the Contract are to be specifically manufactured by the OMFED/Owner:

b. The method of shipment or packing;

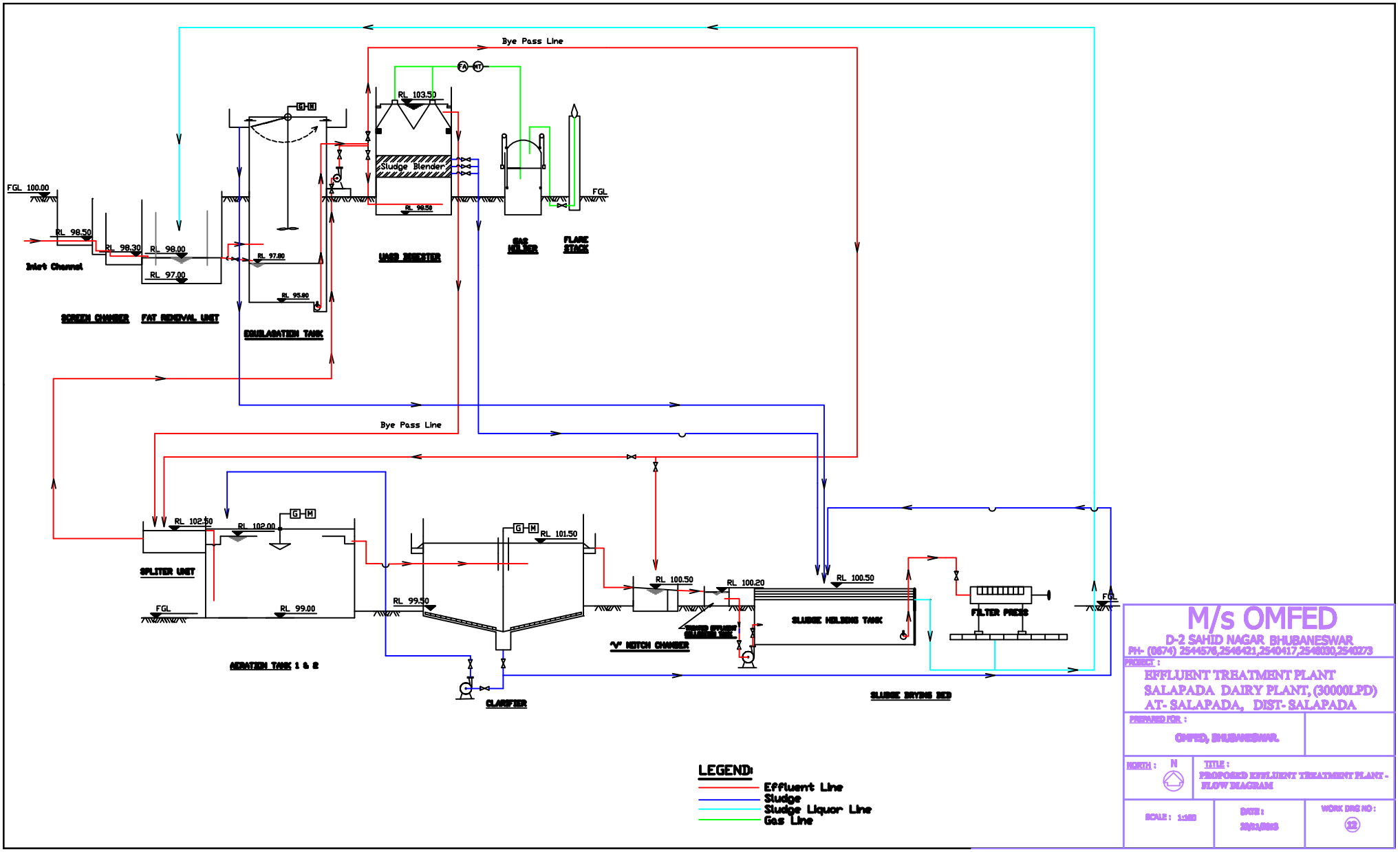
c. The place of delivery; or

d. The Services to be provided by the Contractor,

104.2 If any such change causes an increase or decrease in the cost of, or the time required for the Contractor's performance of any part of the work under the con tract, whether changed or not changed by the order, an equitable adjustment shall be made in the contract price or delivery schedule. Or both, and the contract shall accordingly be amended. Any claims by the contractor for adjustment under this clause must be asserted within thirty (30) days from the date of the contractor's receipt of the OMFED's/Owner's change orders.

105.0 JURISDICTION:

For the settlement of any disputes arising out of the contract against this bid, only the court at Bhubaneswar (Orissa) shall have jurisdiction.


Bye Pass Line
Sludge Blender
RL 103.50
RL 99.50
FGL 100.00
RL 98.50
RL 98.30
RL 98.00
RL 97.00
RL 97.80
RL 95.80
Inlet Channel
SCREEN CHAMBER
FAT REMOVAL UNIT
EQUILAGATION TANK
GAS HOLDER
FLARE STACK
FGL
Bye Pass Line
RL 102.50
RL 102.00
SPLITER UNIT
FGL
RL 99.00
RL 99.50
RL 101.50
AERATION TANK 1 & 2
CLARIFIER
"V" NOTCH CHAMBER
RL 100.50
RL 100.20
RL 100.50
SLUDGE HOLDING TANK
FILTER PRESS
FGL
SLUDGE DRYING BED
LEGEND:
Effluent Line
Sludge
Sludge Liquor Line
Gas Line
M/s OMFED
D-2 SAHID NAGAR BHUBANESWAR
PH- (0674) 2544576,2546421,2540417,2548030,2540273
PROJECT :
EFFLUENT TREATMENT PLANT
SALAPADA DAIRY PLANT, (30000LPD)
AT- SALAPADA, DIST- SALAPADA
PREPARED FOR :
OMFED, BHUBANESWAR.
NORTH : N
TITLE :
PROPOSED EFFLUENT TREATMENT PLANT - FLOW DIAGRAM
SCALE : 1:100
DATE :
WORK DRG NO :
12

TENDER FOR
CIVIL, STRUCTURAL, MECHANICAL & ELECTRICAL WORKS
OF
PROPOSED EFFLUENT TREATMENT PLANT
AT

SALAPADA DAIRY

SECTION I
INSTRUCTIONS TO BIDDERS

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GENERAL CONDITIONS OF THE CONTRACT

SECTION – III
SPECIAL CONDITIONS OF CONTRACT

SECTION IV 'C'
DESIGN DATA TABLES

SECTION IV 'B'
SCHEDULE OF REQUIREMENTS

SECTION IV 'A'
GENERAL TECHNICAL SPECIFICATION FOR CIVIL WORK, PIPING, AND ELECTRICAL

SECTION – V
FORM OF BID

SECTION – VI
SCHEDULE OF MATERIALS TO BE ISSUED BY OWNER

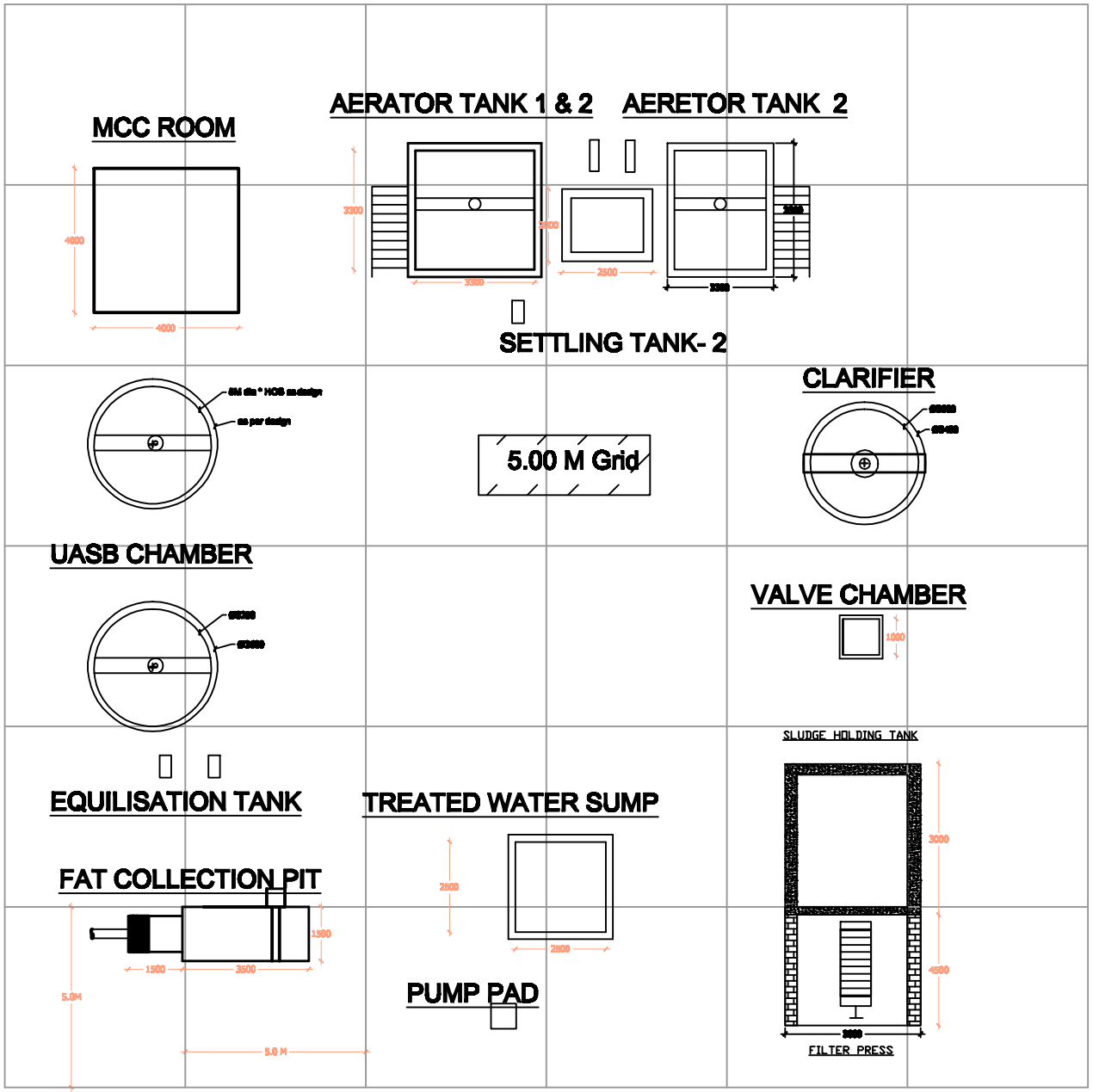
SECTION – VII
SCHEDULE OF SUPPLEMENTARY INFORMATION

SECTION – VIII
FORM OF AGREEMENT

SECTION – IX
ACCEPTABLE FORM OF BANK GUARANTEES

SECTION – X
SCHEDULE OF QUANTITIES

SECTION – XI
STANDARD SKETCHES AND DRAWINGS



M/s OMFED
D-2, SAHID NAGAR, BHUBANESWAR
PH- (0674) 25461121,254576,2540417,2546090

PROJECT : EFFLUENT TREATMENT PLANT SALAPADA DAIRY PLANT, (30000LPD) AT- SALAPADA, DIST- ANUGUL	DRAWN BY : SMWS CONSULTANT APPROVED BY: Er J B Mahapatra
NORTH : E	TITLE : SITE LAYOUT PLAN OF ETP
SCALE : 1:100	DATE : 19/11/2013
	DRG NO : (11)

INVITATION TO BID

TENDER REF: Proj/ETP/Angul- Salapada /14 DATES: 15/02/2016

1.0 **DESCRIPTION OF WORKS:** The Orissa State Co-operative Milk Producers Federation Ltd. Bhubaneswar – 751 017 invites sealed bids from eligible bidders for the construction and completion of the following works:
Design, Construction/Fabrication, Supply, Erection, Testing, Commissioning & Guarantee test-run including all necessary Civil, Mechanical, Instrumentation and Electrical works etc. complete including taking statutory approvals on a turnkey basis for the Effluent Treatment Plant as per the schedule of requirement and technical specifications.

2.0 **ADDITIONAL INFORMATION:** Interested eligible bidders may obtain further information from and inspect the bidding documents at the office of THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD, BHUBANESWAR, at the address given below.

3.0 **REQUEST FOR BIDDING DOCUMENT:** A complete set of bidding documents may be purchased by any interested eligible bidder on the submission of a written application to THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR and upon the payment of a non-refundable fee as detailed below.

Eligibility Criteria

Description	Requirement
The bidder should be in business as turnkey executor for effluent treatment plant including its buildings, equipment and piping etc. in the same name and style at the time of bid opening.	**Minimum 05 years**
The bidder's annual financial turnover of ETP and STP work in the same name and style during any one of the last five financial years should not be less than 40% of the bid value	**Minimum Rs 27 Lakhs**
The bidder shall furnish a copy of the income tax clearance and sales tax clearance certificate, in original or certified true copies for minimum three previous years. The bidder shall also provide their permanent account number for income tax. (PAN)	**-------**
Solvency certificate for at least 20% of the contract value for the current financial year	**Minimum Rs 14 Lakhs**

4.0 **BID DETAILS:** Detailed terms and conditions as well as the technical specifications for all the items of works as indicated in the invitation to bid are contained in the bidding documents. Only one set of document shall be sold to one bidder.

(a) Bid reference : Proj/ETP/Angul- Salapada /14

(b) Price of bidding document : Rs 10500/- per Set

(c) Incidental charges (in land) in case documents : Rs 500/-

are to be sent by post

(d)	Date of commencement of sale of bidding document	: Down load from web site.
(e)	Last date for the sale of bidding document	: As per tender notice.
(f)	Last Date and time for receipt of bids	:
(g)	Time and date of opening of bids	:
(h)	**Place of opening of bids**	: Corporate Office Omfed
(i)	**Address for communication**	: Omfed , D-2, Sahid Nagar, Bhubaneswar
(j)	Estimated value of works (Rs.)	: Rs. 5712557/-
(k)	Time of completion (Months)	: 11 months (eleven months)
(l)	Amount of Bid Security (Rs.)	: 1% of the Quoted Value

5.0 **PURCHASE OF BIDDING DOCUMENT:** Bidders who desire to obtain bidding document in person by paying cash or demand draft may do so on any working day from 11.00 hrs. to 15.00 hrs. only during the period of sale of bid documents as specified in clause 4 hereof. Demand draft to be prepared in favour of **OMFED, Bhubaneswar**

6.0 **DOCUMENT BY POST:** For purchase of bidding document by post, demand draft in favour of **OMFED, Bhubaneswar** of value equal to price of bidding document plus incidental charges, as specified in clause 4 (b) and 4 (c) hereof may be sent to the address of communication during the period of sale of bid document. ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LIMITED, shall not take the responsibility for any delay in receipt of the bidding document if it is sent by post.

7.0 **BID SECURITY:** All bids must be accompanied by a bid security in the acceptable form as specified in the bidding document and must be delivered to the address of communication as stated above on or before the last date and time of receipt of bids as given in clause 4.0 (f) above.

8.0 **PRE BID MEETING:** There will be a pre-bid meeting convened at the office of THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR DAIRY, at the address of communication on 01/03/2016 11.00Hrs to 16.00 Hrs.

9.0 **OPENING OF BIDS:** Bids will be opened in the presence of those bidders or their authorized representatives who choose to attend at the office of THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR DAIRY, at the address of communication.

10.0 **BID VALIDITY:** The Bid shall remain valid for acceptance for a period of 90 days from the date of bid opening as mentioned above.

11.0 **BID SECURITY VALIDITY:** The bid security accompanying the bid shall be valid for 30 days beyond the bid validity period.

12.0 **TENDER DRAWINGS:** If the drawings are not included in this bidding document, the same shall be available for reference at THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR DAIRY at the address of communication on all working days. If the drawings are included in the tender, the same are attached and would become part of the bidding document.

13.0 **RIGHTS RESERVED BY OMFED:** THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR DAIRY at its sole discretion and without assigning any reason thereof reserves the right to accept and / or reject any or all bids.

SECTION I

INSTRUCTION TO BIDDERS

GENERAL

1.0 GENERAL INFORMATION

1.1 **Description of Works** :- Design, Construction/Fabrication, Supply, Erection, Testing, Commissioning & Guarantee test-run including all necessary Civil, Mechanical, Instrumentation and Electrical works etc. complete including taking statutory approvals, on a turnkey basis for the Effluent Treatment Plant as per the schedule of requirement and technical specifications.

1.2 **Owner** :- THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR

1.3 **OMFED** :- THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., D - 2, SAHID NAGAR, BHUBANESWAR PIN – 751 007.

1.4 **Location and area**

(a) Project site **:** THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD. BHUBANESWAR DAIRY, CHANDRAS-EKHARPUR,BHUBANESWAR– 751 017

(b) **Nearest Railway Station** :- SALAPADA

(c) **Nearest Airport** :- Bhubaneswar

(d) **Nearest Major Town** :- Bhubaneswar

(e) **Access Roads** :- Pucca Road

1.5 **Period of Completion**

The period of completion shall be eight months from the date of notification of award, which shall include the non-working periods during monsoon and festivals.

2.0 SOURCE OF FUNDS

The project authority has arranged the funds and provided to the Purchaser.

3.0 ELIGIBILITY AND QUALIFICATION REQUIREMENTS: -

3.1 This invitation to bid is open to all eligible bidders/restrictive bidders.

3.2 All goods and ancillary services to be supplied under this Contract shall have their origin in India.

3.3 To be eligible for the award of Contract, bidders shall provide evidence satisfactory to THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR of their eligibility under sub clause 3.1 above and of their capacity and adequacy of resources to carry out the Contract effectively. Detailed requirements for this have been specified in Clause 13 of the Instruction to Bidders.

4.0 COST OF BIDDING

The bidder shall bear all costs associated with the preparation and submission of his bid and THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR , hereinafter referred to as "OMFED" will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

5.0 SITE VISIT

5.1 The bidder is advised to visit and examine the site of works and its surroundings and obtain for himself on his own responsibility and cost, all information that may be necessary for preparing the bid and entering into a Contract. The costs of visiting the site shall be at bidders own expense.

5.2 The bidder and any of his personnel or agent(s) will be granted permission by the OMFED to enter upon the premises and lands for the purpose of such inspection, but only upon the express condition that the bidder, his personnel or agent(s), will release and indemnify the OMFED and his personnel and agent(s) from the against all liabilities in respect thereof and will be responsible for personal injury (whether fatal or otherwise) loss of or damage to property and any other loss or damage, costs and expenses however caused, which, but for the exercise of such permission would not have arisen.

5.3 Each of the ETP contracts, if executed at site under the circumstances of an operating plant which can not be closed down for any reason, the site works of every nature has to be planned and executed with the knowledge of operational and processing routines at existing plant, as the plant will continue uninterrupted throughout the year. The execution of contract will be done with clear under-standing that their all staff and workers will have to strictly abide by the security rules and procedures that is followed by plant authorities during the concurrency of the contract.

BIDDING DOCUMENTS

6.0 CONTENTS OF BIDDING DOCUMENTS

6.1 The set of Bidding documents issued for the purpose of bidding includes the number of copies as stated below

1

Number	Volume	Section	Description of copies
1	1	O	Invitation to Bid
1	1	I	Instruction to bidders
1	1	II	General Conditions of Contract
1	1	III	Special Conditions of Contract
1	1	IV A	General technical spec. for civil work, piping and electrical
1	II	IV B	Schedule of requirements
	II	IV C	Tables and design data
1	II	V	Form of Bid
1	II	VII	Schedules of Supplementary Information
1	I	VIII	Form of agreement
1	I	IX	Acceptable Forms of Bank Guarantee
1	II	X	Schedule of quantities
1	II	---	Standard sketches and drawings

6.2 The Bidder is expected to examine carefully all instructions, conditions, forms, specifications and drawings in the bidding documents. Failure to comply with the requirements of bid document will be at the bidder's own risk. Pursuant to clause 23, bids which are not substantially responsive to the requirements of the bidding documents will be rejected.

7.0 CLARIFICATION OF BIDDING DOCUMENTS

A prospective bidder requiring any clarification of the bidding documents may notify the OMFED well in advance to the date submission of bids in writing or by fax at the address of communication indicated in the Invitation to bid. The OMFED will respond in writing or by fax to any request for the clarification which is required as early as possible but before expiry of the dead line for the submission of the bids. Written copies of the response of the OMFED (including a description of the enquiry without identifying its source) will be sent to all prospective bidders who purchased the bidding documents.

8.0 AMENDMENT OF BIDDING DOCUMENTS

8.1 At any time prior to the deadline for the submission of bids, the OMFED may for any reason whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bidding documents by the issuance of amendment.

8.2 The amendment will be sent in writing or by telegram/fax to all prospective bidders who have purchased the bidding documents and will be binding upon them. Prospective bidders shall promptly acknowledge receipt thereof by telegram/fax to the OMFED. The amendment will be attached to the bidding document sold subsequently.

8.3 In order to afford prospective bidders reasonable time in which to take an amendment into account in preparing their bids, the OMFED may, at its discretion, extend the deadline for the submission of bids in accordance with clause 19.

8.4 Pre-Bid Meeting:

a. The bidder or his authorized representative is advised to attend a pre-bid meeting if convened at the office of THE ORISSA STATE COOPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR DAIRY as stated in the ITB.

b. The purpose of the meeting is to clarify issues and to answer question on any matter that may be raised at that time.

PREPARATION OF BIDS

9.0 LANGUAGE OF BID

9.1 The bid prepared by the bidder and all correspondence & documents relating to the bid exchanged by the bidder and the OMFED shall be written in the English language. Supporting documents and the printed literature furnished by the bidder with the bid may be in another language provided they are accompanied by an appropriate translation of pertinent passage in the above stated language, in which case for the purpose of the interpretation of the bid, the English translation shall govern.

10.0 DOCUMENTS COMPRISING THE BID

10.1 The bid to be prepared by the Bidder shall comprise of the following:

(a) A Bid Form, its appendix thereof (Section V) and a Price Schedule (Section X) completed in accordance with Clauses 11, 12 .

(b) Documentary evidence established in accordance with Clause 13 that the Bidder is eligible to bid and is qualified to perform the contract if its bid is accepted.

(c) Documentary evidence established in accordance with Clause 14 that the goods and ancillary services to be supplied by the Bidder are eligible goods and services and conform to the bidding Documents.

(d) Bid security (Earnest Money Deposit) furnished in accordance With Clause 15.

(e) Proposed tentative layout of the plant and technical details as asked for.

11.0 BID FORM

11.1 The Bidder shall complete the Bid Form with it appendix and appropriate Price Schedule furnished in the Bidding Document, indicating the goods to be supplied & services to be rendered, a brief description of the goods, country of origin, services, quantity and prices. The format for bid form and price schedule are furnished. The bidders shall prepare their bid strictly according to this format, filling in all the blank spaces.

12.0 BID PRICES

12.1 The Bidder should indicate on the Price Schedule attached to these documents the unit prices and total Bid Prices of goods & services it proposes to supply under the Contract. The quoted prices shall be for delivery of goods & services FOR project site, inclusive of all cost for designing, manufacturing, packing forwarding, delivery at site, with taxes, work contract tax, turnover tax, duties, insurances, levies, installation & commissioning and trial runs etc.

12.2 **Fixed Price**

Prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to variation on any account, for goods and services. A bid submitted with an adjustable price quotation for such goods and services will be treated as non-responsive and rejected, pursuant to Clause 23.

13.0 DOCUMENTS ESTABLISHING BIDDER'S ELIGIBILITY & QUALIFICATION

13.1 Pursuant to Clause 10, 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 provided in Section VII of the bid document.

13.2 Bidder must submit necessary documents to prove their eligibility along with their bid. Failure to do so may lead to rejection of their bid. OMFED reserves the right either to obtain or not to obtain any documents /clarifications and verify the credentials from its own sources in the matter after opening of the bids.

13.3 The documentary evidence of the Bidder's qualification to perform the Contract if its bid is accepted, shall establish to the purchaser's satisfaction:

(a) 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. The bid shall include Manufacturers' Authorization Form as per the format given in bidding document. Offers from other agents, brokers & middlemen shall not be accepted.

(b) 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 under Section VII:

(i) Copies of original documents defining the constitution or legal status, place or registration and principal place of business of the Co. or firm or partnership or if joint venture of each party thereto constituting the bidder.

(ii) Power of Attorney or a true copy thereof duly attested by a Gazetted Officer in case an authorized representative has signed the bid.

(iii) Details of experience and past performance of the bidder (or each party to a joint venture) on works of similar nature within the past five years, and details of current works in hand and other Contractual commitments shall be submitted as per Section VII of this bidding document.

(iv) Major items of constructional plant proposed for use in carrying out the Contract in the format prescribed in Section VII and the qualification and experience of key personnel proposed for the administration and the execution of the Contract, both on and off the site, in the format prescribed in Section VII of this bidding document.

(v) Reports on financial standing of the Bidder or of each party if a joint venture such as profit and loss statements, balance sheets and auditor's report of the past three years, bankers certificates etc;

(vi) Information regarding any current litigation in which the Bidder in involved.

(c) The bidder shall furnish a copy of the **Income tax clearance and Sales Tax clearance certificates for the previous three years in original or certified true copies along with permanent account number for income tax**.

13.4 **For the purpose of this particular Contract, bidders shall meet the following criteria as minimum:**

(a) The bidder should be in business as Turnkey Contractor for Effluent Treatment Plants for a minimum period of three years at the time of bid opening in the same name and style.

(b) The bidder's average financial turnover in the same name and style during the last four financial years. starts from 2011-12.12-13,13-14 & 14-15 Shall not be less than Rs.27.0Lakhs

(c) The bidder, in the same name and style, shall have completed at least two contracts of similar nature as turnkey contractor and of minimum value Rs 20.0 Lakhs. During the last five years ending last day of the month previous to the one in which tender is being opened. For this tender, the similar works are supply and installation of liquid effluent treatment plant for a production industrial unit executed as a turnkey contractor.

(d) Credit worthiness certificate for at least 10% of the contract value ……. to be issued by banker of bidder.

(e) Even though the bidders meet the above criteria, they are subject to be disqualified if they have:

- Made untrue or false representation in the forms, statements and attachments submitted in proof of the qualification requirement and /or

- Record of poor performance such as abandoning the work, not properly completing the contract not maintaining quality in work, inordinate delays in completion or financial failure etc.

(f) The bidder shall furnish copies of registration with Sales Tax Department under Works Contract Tax, Employee State Insurance as per ESI Act and Provident fund as per PF Act, for awarding the contract to bidder.

13.5 Bid submitted by a joint venture of two or more firms, as partners shall comply with the following requirements:

(a) The bid, and in case of successful bid, the form of agreement shall be signed by all parties so as to be legally binding on the partners;

(b) One of the partners shall be nominated, as being in-charge and this authorization shall be evidenced by submitting power of attorney signed by legally authorized signatories of all the partners;

(c) The partner in-charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all the partners of the joint venture and the entire execution of the contract including payment shall be done exclusively with the partner in-charge;

(d) All the partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the contract terms and a relevant statement to this effect shall be included in the authorization mentioned under (b) above as well as in the form of bid and the form of agreement (in case of the successful bid) and

(e) A copy of the agreement entered into by the joint venture partners shall be submitted with the bid.

(f) Experience, resources, men and machinery of each party to the joint venture will be taken into account only to the extent of their participation for performing task under the joint venture agreement.

14.0 DOCUMENTS ESTABLISHING GOODS' ELIGIBILITY AND CONFORMITY TO BIDDING DOCUMENTS

14.1 Pursuant to Clause 10 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.

14.2 The documentary evidence of the goods and services eligibility shall consist of a statement in the Price Schedule on the country of origin of the goods and services offered which shall be confirmed by a certificate of origin issued at the time of shipment.

14.3 The documentary evidence of the goods and services conforming to the Bidding Documents may be in the form of literature, drawing and technical data and shall include:

(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, following commencement of the goods use by the Purchaser: and

(c) A statement of deviations and exceptions to the provisions of the technical Specifications demonstrating substantial responsiveness of the goods and services to those specified in the form provided under Section V.

14.4 The bidder should clearly confirm that all the facilities exist for inspection and shall be made available to the inspecting authority.

14.5 Pursuant to Clause 13.3(c) above, the Bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers designated by the Purchaser in its Technical Specifications are intended to be descriptive only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalogue numbers in its bid, provided that it demonstrates to the Purchaser's satisfaction that the substitutions are substantially equivalent or superior to those designated in the technical Specifications.

15.0 BID SECURITY (EARNEST MONEY DEPOSIT)

15.1 Pursuant to Clause 10, the Bidder shall furnish, as part of its bid, bid security as specified in the Invitation to Bid.

15.2 The bid security is required to protect the Purchaser against the risk of Bidder's conduct, which would warrant the security's forfeiture, pursuant to Para. 15.7.

15.3 The bid security shall at the bidder’s option, be in the form of a Bank Draft or a Pay Order drawn in favour of THE ORRISSA STATE CO-OPERATIVE MILK PRODUCERS’ FEDERATION LIMITED, or a Bank Guarantee from a Nationalized Indian Bank,. The format of the bank guarantee shall be strictly in

accordance with the sample form included in the bidding documents. The bank guarantee shall be valid from the date of opening of the bid till 30 days beyond the period of validity of the bid.

15.4 Any bid not secured in accordance with Para. 15.1 and 15.3 will be rejected by the Purchaser as non-responsive, pursuant to Clause 23.

15.5 Unsuccessful Bidder's bid security will be discharged/returned as promptly as possible but not later than 30 days after the expiration of the period of bid validity prescribed by the Purchaser, pursuant to Clause 16.

15.6 The successful Bidder's bid security will be discharged upon the Bidders executing the Contract pursuant to Clause 30, and furnishing the performance security, pursuant to Clause 31.

15.7 The bid security may be forfeited.

(a) If a Bidder withdraws or modifies his bid during the period of bid validity specified by the Bidder on the Bid Form; or

(b) In the case of the successful Bidder, if the Bidder fails;

(i) To sign the contract in accordance with Clause 30;

Or

(ii) To furnish performance security in accordance with Clause 31.

15.8 No interest shall be paid by the purchaser on the Bid security furnished by the bidder.

16.0 PERIOD OF VALIDITY OF BIDS

16.1 Bids shall remain valid for acceptance for a period of 120 days after the date of bid opening prescribed by the OMFED, pursuant to Clause 19. A bid valid for a shorter period may be rejected by the OMFED, as non- responsive.

16.2 In exceptional circumstance, OMFED may solicit the Bidders' consent to an extension of the period of validity. The request and the responses thereto shall be made in writing (or by cable or fax). The bid security provided under Clause 15 shall also be suitably extended. A bidder may refuse the request without forfeiting its bid security. A Bidder granting the request will not be required nor permitted to modify its bid.

17.0 FORMAT AND SIGNING OF BID

17.1 The bidder shall prepare and submit the original copy of the documents comprising the bidding documents purchased by him.

17.2 All pages of the bidding documents shall be signed by person(s) duly authorized, to bind the bidder to the Contract. Proof of authorization shall be in the form of a written power of attorney, which shall accompany the bid. All pages of the bid documents, where entries and amendments had been made, shall additionally be initialed by the person(s) signing the bids.

17.3 The complete bid shall be without alterations, interlineations or erasures except those in accordance with instructions issued by the OMFED, or as necessary to correct errors made by the bidder in which case such corrections shall be initialed by the person(s) signing the bid. No over writing shall be permitted.

17.4 Only one bid may be submitted by each bidder. No bidder may participate in the bid in the name of another for the same Contract in any relation whatsoever.

17.5 The bidder shall quote the rate of each item both in figures and words.

SUBMISSION OF BIDS

18.0 SEALING AND MARKING OF BIDS

18.1 The bidder shall submit the bid in two envelops. The first envelopes shall contain only the bid security where as the second envelope shall contain the main bid. The bidder shall seal the bid in an inner and an outer envelope, duly marking the envelopes as **"ORIGINAL".**

18.2 The inner and the outer envelopes shall be addressed to the address as given in the address for communication in clause 4.0 of Invitation to Bid and shall bear the following identifications:

i) Name of the Contract-as stated in the clause 1.0 of Invitation to Bid.

ii) Reference of the bid-as given in the Invitation to Bid.

iii) Words "**DO NOT OPEN BEFORE"** (Mention the date and time of opening of the bid as given in clause 4.0 of Invitation to Bid.

18.3 The inner envelope shall indicate the name and the address of the bidder to enable the bid to be returned unopened in case it is declared late or is otherwise unacceptable.

18.4 If the outer envelope is not sealed and as marked as instructed above, the OMFED shall not assume any responsibility for the misplacement or premature opening of the bid submitted. A bid opened prematurely for this cause will be rejected by the OMFED and returned to the bidder.

18.5 The bidders shall submit the "Eligibility and Post Qualification Application" along with the documentary proof.

18.6 Bids received by Telegram/ Fax/E-mail and incomplete bids are liable to be summarily ignored.

19.0 DEADLINE FOR SUBMISSION OF BIDS

19.1 Bids must be received by the OMFED at the address specified under INVITATION TO BID not later than the time specified for receipt of the bids as indicated in clause 4.0 of INVITATION TO BID.

19.2 The OMFED may, at its discretion extend this deadline for the submission of bids by amending the Bidding Documents in accordance with Para 8, above in which case all rights and obligations of the OMFED and Bidders previously subject to the deadlines will thereafter be subject to the deadline as extended.

20.0 LATE BIDS

20.1 Any bid received by the OMFED after the deadline for submission of bids prescribed by the OMFED pursuant to Para 19 will be rejected and/or returned unopened to be Bidder.

BID OPENING AND EVALUATION

21.0 OPENING OF BIDS BY OMFED

21.1 The OMFED will open the bids, including submissions made pursuant to clause 20 in the presence of bidder's representatives who choose to attend, at the office of THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., BHUBANESWAR, in the address of the communication at the time and date stated in the clause 4.0 in the Invitation to Bid. The bidder's representatives who are present shall sign a register evidencing their attendance.

21.2 The OMFED will examine the bids to determine whether they are complete whether the requisite bid security have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

21.3 At the bid opening the OMFED will announce the bidder's names, the bid prices, written notifications of bid modifications and withdrawals, if any, the presence of requisite bid security, and such other details as the OMFED may consider appropriate.

21.4 After the public opening of bids, information relating to the examination clarification, evaluation and comparison of bids and recommendations concerning the award of Contract shall not be disclosed to bidders or other persons not officially concerned with such process until the award of the Contract to the successful bidder has been announced.

21.5 Any effort by a bidder to influence the OMFED in the process of examination, clarification, evaluation and comparison of bids and in the decision concerning the award of Contract may result in the rejection of the bidder's bid.

22.0 CLARIFICATION OF BIDS

22.1 To assist in the examination, evaluation and comparison of bids, the OMFED may, at its discretion, ask the Bidders for a clarification of its bid. The request for clarification and the response shall be in writing and no change in the price or substance of the bid shall be sought, offered of permitted.

23.0 PRELIMINARY EXAMINATION

23.1 The OMFED will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

23.2 Bids determined to be substantially responsive will be checked by the OMFED for any arithmetic errors in computation and summation. Errors will be corrected as follows:

"Where there is a difference between rates in figures and in words, the rates that corresponds to the amounts worked out by the bidders, shall be taken as correct. However, when the total amount of an item is not worked out or it does not correspond with the rates written either in figures or words, then the rates quoted by the bidder in words shall be taken as correct. When the rates quoted by the bidders in figures and words tallies but the amount is not worked out correctly, the rate quoted by the bidders shall be taken as correct and not the amount."

The amount stated in the form of bid will be adjusted by the OMFED in accordance with the above procedures for the correction of errors and, with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount of bid his bid shall be rejected and the bid security shall be forfeited.

23.3 Prior to the detailed evaluation, pursuant to Para 24, the OMFED will determine the substantial responsiveness of the each bid to the bidding documents. For purposes of these clauses, a substantially responsive bid is one, which conforms to all the terms and conditions of the Bidding Documents without material deviations. The OMFED's determination of a bid's responsiveness is to be based on the contents of bid itself without recourse to extrinsic evidence.

23.4 A bid determined as not substantially responsive will be rejected by the OMFED and may not subsequently be made responsive by the Bidder by correction of the nonconformity.

23.5 The OMFED may waive any minor informality or non-conformity or irregularity in a bid, which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of the Bidder.

24.0 EVALUATION AND COMPARISON OF BIDS

24.1 The OMFED will evaluate and compare the bids previously determined to be substantially responsive, pursuant to Clause 23.

In case of bids received as Alternative Bids wherein a system other than that specified in the tender is offered these would be evaluated along with other bids on merit of their technical potential, experience and reports of similar system installation and their workability under Indian Conditions. The capital and recurring costs, power requirement, resource saving, if any, or resources recycle potential, and the cost and availability of spares would be specifically taken into consideration as compared to the system specified in the tender.

24.2 The OMFED's evaluation of bid will exclude and not take into account any allowance for price adjustment during the period of execution of the Contract, if provided in the bid.

24.3 The price comparison shall be of total contract price (execution of building at site, equipment delivered at site, installed and commissioned). This contract price includes all charges for design, manufacturing, constructing, delivery to site, all taxes, duties etc., incidental services including installation and commissioning.

25.0 CONTACTING THE OMFED

25.1 Subject to Para 22, no Bidder shall contact the OMFED on any matter relating to its bid, from the time of the bid opening to the time the Contact is awarded.

25.2 Any effort by a Bidder to influence the OMFED in the OMFED's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidder's bid.

AWARD OF CONTRACT

26.0 POST-QUALIFICATION

26.1 In the absence of pre-qualification the OMFED will determine to its satisfaction whether the Bidder selected as having submitted the lowest evaluated responsive bid is qualified to satisfactorily perform the Contract.

26.2 The determination will take into account the Bidder's financial, technical and product on capabilities. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to Para 13, as well as such other information as the OMFED deems necessary and appropriate including details of experience and records of past performance.

26.3 An affirmative determination will be a prerequisite for award of the Contract to the Bidder. A negative determination will result in rejection of the Bidder's bid in which event, the OMFED proceed to the next lowest evaluated bid to make a similar determination of that Bidder's capabilities to perform satisfactorily.

27.0 AWARD CRITERIA

27.1 Pursuant to Para 29, the OMFED will consider award of contract to the successful bidder whose bid has been determined to be substantially responsive and has been determined as the lowest evaluated bid, provided further that the bidder is determined to be qualified to satisfactorily perform the contract.

28.0 OMFED'S RIGHT TO ACCEPT ANY BID OR REJECT ANY OR ALL BIDS

28.1 The OMFED reserves the right to accept or reject any bid and to annual the bidding process and reject all bids at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for OMFED's action.

29.0 NOTIFICATION OF AWARD

29.1 Prior to expiry of the period of bid validity, the OMFED will notify the successful Bidder in writing by a letter or by cable or fax, to be confirmed in writing by a letter, that its bid has been accepted.

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

29.3 Upon the successful Bidder's furnishing of performance security pursuant to Para 31, the OMFED will promptly notify each unsuccessful Bidder and will discharge its bid security, pursuant to Para 15.

30.0 SIGNING OF CONTRACT AGREEMENT

30.1 At the same time as the OMFED notifies the successful Bidder that its bid has been accepted, the OMFED will send the Bidder the Contract agreement Form provided in the Bidding Documents, incorporating all agreement between the parties.

30.2 Within 30 days of receipt of the Contract agreement Form, the successful Bidder shall sign and date the Contract and return to the OMFED.

31.0 PERFORMANCE SECURITY

31.1 Within 30 days of the receipt of notification of award from the OMFED, the successful Bidder shall furnish the performance Security in accordance with the Conditions of Contract, in the Performance Security Form provided in the Bidding Documents or another form acceptable to the OMFED.

31.2 Failure of the successful Bidder to comply with the requirement of Pars 30 or Pars 31 shall constitute sufficient ground for the annulment of the award and forfeiture of the bid security, in which event the OMFED may make the award to the next lowest evaluated bidder or call for new bids.

32.0 IMPORT LICENSE

32.1 No import license shall be provided by the Purchaser for goods offered against this bid.

SECTION - III

SPECIAL CONDITION OF CONTRACT

1.0 SPECIAL CONDITION OF CONTRACT

The following Special conditions of Contract shall supplement the General conditions of Contract, given in Section II,. Wherever there is a conflict the provision herein shall prevail over those in the General conditions of Contract.

2.0 TAXES

2.1 The rates shall include all taxes. The bidder shall include in his rates all types of taxes including sales tax; works contract tax, turnover tax and octroi as per the law of the Central & the Government of the state, where the Contract is to be performed. No claim on account of any type of tax shall be admissible.

3.0 STORE

3.1 The Contractor shall at his own cost provide a temporary material store of suitable size for storing the materials to be used by him during the work and shall provide electrical connection to the same. The structure shall be removed after the completion of work, by the Contractor, at his own cost.

4.0 WATER FOR CONSTRUCTION AND OTHER USE

4.1 Unless otherwise specified the Contractor shall make his own arrangement for water for the work and nothing extra shall be paid for the same.

4.2 The water used by the Contractor shall be fit for drinking as well as construction purposes to the satisfaction of the OMFED/OWNER.

4.3 The Contractor may be allowed to construct temporary tube wells/wells in the Project site for getting water after he has got written consent of the Owner/Project Authority/Engineer. The Contractor shall be required to provide necessary arrangements to avoid any accident or damage to the buildings, roads, and service lines adjacent to the tube wells/wells sunk. The Contractor shall dismantle the tube well/well on completion of work and restore the ground to its original condition at his own cost.

4.4 In case the Owner/Purchaser supplies water, it shall be on the following conditions:

1. Water charges @0.5% shall be recovered from the gross amount of work done from each Interim bill.

2. The water shall be provided at one point in the site at the discretion of the Engineer. The Contractor shall make his own arrangement for water connection and distribution pipelines in the construction area.

3. The Owner/Purchaser shall not guarantee the maintenance of uninterrupted water supply. It will be the responsibility of the Contractor to make alternative arrangements for water supply at his own cost in the event of any break down so that the progress of work is not affected for want of water. No claim or damage or refund of water charges shall be entertained on account of such break down.

5.0 POWER (ELECTRICITY) SUPPLY

5.1 Unless otherwise specified the Contractor shall have to make his own arrangements for the power supply at his cost. All the works shall be done as per IEA Rules. The temporary lines shall be removed by the Contractor at his cost after the completion of the work or if there is any hindrance, to the other works due to the alignment of these lines, during the Contract period.

5.2 In case the power supply is provided by the Owner/Purchaser, it shall be on the following conditions:-

1. Electricity charges @ 0.5% shall be recovered from the gross amount of work done from each interim bill.

2. The supply shall be made at one point in the site at the direction of the Engineer. The Contractor shall make his own arrangement to receive, carry and distribute the power wherever it is required within the site as per IEA rules.

3. The owner / project authority shall not guarantee the maintenance of uninterrupted electricity supply and voltage fluctuations etc. It will be the responsibility of the contractor to make alternative arrangements for electricity supply at his own cost in the event of any breakdown so that the progress of work is not affected for want of electricity. No claim or damage or refund of electricity charges shall be entertained on account of the above.
4. The temporary supply lines shall be removed and the site shall be cleared by the Contractor after the completion of the work at his own cost.

6.0 TEMPORARY WORKS

6.1 All temporary sheds, godowns, office etc required for storage/safe custody of materials and for contractor's supervisory personnel at site shall be accounted for in the bid prices.

7.0 CHEMICALS AND LUBRICANTS

7.1 All chemicals, nutrients and first fill of lubricants for equipment as necessary for commissioning and test run of the plant shall be provided by the contractor.

8.0 INCIDENTAL WORKS AND SERVICES

8.1 All works necessary and incidental for the satisfactory completion of the plant shall be included in the scope of the work.

8.2 The incidental services shall be provided as per the requirement outlined in the Schedule of Specifications and as covered under Clause 42 of the General Conditions of Contract.

9.0 ACCESS TO THE UNITS

9.1 Platforms, ladders, walkways and railings for the safe and easy access to the units shall be provided.

9.2 CI rungs shall be provided for safe and easy maintenance of all chambers, manholes and plant units.

10.0 TEST- RUN OF THE PLANT

10.1 After stabilization of plant, a **one month guarantee test run** shall be provided by the Contractor during which daily monitoring of raw and treated effluent quality and effluent throughput shall be done. Over and above the daily monitoring of effluent quality by the Contractor, he shall arrange at his own cost, analysis of the composite raw and treated effluent samples for 7 consecutive days at an external laboratory approved by the State Pollution Control Board. The results shall conform to the performance guarantee for the plant, which shall be a pre requisite for the take over of the plant. In case of non-compliance to the guaranteed treated effluent quality for given design input conditions, the Contractor shall take necessary measures to bring the plant to the desired performance.

11.0 LESS EFFLUENT FLOW CONDITION

11.1 In case during the guarantee test run, the effluent flow or organic load shall be found to be less than the rate input, the contractor shall undertake that as and when rated throughput and organic load conditions are available, the contractor shall extend necessary assistance to achieve the guaranteed output quality, through re-deputation of his personnel without extra cost to the OMFED/Owner.

12.0 TRAINING

12.1 The Contractor shall train the plant personnel in the Operation & Maintenance practice for the Effluent Treatment Plant during the one-month guarantee test run.

13.0 OPERATION MANUAL

13.1 The scope of services shall include the Preparation and Submission of Operation & Maintenance Manual prior to plant commissioning. The Manual shall cover the following aspects:

Brief process description & flow sheet. Unit-wise function and description Equipment details, operational instructions, maintenance procedures. Plant start-up, commissioning, normal operation, and emergency operation steps.

14.0 INSURANCE

The insurance shall be for an amount equal to 110% value of the Goods & services including installation/ commissioning on "All Risks" basis including War risks and Strike clauses valid for a period not less than 3 months after the date of handing over.

15.0 SPARE PARTS

The contractor shall carry sufficient inventories to assure ex-stock supply of consumable spares such as gaskets, plugs, washers, belts etc. Other spare parts and components shall be supplied as promptly as possible but in any case within one month of placement of order.

16.0 NOTICES

For the purpose of all the notices, the following shall be the address:

MANAGING DIRECTOR
THE ORISSA STATE CO-OPERATIVE MILK
PRODUCERS' FEDERATION LIMITED,
D- 2, SAHID NAGAR, BHUBANESWAR
PIN – 751 007.

SECTION IV 'A'

GENERAL TECHNICAL SPECIFICATIONS FOR CIVIL WORKS, PIPING AND ELECTRICAL WORK

CONTENTS

SECTION IV - A

GENERAL TECHNICAL SPECIFICATIONS FOR CIVIL WORK, PIPING AND ELECTRICAL

SECTION 1 .0 EARTH WORK

Scope

This section covers the works specification of earthwork in excavation in all kinds of soils including murrum, hard murrum, soft rock (without blasting, hard rock (without blasting), rock (with blasting), filling excavated earth in plinths, sand filling in plinth, rubble soling, and brick on edge soling.

Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

a) IS - 4081 Safety code for blasting and related drilling operations

b) IS - 1200 Method of measurement of building works.

c) IS - 3764 Safety code for excavation work.

d) IS - 3385 Code of practice for measurement of civil engineering works.

e) IS - 2720 Part II Determination of moisture content.

Part VIII Determination of moisture content dry density relation using light compaction.

Part XXVIII Determination of dry density of soils, in-place by the sand replacement method.

Part XXIX Determination of dry density of soils,in-place, by the core cutter method.

Drawings

Engineer will furnish all necessary drawings showing the areas to be excavated, filled, sequence of priorities etc. contractor shall follow strictly such drawings.

General

Contractor shall provide all tools, plants, instruments, qualified supervisory personnel, labour, materials, and temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein, for completion of the work.

Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for levelling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference/grid lines at 5m intervals or nearer as determined by engineer based on ground profile. These shall be checked by engineer and thereafter properly recorded.

The area to be excavated/filled shall be cleared of fences, trees, plants, logs, slumps, bush, vegetations, rubbish slush etc. and other objectionable matter. If any roots or stumps of trees are found during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by engineer. Where earthfill is intended, the area shall be stripped of all loose/soft patches, top soil containing deleterious matter/materials before fill commences.

Relics, objects of antiquity, etc.

All gold, silver, oil minerals archaeological and other findings of importance, all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of owner and contractor shall dully preserve the same to the satisfaction of Owner/Project Authority and from time to time deliver the same to such person or persons as Owner/Project Authority may from time to time authorise or appoint to receive the same.

1.01 **Earth work in excavation up to 1.50m from existing GL**

A) **Classification**

Any earthwork will be classified under any of the following categories :

i) **All kinds of soils**

These shall include all kinds containing kankar, sand, silt, murrum and/or shingle, gravel, clay, loam peat, ash, shale etc. which can generally be excavated by spade, pick-axe and shovel and which is not classified under soft and decomposed rock, and hard rock defined below. This shall also include embedded rock boulders not bigger than 1 metre in any dimension and not more than 200 mm in any one of the other two dimensions.

ii) **Soft rock**

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite etc. which are to be excavated with or without blasting or could be excavated with picks, hammer, crow bars, wedges. This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders not bigger than 1 metre in any dimension and not more than 500 mm in any one of the other two dimensions Rubble masonary to be dismantled will also be measured under this item.

iii) **Hard rock**

This shall include rock which cannot be easily excavated with pick-axes, hammer, crow bars and wedges but has to be either heated where blasting is prohibited or has to be blasted. They shall be stacked separately for measurement.

B) The earth work in excavation shall be done as per the approved drawings up to required depths and levels and alignments in all sorts of soils. The depth of the foundation will be as per the engineer's instructions. The lining work should be done by the contractor. Roots or trees met with during the excavation shall be cut and smeared with coal tar. Excavated earth shall be stacked atleast 3 m away from the trenches or as per the Engineer's instructions, so that it may not damage the sides of the excavated trenches. The sides of the excavated trenches shall be vertical and in straight line and bottom uniformly levelled watered, consolidated and ready for termite treatment. The maximum lead for stacking the earth shall be 100 m, unless otherwise categorically specified in the item description.

C) In firm soil if the excavation is deeper than 2 m the sides of the trenches shall be made bigger by allowing steps of 50 cm on either side so as to keep the slope 0.25 to 1. In loose soft or slushy soil the width of the step shall be suitably increased or the sides sloped or shoring and strutting may be done as per the engineer's instructions.

D) For excavation for drain work, the sides and the bottoms should be to the required slope, shape and gradient. The cutting shall be done from top to bottom. Under no circumstances shall undermining or under cutting be allowed. The final surface shall be neatly levelled and well compacted. The earth from the cutting shall be directly used for filling either in plinth or on grounds.

E) For excavation in trenches for pipes nothing extra shall be payable for the lift irrespective of the depth unless specifically mentioned otherwise in the schedule of quantities.

F) If the trenches are made deeper than specified level due to oversight or negligence of the contractor the extra depth shall be filled up by lean concrete of mix 1:5:10(1 cement: 5 coarse sand:10 coarse aggregate of nominal size 40mm & down) and if the trench is made wider than shown in

the drawings, the contractor has to make good, at his own cost. The foundation trenches shall be free from water and muck, while the foundation work is in progress.

G) The trenches which are ready for concreting shall be got approved by the Engineer.

H) The excavated stacked earth shall be refilled in the trenches and sides of foundation in 150 mm layers and the balance surplus shall be first filled in layers in plinth and the remaining surplus shall be disposed off by uniform spreading within the site/ outside the site as directed by the Engineer.

I) Adequate protective measures shall be taken by the contractor to see that the excavation for the building foundation does not affect the adjoining structure's stability and safety. contractor will be responsible if he has not taken precaution for the safety of the people, property or neighbour's property caused by his negligence during the constructional operations.

J) To the extent available, selected surplus soils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic & other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill up the voids and the mixture used for filling.

K) As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with earth in layers 15 cm to 20 cm , each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer.

1.02 **Earth work in excavation for depth exceeding 1.50m but not exceeding 3.0m**

The general specification shall be same as for the item 1.01 given above.

1.03 **Earth work in excavation for depth exceeding 3.0m but not exceeding 4.5m**

The general specification shall be same as for the item 1.01 given above.

1.04 **Earth work in excavation in rocks upto 1.50m from EGL**

(A) Unless otherwise stated herein, IS 4081, safety code for blasting and related drilling operations shall be followed. After removal of over burden, if any, excavation shall be continued in rock to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by Engineer. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions, shall be taken to preserve the rock below and beyond the lines

specified for the excavating, in the soundest possible condition. The quantity and strength of explosive used, shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by engineer shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structure as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Engineer at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

(B) Specific permission of engineer will have to be taken by Contractor for blasting rock and he shall also obtain a valid blasting licence from the authorities concerned. If permission for blasting is refused by Engineer, the rock shall be removed by wedging, pick barring, heating and quenching or other approved means. All loose/loosened rock in the sides shall be removed by barring wedging, etc. The unit rates for excavation in hard rock shall include the cost of all these operations.

(C) Contractor shall obtain necessary license for storage of explosives fuses and detonators issued to him from Owner's stores or from a supplier arranged by the contractor, from the authorities dealing with explosives. The fees, if any, required for obtaining such license, shall be borne by contractor. Contractor shall have to make necessary storage facilities, for the explosives etc. as per rules and regulations of local, State and Central Govt. authorities and Statutory bodies. Explosives shall be kept dry and shall not be exposed to direct rays of sun or be stored in the vicinity of fire, stoves, steam pipes or heated metal, etc. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as far as possible from the area to be blasted. engineer's prior approval shall be taken for the location proposed for the magazine.

(D) In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old.

(E) For blasting operations, the following points shall be observed:

i) Contractor shall employ a competent and experienced supervisor and licensed blaster in-charge for each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.

ii) Before any blasting is carried out, contractor shall intimate engineer and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.

iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within 200M radius from the firing point, at least 15 minutes before firing time by sounding warning siren. The areas shall be encircled by red flags. Clearance signal shall also be given sounding a distinguishing siren.

iv) The blasting of rock near any existing buildings, equipment or any other property shall be done under cover and contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by engineer, a trench shall have to be cut by chiselling prior to the blasting operation separating the area under blasting from the existing structures.

v) The firing shall be supervised by a Supervisor and not more than six (6) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along with misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.

vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth the balance of the hole shall be filled with stemming which may consist of sand or stone dust or similar inert material.

vii) Contractor shall preferably detonate the explosives electrically.

viii) The explosive shall be exploded by means of a primer which shall be fired by detonating a fuse instantaneous detonator (FID) or other approved cables. The detonators with FID shall be connected by special nippers.

ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatine with detonator and fuse wire may be used. Under water or for excavation in rock with substantial accumulated seepage electric detonation shall be used.

x) Holes for charging explosive shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.

xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond an over-break limit of 75mm shall be filled up as instructed by engineer, with concrete of strength not less than M10. The cost of filling such excess depth shall be borne by contractor and the

excavation carried out beyond the limit specified above will not be paid for. Stepping in rock excavation shall be done by hand trimming.

xii) Contractor shall be responsible for any accident to workmen, public or owner's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by inspector of explosives, or any other authority, duly constituted under the State and/or Union Government.

1.05 **Earth work in excavation in rocks depth exceeding 1.50m but not exceeding 3.0m**

The general specification is same as item no. 1.04.

1.06 **Filling in plinth with selected excavated earth**

A) Plinth above in layers 30 cm, watered and compacted with mechanical compaction machines. When filling reaches the finished level, the surface shall be flooded with water, if directed by the engineer, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

B) Where specified in the item discretion given in the Schedule of Quantities that the compaction of the plinth fill shall be carried out by means of 10/12 tonnes rollers smooth wheeled, sheep-foot or wobble wheeled rollers. As rolling proceeds water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill.

1.07 **Filling in plinth with selected earth for lead exceeding 300m**

The general specification is same as item no. 1.06.

1.08 **Filling excavated earth in ground for land development**

A) No earthfilling shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by engineer.

B) Filling shall be carried out as indicated in the drawings and as directed by engineer. If no compaction is called for, the fill may be deposited to the full height in one operation and levelled. If the fill has to be compacted, it shall be placed in layers not exceeding 600 mm and levelled uniformly and compacted before the next layer is deposited.

C) Field compaction is called for, test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankments as well.

D) Contractor shall protect the earthfill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor shall remove the affected material and make good the slip at his own cost.

E) The fill shall be carried out to such dimension and levels as indicated on the drawings after the stipulated compaction. The fill shall be considered as incomplete if the desired compaction has not been obtained.

1.09 **Filling in plinth and ground with earth brought from outside**

A) Filling shall be carried out with approved material as described in 1.01 (J). The material and source shall be subject to prior approval of Engineer. The approved area, from where the fill material is to be dug, shall be cleared of all bushes, roots plants, rubbish etc. top soil containing salts, sulphate and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by engineer. The contractor shall make necessary access roads to those areas and maintain the same, if such access road does not exist, at his cost.

B) If any material is rejected by engineer, contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be disposed off by uniform spreading within the site as instructed by the engineer.

C) The compaction shall be carried out as specified in the item no. 1.06 for filling in plinth and as per item no. 1.08 for filling in ground for land development.

1.10 **Providing and filling local sand in trenches, plinth and surrounding areas**

A) At places backfilling shall be carried out with local sand if directed by engineer. The sand used shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to contractor's account. The surface of the consolidated sand shall be dressed to require level or slope. Construction of floors or other structures on sand fill shall not be started until engineer has inspected and approved the fill.

1.11 **Providing and laying rubble soling**

A) Rubble used for packing under floors, foundations etc. shall be hard, durable rock, free from veins, flaws and other defects. The size of the rubble shall be 100 mm - 150mm unless otherwise specified in the item description in the schedule of quantities and the quality shall be got approved by the engineer.

B) Rubble shall be laid closely in position on the sub-grade. All interstices between the stones shall be wedged in with smaller stones of suitable size well driven to ensure tight packing and complete filling of interstices. Such filling shall be carried out simultaneously with the placing in position of rubble stone and shall not lag behind.

C) Small interstices shall be filled with murrum, well watered and rammed.

1.12 **Brick soling**

A) Bricks shall be laid on edge or flat as per the item specification. The bricks shall be placed as close as possible. Broken bricks shall not be used except for closing the line. Bricks should not show any efflorescence on drying.

B) The soling pattern shall be as specified in the item specification, it can be plain, diagonal or herring-bone. Suitable slope shall be maintained as specified by the engineer.

C) The joints shall be filled with earth or sand as specified. If it is to be filled with cement mortar, the proportion of the mortar shall be as specified in the item specification.

1.13 **Providing and laying dry stone pitching**

A) Stone subject to marked deterioration by water or weather will not be accepted. The stone shall be hard, durable and fairly regular in shape and its thickness in any one direction shall not be less than the thickness of the pitching as specified in the Schedule of Quantities.

B) Before laying the pitching the sides of the sloped surface shall be trimmed to the required slope and profiles. The depressions shall be thoroughly filled and compacted. It shall commence from the bottom. The stones shall be placed normal to the slope and the largest dimension is perpendicular to the face of the slope unless such dimension is more than the thickness of the pitching. The largest stones shall be placed at the bottom. The joints between the stones shall be filled with good earth. The earth shall be got approved by the engineer before filling.

1.14 **Providing and laying dry stone pitching with cement pointing**

A) The general specification shall be same as the item no. 1.13 but for the joints between the stones shall be filled with cement mortar 1:4 (1 part cement: 4 parts coarse sand).

1.15 **Providing and filling dry brickbats at all levels**

The brickbats shall be of 40-65mm (average) thickness in size. The brickbats shall be clean and mortar free. They should be washed off dust before it is filled. They shall be filled in places as directed by the engineer.

SECTION 2.00

CONCRETE AND ALLIED WORKS

I **Applicable Codes**

The following codes and standards are made a part of the Specifications. All standards, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall prevail.

(a) **Materials**

1)	IS 269:	Specification for ordinary, rapid hardening and low heat portland cement.
2)	IS 455:	Specification for Portland blast furnace slag.
3)	IS 1489:	Specification for portland-pozollana cement.
4)	IS 4031:	Methods of physical tests for hydraulic cement.
5)	IS 650:	Specification for standard sand for testing of cement.
6)	IS 383:	Specification for coarse and fine aggregates from natural sources for concrete.
7)	IS2386 (Parts I to III):	Methods of test for aggregates for concrete.
8)	IS 516:	Methods of test for strength of concrete.
9)	IS 1199:	Methods of sampling and analysis of concrete.
10)	IS 2396(I) IS 5640	Flakiness Index of aggregates
10)	IS 3025:	Methods of sampling and test (physical and chemical water used in industry)
11)	IS 432 (Part I & II):	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
12)	IS 1139:	Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement
13)	IS 1566:	Specification for plain hard drawn steel wire fabric for concrete reinforcement.
14)	IS 1785:	Specification for plain hard drawn (Part I) steel wire for pre-stressed concrete.
15)	IS 1786:	Specification for cold twisted steel bars for concrete reinforcement.
16)	IS 2090:	Specification for high tensile steel bars used in pre-stressed concrete

17) IS 4990: Specification for plywood for concrete shuttering work.

18) IS 2645: Specification for integral cement waterproofing compounds.

(b) **Equipment**

1) IS 1791: Specification for batch type concrete mixers

2) IS 2438: Specification for roller pan mixer

3) IS 2505: Specification for concrete vibrators immersion type

4) IS 2506: Specification for screed board concrete vibrators

5) IS 2514: Specification for concrete vibrating tables.

6) IS 3366: Specification for pan vibrators

7) IS 4656: Specification for form vibrators for concrete.

8) IS 2722: Specification for portable swing weigh-batchers for concrete (single and double bucket type)

9) IS 2750: Specification for steel scaffoldings

(c) **Codes of Practice**

1) IS 456: Code of practice for plain and reinforced concrete.

2) IS 1343: Code of practice for pre-stressed concrete

3) IS 457: Code of practice for general construction of plain and reinforced concrete for dams and other massive structures

4) IS 3370: Code of practice for concrete (Part I to IV) structures for storage of liquids

5) IS 3935: Code of practice for composite construction

6) IS 3201: Criteria for design and construction of pre-cast concrete trusses.

7) IS 2204: Code of practice for construction of reinforced concrete shell roof

8) IS 2210: Criteria for the design of RC shell structures and folded plates.

9) IS 2751: Code of practice for welding of mild steel bars used for reinforced concrete construction.

10) IS 2502: Code of practice for bending and fixing of bars for concrete reinforcement.

11) IS 3558: Code of practice for use of immersion vibrators for consolidating concrete.

12) IS 3414: Code of practice for design and installation of joints in buildings

13) IS 4014: Code of practice for steel tubular, (Part I&II) scaffolding.

14) IS 2571: Code of practice for laying in-situ cement concrete flooring.

(d) **Construction Safety**

1) IS 3696: Safety code for scaffolds and ladders

(e) **Measurement**

1) IS 1200: Method of measurement of building works.

2) IS 3385: Code of practice for measurement of civil engineering works.

The above mode of measurements shall be applicable only if it is not given specifically in the tender document.

II General

The quality of materials, method and control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall conform to the applicable portions of this specification.

Engineer shall have the right to inspect the source/s of material/s, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and engineer's approval obtained, prior to starting of concrete work.

III Materials

The ingredients to be used in the manufacture of standard concrete shall consist solely of standard type portland cement, clean sand, natural coarse aggregate, clean water and admixtures.

(A) **Cement**

a) **If the Contractor is instructed to supply cement, then the following points shall be applicable:**

i) Unless otherwise specified the cement shall be ordinary portland cement in 50 kg bags. The use of bulk cement will be permitted only with the approval of Engineer.

ii) A certified report attesting to the conformance of the cement to IS specifications by the cement manufacturer's chemist shall be furnished to engineer if demanded.

iii) Cement held in storage for a period of ninety (90) days or longer shall be tested. Should at any time Engineer have reasons to consider that any cement is defective, then irrespective of its origin, and/or manufacturers test certificate, such cement shall be tested immediately at contractor's cost at a National Test Laboratory/approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any work. Contractor shall not be entitled to any claim of any nature on this account.

b) **If the cement is supplied by the Project Authority,**

i) Contractor will have to make his own arrangements for the storage of minimum 250MT of cement. If supplies are arranged by owner, cement will be issued in quantities to cover work requirements of one month or more, as deemed fit by Engineer and it will be the responsibility of contractor to ensure adequate and proper storage. Cement in bulk may be stored in bins or silos which will provide complete protection from dampness contamination and minimize caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be approved by Engineer. Consignments of cement shall be stored as received and shall be consumed in the order of their delivery.

(B) **Aggregates**

a) Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75 mm IS sieve. Coarse aggregate is aggregate most of which is retained on 4.75 mm sieve

b) All fine and coarse aggregates proposed for use in the work shall be subject to Engineer's approval and after specific materials have been accepted the source of supply of such materials should not be changed without prior approval of Engineer.

c) Aggregates shall, except as noted above, consist of natural sands, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may

cause corrosion of the reinforcement or may impair the strength and/or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the mix design and preliminary tests on concrete specified later.

d) **Sampling and testing**

Samples of the aggregates for mix design and determination of suitability shall be taken under the supervision of Engineer and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to Engineer in advance of the work for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by contractor.

e) **Storage of Aggregates**

All coarse and fine aggregates shall be stacked in stock separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and with earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rackers shall be used for lifting the coarse aggregates from bins or stockpiles. Coarse aggregate shall be piled in layers not exceeding 1.20 meters in height to prevent coning or segregation. Each layer shall cover the entire area of the stockpile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

f) **Specific Gravity**

Aggregate except as noted above, and for other than light weight concrete shall consist of natural or crushed sand shall conform to IS 383. The sand shall be clean sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities/strength/ durability of concrete.

(C) **Machine made Sand**

Machine made sand will be acceptable, provided the constituent rock/gravel composition shall be sound, hard dense, non-organic uncoated and durable against weathering.

i) **Screening and Washing**

Sand shall be prepared for use for such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions.

ii) **Foreign Material Limitations**

The percentages of deleterious substances in sand delivered to the mixer shall not exceed the following:

i)	Material finer than 75 micron IS sieve	3.00	15.00
ii)	Shale	1.00	-
iii)	Coal and lignite	1.00	1.00
iv)	Clay lumps	1.00	1.00
v)	Total of all above substances including items (i) to (iv) for uncrushed sand and items (iii) and (iv) for crushed sand	5.00	2.00

iii) **Gradation**

Unless otherwise directed or approved, the grading of sand shall be within the limits indicated hereunder:

	Percentage passing for			
IS Sieve Designation	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100

300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of sieves other than 600 micron IS sieve, by total amount not exceeding 5 percent, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV.

iv) **Fineness Modulus**

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieves sizes 4.75mm, 2.36 mm, 1.18 mm 600 micron, 300 micron and 150 micron and dividing the sum by 100.

(D) **Coarse Aggregate**

a) Coarse aggregate for concrete, except as noted above and for other than light weight concrete shall conform to IS 383. This shall consist of natural or crushed stone and gravel and shall be clean and free from elongated, flaky or laminated pieces adhering coatings, clay lumps, coal residue, clinkers slag, alkali, mica, organic matter or other deleterious matter.

b) **Screening and Washing**

Natural gravel and crushed rock shall be screened and/or washed for the removal of dirt or dust coating, if so demanded by Engineer.

c) **Grading**

Coarse aggregate shall be graded in both cases the grading shall be within the following limits.

IS Sieve Designation	% passing for single sized aggregate of nominal size (mm)					% passing for graded aggregate of nominal size (mm)			
	40	20	16	12.5	10	40	20	16	12.5
63mm	100	-	-	-	-	100	-	-	-
40mm	85-100	100	-	-	-	95-100	100	-	-
20mm	0-20	85-100	100	-	-	30-70	95-100	100	-
16mm	-	-	85-100	100	-	-	-	90-100	-
12.5mm	-	-	-	85-100	100	-	-	-	90-100
10mm	0.5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85

4.75mm	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36mm	-	-	-	-	0-5	-	-	-	-

The pieces shall be angular in shape and shall have grannular or crystalline surfaces, Friable, flacky and laminated pieces, mica and shale, if present, shall be only in such quantities that will not, is the opinion of Engineer affect adversely the strength and/or durability of concrete. The maximum size of coarse aggregate shall be 75 mm for class A concrete 40 mm for class B concrete and 20mm for class C concrete. The maximum size of coarse aggregate shall be the maximum size specified above, but in no case greater than 1/4 of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. Plums above 150 mm and upto any reasonable size can be used in plain mass concrete work of large dimensions upto a maximum limit of 20% of volume of concrete when specifically approved by Engineer. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occuring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air, as determined by IS 2386.

d) **Foreign Materials Limitations**

The percentages of deleterious substance in the coarse aggregate delivered to the mixer shall not exceed the following:

		Percentage by Weight	
		Uncrushed	Crushed
i)	Material finer than 75 micron IS sieve	3.00	3.00
Ii)	Coal and lignite	1.00	1.00
Iii)	Clay lumps	1.00	1.00
Iv)	Soft fragments	3.00	-
v)	Total of all the above substances	5.00	5.00

(E) **Water**

a) Water used for both mixing and curing shall be free from injurious amounts of deleterious materials. Potable waters are generally satisfactory for mixing and curing concrete.

b) In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS-456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

c) Average 28 days compressive strength of at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water.

d) The initial setting time or test block made with the appropriate set cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than plus minus 30 seconds form the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS 4031.

e) Where water can be shown to contain an excess of acid, alkali sugar or salt, engineer may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values:

   i) To neutralize 200 ml sample of water, using phenolphthalein as indicator, it should not require more than 2 ml of 0.1 normal NaOH. The details of test shall be as given in IS 3025.

   ii) To neutralize 900 ml sample of water using methyl orange as an indicator, it should not require more than 10 ml of 0.1 normal HCl. The details of test shall be given in IS 3025.

   iii) Percentage of solids when tested in accordance with the method indicated below shall not exceed the following:

	Percent	Method of Test (Ref. To clause no. in IS 3025-1964)
Organic	0.02	10 and 11 (organic solids = total solids minus ignited residue)
Inorganic	0.30	11 (Ignited residue)

Sulphate (as SO_4)	0.05	20
Alkali Chlorides (as Cl)	0.10	24

(F) **Brick aggregates**

The brickbats shall be of new bricks well burnt, hard, durable and broken to sizes, well graded. It shall be free from dust, the size shall be of 37mm and down. It shall be free from earth and other impurities.

(G) **Reinforcement Steel**

a) Reinforcement bars, if supplies are arranged by contractor, shall be either plain round mild steel bars grade I as per IS 432 (part I) or medium tensile steel bar as per IS 432 (Part I) or hot rolled mild steel and medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from Engineer.

b) Plain round mild steel bars grade II as per IS: 432 (part I) may be used with prior approval of Engineer in writing and with 10% increase in the reinforcement area but its use shall not be permitted in structures located in earthquake zones subjected to severe damage (as per IS:1895) and for structures subject to dynamic loading (other than wind loading), such as frames supporting rotary or reciprocating machinery etc.

(c) All reinforcement shall be clean, free from grease, oil, paint, loose mill scale, loose rust, dust, bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used.

2.01 **Providing and laying Brickbat Cement Concrete 1:4:8 (1 cement, 4 coarse sand, 8 brickbats of size 37mm and down).**

The brickbats, sand and cement shall be of quality as described in the materials section above. The materials shall be mixed in volumetric proportions in concrete mixer only. The concrete shall be laid in layers of 150mm thick and well consolidated with rammer of weight 4.5 to 5.5 kg steel rammers of base area 300 sq. cm till slurry comes on top before the next layer is laid. Curing shall be done for 7 days. For joints the edge of the concrete shall be finished off with a slope not steeper than 2:1 and well roughened.

2.02 **Providing and laying Brickbat Cement Concrete 1:5:10 (1 cement, 5 coarse sand, 10 brickbats of size 37mm and down).**

The general specification is same as for item no. 2.01 but for the volumetric proportion of the sand and brickbats is 5 and 10 instead of 4 and 8 respectively.

2.03 **Providing and laying plain cement concrete 1:4:8(1cement: 4 coarse sand, 8 graded stone aggregate of nominal size 37 mm and down.**

The coarse aggregate, cement and coarse sand shall be of quality as specified in the materials section. The other procedures are same as that specified in item no. 2.01.

2.04 **Providing and laying plain cement concrete 1:3:6(1cement: 3 coarse sand, 6 graded stone aggregate of nominal size 37 mm and down.**

-Do- same as per item no. 2.03 but for the volumetric proportions of the coarse sand and the stone aggregate which shall be 3:6 instead of 4:8.

2.05 **Providing and laying RCC of mix M20 for structures up to plinth level**

Mix Design

a) All concrete in the works shall be of design mix as defined in IS 456, unless it is a nominal mix concrete such as 1:3:6, 1:4:8 or 1:5:10. Whether reinforced or otherwise, all design mix concrete works to be carried out under this specification shall be divided into the following classifications:

MINIMUM COMPRESSIVE STRENGTH OF 15 CM CUBES AT 7 AND 28 DAYS AFTER MIXING, CONDUCTED IN ACCORDANCE WITH IS 516

Class	Preliminary test N/SQ.MM		Work test N/SQ.MM		Max. size of aggregate mm.	Min. Cement Content / cum
	at 7 days	at 28 days	at 7 days	at 28 days		
M 40	35.0	40.0	27.0	40	20	360 kg
M 35	31.0	35.0	23.5	35	20	340 kg

Class	Preliminary test N/SQ.MM		Work test N/SQ.MM		Max. size of aggregate mm.	Min. Cement Content / cum
	at 7 days	at 28 days	at 7 days	at 28 days		
M 30	28.0	30.0	20.0	30	40 or 20	320 kg
M 25	23.5	25.0	17.0	25	40 or 20	300 kg
M 20	19.4	20.0	13.5	20	40 or 20	300 kg

b) **It shall be very clearly understood that whenever the class of concrete such as M 20 is specified it shall be the Contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate by weight per 50 kg of cement shall not exceed 450 kg except when otherwise specifically permitted by Engineer.**

c) To fix the grading of aggregates, water cement ratio, workability and the quantity of cement required to give preliminary and works cubes of the minimum strength specified, the proportions of the mix shall be determined by weight/volume. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to Indian Standard Specifications.

d) Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of aggregates and/or cement, preliminary tests shall be repeated to determine the revised proportions, of the mix to suit the altered conditions.

e) While fixing the value for water cement ratio for preliminary mixes, assistance may be derived from the graph (appendix IS 456 showing the relationship between the 28 day compressive strengths of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269.

Preliminary test

a) Test specimens shall be prepared with at least two different water/cement ratios for each class of concrete, consistent with workability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce concrete of required consistency and to give the specified strength. It will be the Contractor's sole responsibility to carry out these tests and he shall therefore furnish to Engineer a statement of proportions proposed to be used for the various concrete mixes.

b) Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water, cement and aggregates for each mix shall be determined by weight/volume to an accuracy of 1 part in 1000 parts.

c) Mixing shall be done by a mixer machine as per IS 516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added,. mixed and water added and mixed thoroughly for a period of not less than 3 minutes until the resulting concrete is uniform in appearance. Each

mix of concrete shall be of such a quantity as to leave about 10% excess concrete after moulding the desired number of test specimens.

d) The consistency of each mix of concrete shall be measured immediately after mixing, by the slump test in accordance with IS 1199. If in the slump test, care is taken to ensure that no water or other materials is lost, the materials used for the slump test may be remixed with the reminder of the concrete for making the specimen test cubes. The period of re-mixing shall be as short as possible yet sufficient to produce a homogeneous mass.

e) Compression tests of concrete cubes shall be made as per IS 516 on 15 cm cubes. Each mould shall be provided with a metal base having a plane surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

   Height and distance between the opposite faces of the mould shall be of specified size plus minus 0.2mm. The angle between the adjacent internal faces and between internal faces and top and bottom planes of mould shall be 90 Deg. plus/minus 5 Deg. The interior faces of the mould shall be plane surfaces with a permissible variation 0.03mm.

f) Concrete test cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS 516.

g) Curing shall be as specified in IS 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temp. of 27 Deg. Cent. plus minus 2 Deg. Cent. for 24 hours plus minus half hour from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and kept immersed in clean, fresh water and kept at 27 Deg. Cent. plus minus 2 Degree Centigrade temperature until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

h) **Testing of specimens**

   The strength shall be determined based on not less than five cubes test specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to Engineer. The test result shall be accepted by Engineer if the average compressive strengths of the specimens are tested subject to the condition that only one out of the five consecutive test may give a value less than the specified strength for that age. The Engineer may direct the Contractor to repeat the tests if the results are not satisfactory and also to make such changes as he considers necessary to meet the requirements specified. All these preliminary tests

shall be conducted by the Contractor at his own cost in an approved laboratory.

Proportioning consistency, batching and mixing of concrete
Proportioning

a) **Aggregate**

The proportions which shall be decided by conducting preliminary test shall be by volume. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete mixing. The supply of properly graded aggregate of uniform quality shall be maintained over the period of work, the grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stocked in separate stockpiles. The grading of coarse and fine aggregate shall be checked as frequently as possible as determined by Engineer, to ensure maintaining of grading in accordance with the samples used in preliminary mix design. The material shall be stock piled well in advance of use.

b) **Cement**

The cement shall be measured by volume.

c) **Water**

Only such quantity of water shall be added to the cement and aggregates in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with the strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of material or the collection of excessive free water on the surface of the concrete.

The water cement (W/C) ratio is defined as the volume of water in the mix (including the surface moisture of the aggregates) divided by the volume of cement in the mix. The actual water cement ratio to be adopted shall be determined in each instance by the Contractor and approved by the Engineer.

d) **Proportioning by water/Cement ratio**

The w/c ratio specified for use by Engineer shall be maintained. The Contractor shall determine the water content of the aggregates as frequently as directed by Engineer as the work progress and as specified in IS 2386 (Part-III) and the amount of water added at the mixer shall be adjusted as directed by Engineer so as to maintain the specified W/C ratio. To allow for the variation in volume of aggregates due to variation in their moisture

content suitable adjustments in the volume of aggregates shall also be made.

e) **Consistency and slump**

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined, the consistency of the mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor tests, in accordance with IS 1199 shall be conducted from time to time to ensure the maintenance of such consistency.

f) The following tabulation gives a range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer.

SLUMPS FOR VARIOUS TYPES OF CONSTRUCTION

Only sufficient quantity of water shall be added to concrete during mixing to produce a mix of sufficient workability to enable it to be well consolidated, to be worked in to the corners of the shuttering and around the reinforcement, to give the specified surface finish, and to have the specified surface strength. The following slumps shall be adopted for different kinds of works:-

Name of Work	When vibrator used	When vibrator not used
Mass concrete in foundations, footings retaining walls and pavements.	10mm to 25mm	50mm to 75mm
Thin sections of floors of less than 75mm thick	25mm to 40mm	75mm to 100mm
For Reinforced cement concrete work:		
Mass concreting in foundations, footings retaining walls and pavements	10mm to 25mm	80mm
Beams, slabs, columns	25mm to 40mm	100mm to 125mm
Thin shells, folded plates etc.	40mm to 50mm	125mm to 150m

Sampling and testing concrete in the field

a) Facilities required for sampling materials and concrete in the field shall be provided by the Contractor at no extra cost. The following equipment with operator shall be made available at Engineer's request (all must be in serviceable condition):

i) One concrete cube-testing machine suitable for 15 cm machine suitable for 15 cm cubes of 100 tones capacity with proving calibration ring.

ii) Twelve cast iron cube moulds of 15 cm size

iii) One Lab. balance to weigh up to 5 kg with sensitivity of 10gm

iv) One set of sieves for coarse and fine aggregates

v) One set of slump cone complete with tamping rod

vi) A set of measures from 5litre to 0.1litre

vii) One electric oven with thermostat upto 120 Deg. Cent.

viii) One flakiness gauge

ix) One elongation index gauge

x) One sedimentation pipette

xi) One Pyconometer

xii) Two calibrated glass jar of 1litre capacity

Arrangement can be made by the contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Engineer.

b) At least 6 test cubes of each class of concrete shall be made for every 15.0 cu.m of concrete or part thereof. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The laboratory test results shall be tabulated and furnished to Engineer. Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. The cubes shall be tested on 7th and 28th day from the day of casting of the cubes.

Admixtures

a) Admixtures may be used in concrete only with the approval of Engineer based upon evidence that, with the passage of time, neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating setting of the cement for any concrete containing reinforcement, or embedded steel parts. When calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the volume of the

cement in concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer.

b) **Air entraining agents**

Where specified and approved by Engineer, neutralized vinyl resin or any other approved air-entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6260, air entraining admixtures for concrete. The recommended total air content of the concrete is 4% plus minus 1%. The method of measuring air content shall be as per IS 1199.

c) **Water reducing admixtures**

Where specified and approved by Engineer water reducing lignosulfonate mixture shall be added in quantities specified by Engineer. The admixtures shall be added in the form of a solution.

d) **Retarding admixtures**

Where specified and approved by Engineer, retarding agents shall be added to the concrete mix in quantities specified by Engineer.

f) **Water proofing agent**

Where specified and approved by Engineer, water proofing agent conforming to IS: 2645 shall be added in quantities specified by Engineer.

Optional tests

a) Engineer may order tests to be carried out on cement, sand, coarse aggregate and water in accordance with the relevant Indian Standards. Tests on cement shall include (i) fineness test (ii) test for normal consistency (iii) test for setting time (iv) test for soundness (v) test for tensile strength (vi) test for compressive strength (vii) test for heat of hydration by experiment and by calculations in accordance with IS:269. Tests on sand shall include (i) sieve test (ii) test for organic impurities (iii) decantation test for determining clay and silt content (iv) specific gravity test (v) test for unit weight and bulkage factor . Tests on coarsed aggregate shall include (i) test for sieve analysis (ii) specific gravity and unit weight of dry loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) petrographic examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value. Any or all these tests would normally be ordered to be carried out only if Engineer feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed

by contractor at site or at an approved test laboratory. If the tests are successful, Project Authority shall pay for all such optional tests otherwise the Contractor shall have to pay for them.

b) If the works cubes do not give the stipulated strengths Engineer reserves the right to ask contractor to dismantle such portions of the work, which in his opinion are unacceptable and re-do the work to the standard stipulated at contractor's cost.

c) **Load test on members or any other tests**

i) In the event of any work being suspected of faulty material or workmanship or both, Engineer requiring its removal and reconstruction may order the contractor that it should be load tested in accordance with the following provisions.

ii) The test load shall be 125 % of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of the concrete. During the test, struts strong enough to take the load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.

iii) If within 24 hours of the removal of the load, the structure does not show a recovery of at least 75 percent of the maximum deflection shown during the 24 hours under load the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75 percent of the maximum deflection shown during the second test. If the structure is certified as failed by Engineer, the cost of the load test shall be borne by the contractor.

iv) Any other tests e.g. taking out in approved manner concrete cores, examination and tests on such cores removed from such parts of the structure as directed by Engineer, sonic testing etc. shall be carried out by contractor if so directed.

v) Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove and rebuild the member or members involved or carry out such other remedial measures as may be required by Owner/Project Authority. The Contractor shall bear the cost of so doing, unless the failure of the member or members to fulfill the test conditions is proved to be solely due to faulty design.

Concrete in alkali soils and alkaline water

Where concrete is liable to attack from alkali salts or alkaline water, special cements containing low amount of tricalcium aluminate shall be used, if so specified in the drawings. Such concrete shall have a minimum 28 days

compressive strength of 250 kg per sq.cm and shall contain not less than 370 kg of cement per cubic metre of concrete in place. If specified, additional protection shall be obtained by the use of a chemically resistant stone facing or a layer of plaster of Paris covered with suitable fabric, such as jute thoroughly impregnated with tar.

Preparation prior to concrete placement

a) Before the concrete is actually placed in position, the insides of the form work shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and walls forms to permit removal of saw dust, wood shavings, binding wire, rubbish dirt etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/holes shall be later suitably plugged.

b) The various agencies shall be permitted ample time to install drainage and plumbing lines in floor and trench drains, conduits, hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawings or as is necessary for the proper execution of the work Contractor shall cooperate fully with all such agencies and shall permit the use of scaffolding form work etc. by other agencies at no extra cost.

c) All embedded parts, inserts etc. supplied by Owner or Contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

d) Anchor bolts shall be positioned and kept in place with the help of proper manufactured templates. The use of all such templates, fixture etc. shall be deemed to be included in the rates.

e) Slots, openings, holes, pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by Engineer.

f) Prior to concrete placement all work shall be inspected and approved by Engineer and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected at Contractor's cost. Cat ladders shall be provided on the reinforcement to facilitate labour movement.

g) Approval by Engineer for all materials and work as required herein shall not relieve contractor from his obligation to produce finished concrete in accordance with the drawings and specifications.

h) No concrete shall be placed in wet weather or on water covered surface. Any concrete that has been washed by heavy rains, the work shall be entirely removed, if there is any sign of cement and sand having been washed from the concrete mixture. To guard against damage which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted. Any water accumulating on the

surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitable drains and sumps shall be provided.

i) Immediately before concrete placement begins, proposed surfaces except framework, which will come in contact with the concrete to be placed, shall be covered with a bonding mortar.

Transportation

a) All buckets, containers or conveyors used for transporting concrete shall be mortar tight. Irrespective of the method of transportation adopted, concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. However, chutes shall not be used for transport of concrete without the written permission of Engineer and concrete shall not be re-handled before placing.

b) Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing concrete which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by Engineer.

c) All equipment used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets. hoppers, chutes, pipelines and other equipment shall be thoroughly cleaned after each period of placement.

Procedure for placing of concrete

a) Before any concrete is placed, the entire placing programme consisting of equipment, layout proposed procedures and methods shall be submitted to engineer for approval if so demanded by Engineer and no concrete shall be placed until Engineer's approval has been received. Conveyor for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job and placement location.

b) Concrete shall be placed in its final position before the cement shall normally be compacted in its final position within thirty minutes of leaving the mixer and once compacted it shall not be disturbed.

c) Concrete, in all cases, be deposited as nearly as practicable directly in its final position, and shall not be re-handled or caused to flow in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible, and in narrow forms, contractor shall provide suitable drop and elephant trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped

from a height especially if reinforcement is in the way, particularly in columns and thin walls.

d) Except when otherwise approved by Engineer, concrete shall be placed in shovels or other approved implements and shall not be dropped from a height more than 1 M or handled in a manner which will cause segregation.

e) The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharger, concrete shall be discharged by a vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to thoroughly all stages of delivery until the concrete comes to rest in its final position.

f) Central bottom dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping position, shall be employed.

g) In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and than lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1 M. The bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner which results in separation of ingredients or disturbance of previously placed concrete will not be permitted.

h) Concrete placed in restricted forms by wheel barrows, buggies, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

i) Where it is necessary to use transfer chutes, specific approval of Engineer must be obtained to the type, length, slopes, baffles, vertical terminals and timing of operations, the discharge and without segregation. To allow for the loss of mortar against the sides of the chutes, the first mix shall have less coarse aggregate. During cleaning of chutes the waste water shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1 M. Chutes when approved for use shall have slopes not flatter than 1: 3 and steeper than 1: 2 chutes shall be of metal or metal lined and of rounded cross section. The slopes of all chutes sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

j) Concrete may be conveyed and placed by mechanically operated equipment e.g. pumps or pneumatic placers only with the written permission of Engineer. The slump shall be held to the minimum, necessary for conveying concrete by this method.

k) When pumping is adopted, before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

l) When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's advice shall be followed regarding concrete quality and all other related matters when pumping or pneumatic placing equipment are used.

m) Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 to 90 mm as directed by Engineer. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as well facilitate spreading the layer to uniform depth and texture with a minimum of shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer.

n) The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

p) **Compaction**

i) Concrete shall be compacted during placing the approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the forms faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over-vibrate the concrete to the point that segregation results.

ii) Vibrators shall conform to IS specifications. Type of vibrator to be used shall depend on the structure where concrete is to be placed. Shutter vibrators to be effective, shall be firmly secured to the formwork which must be sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators shall have no load frequency, amplitude and acceleration as per IS 2505 depending on the size of vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or

external vibrating of forms by hand tools or immersion vibrators will not be permitted.

iii) The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of a lift e.g. in a column or wall.

iv) When placing concrete in layers., which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration, blending and mixing of the concrete between the succeeding layers.

v) The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below with the underlayer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

vi) Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come in contact with forms or finished surfaces.

vii) Form attached vibrators shall be used only with specific authorization of Engineer.

viii) The surface vibratorts will not be permitted under normal conditions. However for thin slabs vibration by specially designed vibrators may be permitted upon approval of Engineer.

ix) The formation of stone pockets or mortar bondages in corner and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for thorough bonding, as directed by Engineer.

q) **Placement interval**

Except when placing with slip forms each placement of concrete in multiple lift work, shall be allowed to set for atleast 24 hours after the final set of concrete and before the start of a subsequent placement.

r) **Special provision in placing**

When placing concrete in walls with openings and in floors of integral slab and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls and bottom

horizontal surface of the slab, as the case may be placing shall be resumed before the concrete in place takes initial set, but not until it has time to settle as determined by Engineer.

s) **Placing concrete through reinforcement steel**

When placing concrete through reinforced steel, care shall be taken to prevent segregation of the coarse aggregate. When the congestion of steel makes placing difficult, it may be necessary to temporarily move the top steel aside to get proper placement and restore reinforcing steel to design position.

t) **Bleeding**

Bleeding of free water, on top of concrete being deposited, in to the forms shall be caused to stop the concrete pour. The conditions causing this defect corrected before any further concreting is resumed.

Curing, protecting, repairing and finishing

a) **Curing**

i) All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water continuously saturated covering of sacks, canvas, hessian or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot water as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

ii) Certain types of finish or preparation for overlaying concrete must be done at certain stage of the curing process and special treatment may be required for specific concrete surface finish.

iii) Curing of concrete made of high alumina cement and supersulphated cement shall be carried out as directed by Engineer.

iv) Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied uniformly to concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

v) Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliance of hose, sprinklers and spraying

devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by Engineer.

vi) Whenever, by the judgement of Engineer, it may be necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during the curing period.

vii) For curing of concrete in pavements, sidewalks floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer. Special attention shall be given to edges and corners of the slabs to ensure proper protection to these area. The ponded area shall be kept continuously filled with water during the curing period.

viii) Surface coating type compounds shall be used only by special permission of Engineer, curing compounds shall be liquid type white pigmented. Other curing compounds shall be used on surfaces where future blending with concrete, water or acid proof membrane or painting is specified.

ix) All equipment and materials required for curing shall be on hand and ready for use before concrete is placed.

b) **Protecting fresh concrete**

Fresh concrete shall be protected from defacements and damage due to construction operation by leaving forms in place for an ample period as specified later in this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with other materials etc, that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that workmen enter the area of freshly placed concrete, Engineer may require that bridges be placed over the area.

c) **Repair and replacement of unsatisfactory concrete**

i) Immediately after the shuttering is removed, the surface of concrete shall be very carefully inspected and all defective areas called to the attention of Engineer who may permit patching of the defective areas or also reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to owner. Holes left by from bolts etc. shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing 2.36 mm IS sieve after removing any loose stones adhering to the

concrete shall be finished as described under the particular items of work.

ii) Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal of shuttering to remove fine or other irregularities and necessary care being taken to avoid damage to the surface. Surface irregularities shall be removed by grinding.

iii) If reinforcement is exposed or the honeycombing occurs at vulnerable positions e.g. ends of beams or columns it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25mm) the edges being cut perpendicular to the affected surface or with small under cut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place an area extending several centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

iv) The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer. Epoxy shall be applied in strict accordance with the instructions of the manufacturer.

v) Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bottom, grout insert holes and slots cut for repair of cracks shall be repaired as follows. The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops.

A 5mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete which shall be well consolidated with a wooden float. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and smooth finish obtained by wiping with hessian, a steel trowel shall be used for this purpose. The mix for patching shall be of same material and in the same proportions as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

Mortar filling by air pressure (guniting) shall be used for repairing of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour and texture of the

surrounding concrete. While cement shall be substituted for ordinary cement, if so directed by Engineer, to match the shade of the patch with original concrete.

vi) The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bag which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by fine spray of sprinkling for not less than 10 days.

vii) All materials, procedures and operations used in the repairing of concrete and also the finished repair work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and finished.

d) **Finishing**

i) The type of finish for formed concrete surface shall be as follows, unless, other wise specified by the Engineer.

For surfaces against which backfill or concrete is to be placed, no treatment is required except repairing of defective areas.

For surface below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which would interfere with proper application of the waterproofing material which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repairing of damage or defective concrete removal of fins and abrupt irregularities, fillings of holes left by form ties and rods and clean up of loose or adhering debris.

ii) Surfaces which will be exposed to the weather and which would normally be level, shall be sloped for drainage. Unless the drawing specifies such as stair treads, walls shall be sloped across the width approximately 1 in 30 broader surface such as walkways., roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete subfloors to be covered either concrete topping, terrazzo or quary tile and similar surfaces shall be smooth screeded and leveled to produce even surfaces. Surface irregularities shall not exceed 6mm. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, sidewalks floors and slabs shall be consolidated, screeded and floated. Excess water and laitance shall be removed before finishing. Floating may be done with hand or power tools and started as the screeded surface has attained a stiffness to permit finishing operation and these shall be the minimum required to produce a surface uniform in texture and free from screed marks or other imperfections. Joints edges

panels and forms linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, projections etc, removed leaving the surfaces reasonably smooth and unmarred.

iv) **Integral cement concrete finish**

When specified on the drawings and integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawings as per IS 2571. The surface shall be compacted and then floated with a wood float or power-floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or toweling of finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

v) **Exposed Concrete finish/Rendering**

A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings. Upon removal of forms, all fins and other projections on the surfaces shall be carefully removed, off-sets leveled and voids and damaged sections be immediately saturated with water and repaired by filling with a concrete or mortar of the same composition as was used in the surface. Then surface shall be thoroughly wetted and rubbed with carborundrum or other abrasive. Cement mortar may be used in the rubbing, but the finished surface shall be brush coated with either cement grout after rubbing. The finished surfaces shall present a uniform and smooth appearance.

2.06 **Providing and laying RCC of M 25 mix for structures up to plinth level**

The general specification is same as per item no. 2.05 but for the design mix.

2.07 **Providing and laying RCC of M 25 mix for structures up to plinth level**

The general specification is same as per item no. 2.05 but for the design mix.

2.08 **Providing and laying RCC of M 30 mix for structures up to plinth level**

The general specification is same as per item no. 2.05 but for the design mix.

2.09 **Providing and laying M 20 concrete in superstructure up to 12 M height from plinth level**

The general specification is same as per item no. 2.05.

2.10 **Providing and laying M 20 concrete in super structure up to 12 M height from plinth level**

The general specification is same as per item no. 2.05.

2.11 **Providing and laying M 25 concrete in superstructure up to 12 M height from plinth level**

The general specification is same as per item no. 2.05

2.12 **Providing and laying M 30 concrete in super structure up to 12 M height from plinth level**

The general specification is same as per item no. 2.05.

2.13 **Providing and laying M 20 concrete in super structure above 12 M height**

The general specification is same as per item no. 2.05.

2.14 **Providing and laying M 20 concrete in super structure above 12 M height**

The general specification is same as per item no. 2.05.

2.15 **Providing and laying M 25 concrete in super structure above 12 M height**

The general specification is same as per item no. 2.05.

2.16 **Providing and laying M 30 concrete in super structure above 12 M height**

The general specification is same as per item no. 2.05.

2.17 **Providing and laying RCC for equipment/machine foundation**

The general specification is same as item no. 2.05 but for the mix of the concrete, which shall be as specified in the item. The rate is exclusive of reinforcement steel but inclusive of centering and shuttering, providing number of holes, pockets (size and as shown in the drawings/directed) and grouting the same after the machine/equipment is erected with concrete of specified mix and finishing the same as specified.

2.18 **Precast concrete**

Precast concrete shall comply with IS 456 and with the following requirements:

a) All precast units shall be cast on suitable bed or platform with firm foundation and free from wind. Contractor shall be responsible for the accuracy of the level or shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.

b) Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches a

strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.

c) The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending stresses to or in the units. Before lifting and removal takes place Contractor shall satisfy Engineer or his representative that the methods he proposes to adopt for these operations shall not over stress or otherwise affect seriously the strength of the precast units. The reinforced side of the units shall be distinctly marked.

d) All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits, otherwise curing practice as given in clause 20 shall be followed.

e) Slots, openings or holes, pockets etc. shall be provided in the concrete work as shown in the drawings or as directed by Engineer. Any deviation from the approved drawings shall be made good by Contractor at his own expense, without damaging any other work sleeves, bolts, inserts, etc. shall also be provided in concrete work where so specified.

2.19 **Providing and erecting Formwork for structures up to plinth level**

a) The formwork shall consist of shores, bracings, sides of beams and columns, bottom of slabs etc, including ties anchors, hangers, inserts, etc, complete which shall be properly designed and planned for the work. False work shall be so constructed that necessary adjustment can be made to compensate for take up and settlements. Wedge may be used at the top or bottom of timber shores but not at both ends to facilitate vertical adjustment or dismantling of the formwork.

b) **Design of formwork**

The design of the formwork as well as its construction shall be the responsibility of Contractor. If so instructed, the drawings and/or calculation for the design for the formwork shall be submitted to Engineer for approval before proceeding with work, at no extra cost. Engineer's approval shall not however relieve Contractor of the full responsibility for the design and construction of the formwork. The design shall take into account all the load vertical and lateral that the forms will be carrying live and vibration loadings.

c) **Type of formwork**

Formwork may be of timber, plywood metal, plastic or concrete. For special finishes the formwork may be lined with plywood, steel sheets oil tempered hard board etc. Sliding forms and slip forms may be used with the approval of Engineer.

d) **Form work requirements**

i) Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, braces, ties, straps, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete is set sufficiently to permit removal of forms. Forms shall be strong enough to permit the use of immersion vibrators. In special cases form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water or any fine material from concrete.

ii) Plywood shall be used for exposed concrete surfaces; where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces which are to be rubbed finished shall be planed to remove irregularities or unevenness in the face. Formwork with linings shall be permitted.

iii) All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber unsatisfactory in any respect shall not be used and if rejected by Engineer shall be removed from the site.

iv) Shores supporting successive members shall be placed directly over those below or be so designed and placed that the load will be transmitted directly to them. Trussed supports shall be provided for shores that cannot be secured on adequate foundations.

v) Formwork, during any stage of construction showing signs of distortion or distorted to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be removed completely and the formwork be corrected prior to placing of new concrete.

vi) Excessive construction camber to compensate for shrinkage, settlement may impair the structural strength of members and shall not be permitted.

vii) Forms shall be so designed that their removal will not damage the concrete. Face formwork shall provide true vertical and horizontal joints, conform to the architectural features of the structure as to location of joints and be as directed by engineer.

viii) Where exposed smooth or rendered concrete finishes are required the forms shall be constructed with special care so that the resulting concrete surfaces require a minimum finish.

e) **Formwork For Slope Surfaces**

i) Forms for sloped surfaces shall be built so that the formwork can be placed board-by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration inspection and repair of the concrete.

ii) The formwork shall also be built so that the boards can be removed one by one from the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 4 horizontal: 1 vertical shall be formed as required herein.

f) **Formwork For Curved Surfaces**

i) The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form timber shall be built up of laminated splines cut to make tight, smooth form surfaces.

ii) After the forms have been constructed, all surface imperfections shall be corrected and all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

g) **Formwork For Exposed Concrete Surfaces**

i) Where it is desired, directed or shown on the drawings to have original fair face finish of concrete surface without any rendering or plastering, formwork shall be carried out by using wood planks, plywood or steel plates of approved quality and as per direction of the Engineer.

ii) The contractor shall use one type of material for all such exposed concrete faces and the forms shall be constructed so as to produce uniform and consistent texture and pattern on the face of the concrete. Patches or forms for these surfaces will not be permitted. The formwork shall be placed so that all horizontal formworks are continuous across the entire surface.

iii) To achieve a finish which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features, cills, window heads or change in direction of the surface. All joints between shuttering plates or panels shall be vertical or horizontal unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces.

iv) To achieve a finish which shall give the rough appearance of concrete cast against sawn boards, formwork boards unless otherwise stated shall be of 150 mm wide, securely jointed with tongue and grooved joints if required to prevent grout loss with tie rod positions and direction of

boards carefully controlled. Sawn boards shall be set horizontally, vertically or at an inclination shown in the drawings. All bolt holes shall be accurately aligned horizontal and vertically and shall be filled with matching mortar recessed 5mm back from the surrounding concrete face.

v) Forms for exposed concrete surfaces shall be constructed with grade strips (the underside of which indicated top of pour) at horizontal construction joints, unless the use of groove strips is specified on the drawings. Such forms shall be removed and reset from lift to lift , they shall not be continuous from lift to lift. Sheeting of reset forms shall be tightened against the concrete so that the forms will not be spread and permit abruption irregularities or loss of mortar. Supplementary form ties shall be used as necessary to hold the reset forms tight against the concrete.

vi) For fair faced concrete, the position of through bolts will be restricted and generally indicated on the drawings.

vii) Chamfer strips shall be placed in the corners of forms for exposed exterior corners so as to produce 20 mm levelled edges except where otherwise shown in the drawings. Interior corners and edges at formed joints shall not be levelled unless shown on the drgs. Mouldings for grooves, drip courses and bands shall be made in the form itself.

viii) The wood planks, plywood and steel plates used in formwork for obtaining exposed surfaces shall not be used for more than 3 times in case of wood planks, 6 times for plywood and 10 times for steel plates respectively. However, no forms will be allowed for reuse, if in the opinion of the Engineer it is doubtful to produce desired texture of exposed concrete.

ix) In order to obtain exposed concrete work of uniform colour it shall be necessary to ensure that the sand used for all exposed concrete work shall be of approved uniform colour. Moreover the cement used in the concrete for any complete element shall be from single consignment.

x) No exposed concrete surface shall be rendered or painted with cement or otherwise. Plastering of defective concrete as a means of achieving the required finish shall not be permitted, except in the case of minor porosity on the surface, the Engineer may allow a surface treatment by rubbing down with cement and sand mortar of the same richness and colour as for the concrete. This treatment shall be made immediately after removing the formwork.

xi) The contractor shall also take all precautionary measures to prevent breaking and chipping of corners and edges of completed work until the building is handed over.

h) **Bracings struts and props**

i) Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bearers.

ii) The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Repropping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated being in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering. If the shuttering for a column, is erected for the full height of the column, one side shall be left open and built up in sections as placing of concrete from the sides to limit the drop of concrete to 3M or as directed by engineer.

j) **Mould Oil**

Care shall be taken to see that the faces of form wok coming in contact with concrete are perfectly clearned and two coats of mould oil or any other approved material applied before fixing reinforcement and placing concrete. Such coating shall be insoluble in water, non-staining and not injurious to the concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concretee shall not be placed until coating of the forms is complete, adjoining concrete surface shall also be protected against contamination from the coating material.

k) **Chamfers and fillets**

All corners and angles exposed in the finished structure shall be formed with moulding to form chamfers or fillets on the finished concrete. The standard dimension of chamfers and fillers, unless otherwise specified shall be 20 mmx20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the mouldings shall be planned or surfaced to the same texture as the forms to which it is attached.

l) **Wall ties**

Wire ties passing through the walls shall not be allowed. In their place bolts through sleeves be used.

m) **Reuse of forms**

Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary, repaired and the inside retreated to prevent adhesion,. to the satisfaction of Engineer. Warped lumber shall be resized. Contractor shall

equip himself with enough shuttering material to complete the job in the stipulated time.

n) **Removal of forms**

i) Contractor shall record on the drawings and in a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed therefrom. The Contractor shall remove remove the shuttering after obtaining the approval of the Engineer.

ii) In no circumstances shall forms be struck until the concrete reaches a strength of at least twice the stress due to self weight and any construction/erection loading to which the concrete may be subjected at the time of striking formwork.

iii) In normal circumstances (generally where temperatures are above 20 Deg. Cent.) forms may be removed after expiry of the following periods:-

		Ordinary portland cement concrete	Rapid hardening portland cement concrete
a)	Walls columns and vertical sides of beams	24 to 48 hrs as directed by the Engineer	24 hrs.
b)	Slabs left under	3 days	2 days
c)	Beam soffits props left under	7 days	4 days
d)	Removal of props to slabs:		
	i) Spanning upto 4.5 m	7 days	4 days
	ii) Spanning over 4.5 m	14 days	8 days
e)	Removal of props to beams & arches:		
	i) Spanning upto 6 m	14 days	8 days
	ii) Spanning over 6 m	21 days	12 days

iv) Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration, by gently easing the wedges. If after removing the form work, it is found that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

v) Reinforced temporary openings shall be provided as directed by Engineer to facilitate removal of formwork which otherwise may be inaccessible.

vi) Tie rods, clamps, form bolts etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than 24 hours nor later than 40 hrs. after the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties,. withdrawn from walls and grade beams shall be pulled towards the inside face cutting ties back from the faces of walls and grade beams will not be permitted.

vii) For liquid retaining structures no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case, shall be cut at 25 mm depth from the surface and then the hole shall be made good by sand, cement mortar of the same proportions as the concrete just after striking the formwork.

2.20 **Providing and erecting Formwork for structures in super structure up to 12 M height from plinth level.**

The general specification is same as per item no. 2.15.

2.21 **Providing and erecting Formwork for structures in super structure above 12 M height from plinth level.**

The general specification is same as per item no. 2.15.

2.22 **Providing and erecting false staging for formwork**

The additional height for which it is required shall be as specified in the item specification. This shall be measured and paid for in sq.m. The plan area of the structure shall measured for all members except RCC walls and gable ends. For RCC walls and gable ends the elevational area shall be measured for payment under this item.

2.23 **Providing & Erecting shuttering for exposed RCC work**

The specification for the nature of shuttering shall be as specified in the item 2.19 under the sub-head shuttering for exposed concrete works. Only the surfaces which are given such finish shall be measured in sq.m. and paid for.

2.24 **Providing and laying DPC 25-50mm thick**

This shall be of plain cement concrete of mix as specified in the item speicification. The top surface of the masonry shall be levelled properly before laying the concrete. The side shuttering shall be vertical and strong. There should not be any honey combing . Curing shall be done for 7 days. After the curing period is over the surface shall be cleaned with brush and kerosene shall

be applied over it. Then hot bitumen shall be applied @ 1.7 kg/sqm over the surface. It shall be applied uniformly without any blank space.

2.25 **Supplying and mixing water proofing compound**

The water proofing compoundshall be of approved make. It shall be added to cement concrete or cement mortar as instructed by the Engineer. The proportion of the compound to be added shall be as per the Manufacturer's specifications.

2.26 **Providing , fabricating and placing in position Reinforcement steel**

The quality of the steel shall be as mentioned in the materials section. The bars shall be fabricated as per the drawings. Laps and splices for reinforcement shall be as shown on the drawings. Splices in adjacent bars shall be approved by Engineer. The bars shall not be lapped unless the length required exceeds the maximum available lengths of bars at site.

Bending

a) Reinforcing bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done in cold and without damaging the bars. This is considered as a part of reinforcement bending fabricating work.

b) All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and rebend in a manner that will injure the material, bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 32mm in diameter which may be bent hot if specifically approved by Engineer. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 845 deg. C.) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the means used for straightening and rebending shall not injure the material. No reinforcement shall be bent when in position in the work without approval whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

Fixing

a) Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the drawings by the use of block, spacers and chairs as per IS 2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be strongly bound together at all such points with two no. 16 gauge annealed soft iron wire. The vertical distance required between successive layers of bar in beams or other members shall be maintained by providing of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

Cover

a) Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

i) At each end of reinforcing bar, not less than 25 mm nor less than twice the diameter of the bar whichever is less.

ii) For a longitudinal reinforcing bar in a column not less than 40mm, nor less than the diameter of the bar. In case of columns of minimum dimensions of 20 cm or under, with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.

iii) For longitudinal reinforcing bars in a beam 25 mm nor less than the diameter of the bar.

iv) For tensile, compressive, shear, or other reinforcement in a slab or wall not less than 12mm nor less than the diameter of such reinforcement.

v) For any other reinforcement not less than 12 mm nor less than the diameter of such reinforcement.

vi) For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be 75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm.

vii) For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, footing sides and top etc., not less than 50 mm for bars larger than 16 mm dia and not less than 40 mm for bars 16 mm dia or smaller.

viii) Increased cover thickness shall be provided, as indicated on the drawings, for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical, acid, alkali, saline atmosphere, sulphurous smoke, etc.

ix) For reinforced concrete members, totally or periodically immersed in sea water or subject to sea water spray, the cover of concrete shall be 50mm more than those specified in (i) to (v) above.

x) For liquid retaining structures the minimum cover to all steel shall be 40mm or the diameter of the main bars, whichever is greater. In the presence of sea water and soils and waters of a corrosive character the cover shall be increased by 10 mm.

xi) Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coatings, as specified by the Engineer.

xii) The correct cover shall be maintained by cement mortar cover blocks. Reinforcement for footings, beams and slabs on sub-grade shall be supported on precast concrete blocks as approved by engineer. The use of pebbles or stones shall not be permitted.

Inspection

Erected and secured reinforcement shall be inspected, jointly measured and recorded and approved by Engineer prior to placement of concrete.

2.27 **Providing and placing in position bitumen impregnated fibres**

The bitumen impregnated fibre boards shall be placed in locations before concreting as instructed by the Engineer. The work shall be done at all levels without any extra cost.

The thickness of the board shall be as specified in the item specification.

2.28 **Providing and laying bituminous mastic**

This shall be of approved make and qualify. This shall be filled in the expansion joints as directed by the Engineer/shown in the drawings. The joints shall be of uniform width and care shall be taken for proper bonding of the joints.

Clean-up

i) Upon the completion of concrete work, all forms, equipment, construction tools protective coverings and any debris resulting from the work shall be removed from the premises.

ii) All debris, i.e. empty containers, wooden pieces etc. shall be removed .

iii) The finished concrete surfaces shall be left in a clean condition satisfactory to engineer.

SECTION 3.00

MASONRY WORKS

Applicable codes and Specifications

The following codes, standards and specifications are made a part of this specification. All standards, tentative specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

IS : 1077 - Common burnt clay building bricks
IS : 3102 - Classification of burnt clay bricks
IS : 2180 - Burnt clay building bricks, heavy duty
IS : 3495 - Method of sampling and testing clay building bricks
IS : 2691 - Burnt clay facing bricks
IS : 2221 - Code of practice for brick work
IS : 2185 - Load bearing hollow concrete blocks
IS : 5498 - Lime-cement-cinder hollow concrete blocks
IS : 3115 - Lime-cement cinder solid blocks
IS : 1597 - Code of practice for construction of stone masonry (Part I)

3.01 **Providing and constructing brick masonry in CM in foundation and upto plinth level**

(a) Bricks used in works shall be bricks of specified crushing strength as described in the Schedule of Quantities. They shall have the following general properties:

They shall be sound, hard, homogenous in texture, well burnt in kiln without being vitrified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and paralled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing unground particles and which absorb water more than 1/5th of their weight when soaked in water for twentyfour hours shall be rejected. Overburnt or under burnt bricks shall be liable to rejection. These bricks shall give a clear ringing sound when struck.

(b) Samples of bricks shall be submitted before starting the brick work to the Engineer for approval. Bricks supplied shall conform to these approved samples. Brick sample shall be got tested as per IS:3495 by Contractor at no extra cost. Bricks rejected by Engineer shall be removed from the site of works within 24 hours.

(c) Mortar

(i) Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing 50 kgs. of cement forms one unit. The sand shall be free from clay shale, loam, alkali and organic materials and of sound, hard, clean and durable particle. Sand shall be approved by the engineer. If so directed by the engineer sand shall be thoroughly washed till it is free of any contamination.

(ii) For preparing cement mortar the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine mixed, thorough mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 30minutesof mixing. Mortar left unused in the specified period shall be rejected.

(iii) The contractor shall arrange for test on mortar samples if so directed by the engineer re-tampering of mortar shall not be permitted.

(d) Workmanship

(i) All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work. Brick work 250 mm thick and over shall be laid in english bond unless otherwise specified. While laying bricks shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

(ii) All brick work shall be plump, square and true to dimensions. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick curses shall be kept uniform. For walls of thickness greater than 250 mm both faces shall be kept in vertical planes. No broken bricks shall be used except as closers. Care shall be taken that the bricks forming the top corners and ends of the wall shall be properly radiated and keyed into position. Holes kept in masonry or scaffolding shall be closed before plastering. All interconnected brick work shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work where this is not possible, the work shall be raked back accordingly to bond (and not saw toothed) at an angle not exceeding 45 deg.

(iii) Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6mm and not more than 10mm. The face joint shall be raked to a minimum depth of 12mm by raking tools daily during the progress of work when the mortar is still green so as to provide a proper key for the plaster of pointing to be done. Where plastering or point is not required to be done, the joints shall be uniform in thickness and the struck flush and finished at the time of laying. The face of brick work shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If the mortar in the lower course has begun to set the joints shall be raked out to a depth of 12mm before another course is laid.

(iv) All brick work shall be built tightly against columns, floor slabs or other structural member.

(v) Where drgs. indicate that structural steel columns are to be fireproofed with brick work, the brick shall be built closely against all flanges and webs with all spaces between the steel and brick works filled solid with mortar. Steel members partly embedded in brick work and not indicated to be fireproofed with concrete shall be covered with not less than 12mm thick mortar unless directed otherwise by engineer.

(vi) The work shall be cured for 15 days.

(e) Miscellaneous inserts in masonry e.g. sleeves, wall ties, anchors, conduits, structural sheet, steel lintels etc., shall be installed by the Contractor. Furnishing fixing of any of these inserts by the Contractor will be paid for separately under steel work. Openings, arches, etc., shall be provided as shown on the drawings, chases, pockets etc., shall be provided as shown on the drawings to receive rain water pipes etc. Wall ties and flashings shall be built into the brick work in accordance with the drawings and specifications.

3.02 **Providing and brick work in CM in super structure at all levels**

The general specification is same as per item no.3.01.

3.03 **Providing and constructing 115 mm brick masonry in partition for super structure in CM**

The bricks shall be laid with stretchers. The proportion of the mortar shall be as specified in the item description. The quality of the bricks shall be as specified in the item 3.01. The brick shall be well soaked in water before using them. The brick work shall be plumb and square. Two nos. of 6mm dia MS bars or 25mm x 1.2mm deep iron band kept at every third course of 115mm thick brick work. This shall be provided by the Contractor.

3.04 **Providing and constructing 75mm partition wall in CM**

The general specification shall be same as per item 3.03.

3.05 **Providing and constructing honeycomb brick work**

The specification for the material and the workmanship shall be as specified in the items 3.01 or 3.03 depending on the thickness of the brick work. The porportion of the CM shall be as specified in the item description in the Schedule of Quantities.

3.06 **Providing and constructing Facing brick work**

(a) Facing bricks of the type specified shall be laid in the positions indicated on the drawings and all facing brick work shall be well bonded to the backing

bricks. No facing brick work shall at any time be more than 600mm above the backing brick work.

(b) Facing work shall be pointed as the work proceeds and internal faces of the brick work shall be pointed with neat joint to give a fair face.

(c) Faced work shall be kept clean and free from damage, discolouration etc., at all times. The Contractor shall carefully plug all holes with bricks similar to the surrounding.

(d) For facing brick work double scaffolding shall be used and no holes in brick work for scaffolding shall be permitted.

3.07 **Providing and constructing concrete block masonry**

Concrete blocks (hollow or solid) shall generally conform to IS:2185. Blocks shall be regular in size and shape and shall be of specified strength. Blocks shall be properly cured before they are brought to site. Half or three quarter size blocks are to be used wherever required to make up length of wall and broken blocks shall not be used. The texture of the blocks shall be such that plaster will adhere to it. The contractor shall supply samples for approval. Blocks supplied shall conform to approved samples.

Mortar

Mortar shall be similar to mortar in brick work as given 3.01 herein before.

Workmanship

(a) All block work shall be plumb, square and properly bonded. The joints shall be broken. The thickness of courses shall be uniform with courses horizontal. All connected work shall be carried out at nearly one level and no portion of the work shall be left more than one course lower than the adjacent work.

(b) Blocks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6mm and not more than 8mm. The face joints shall be raked to a minimum depth of 10mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plaster or pointing. When plastering or pointing is not required, the joints shall be struck flush. For pointed masonry without plaster, smooth textured concrete block shall be used. The face of blocks work shall be kept clean at all times.

(c) Where block are to be used for load bearing walls, the uppermost layer of block masonry supporting slab or other structured members, shall be solid or treated as directed by the Engineer.

(d) Precast concrete screen blocks or Jali work may be used for decorative purpose. The contractor shall furnish samples for approval.

3.08 **Providing and constructing Random rubble masonry uncoursed in foundation and upto plinth level**

(a) Stones for this work shall be hard, durable rock, close or fine grained and uniform in colour free from veins, flaws and other defects and shall conform to IS:1597(Part I). The stones shall be laid in mortar proportions specified for the particular item of work. Stones shall be got approved.

(b) For all work below ground level the masonry shall be random rubble uncoursed with ordinary quarry dressed stones or hearting and faced with selected quarry dressed stones.

(c) For all work above ground level, the masonry shall be random rubble faced with hammer dressed stones with squared quoins at joints and corners.

(d) No stones shall tail into the wall, either with a point or to length less than 1. 1/2 times its height. The thickness of the joints shall not exceed 12mm.

(e) Spauls an pinnings shall not be allowed to show on the face of the wall. Two bond stones each of minimum area of 500 sq.cm. for every 1.0 sq.m. of each wall face shall be provided. These shall be through stones in walls 600mm. thick and under, in walls thicker than 600mm. the length of bond stones shall be 2/3 times the thickness of walls. The stones for hearting of the wall shall not be less than 150mm in any direction. Chips and spauls shall be wedged into avoid thick mortar beds and joints. The wall faces, corners and joints or openings shall be truly vertical and quoins shall be of selected stones, nearly dressed with chiesel to form the required angle and laid header and stretcher alternatively.

(f) The exposed face of the work shall be carefully and neatly pointed with mortar in all joints on the other side and joints shall be neatly struck with trowel while the mortar is fresh.

Mortar

The mortar for the work shall be as specified in the respective item of work. Curing of masonry shall continue for a minimum period of ten days.

3.09 **Providing and constructing Random rubble masonry uncoursed in super structure**

The specification shall be same item 3.08.

3.10 **Providing and constructing Coursed rubble masonry in foundation and upto plinth level**

(a) The stones used shall be hard, durable rock, free from veins, flaws and other defects and shall conform to IS:1597 (Part I). Height of each course in the

masonry shall not be less than 150mm. The stones in each coarse shall be of equal height. All course shall be of the same height unless otherwise specified. All stones shall be set in full cementmortar of proportion specified for the respective item of work. Stones shall be got approved by the Engineer.

(b) The face stones shall be squared on all joints and bends. The bends being hammer dressed or chiesel dressed type and square for at least 75mm from the face and the joints for at least 40mm. The face of the stone shall be hammer dressed so that bushings shall not project more than 40mm.

(c) No spauls or pinnings shall be allowed on the face. All bed joints shall be horizontal and side joints vertical and no joints shall be more than 10mm in thickness.

(d) No face stone shall be less in breadth than in height or shall tail into the work to a length less than the height and at least 1/3rd the number of stones shall tail into the work to at least twice their height, or in walls over 600mm in thickness 3 times their height.

(e) Through stones shall be inserted every 1.5 meters or 1.8 meters apart in every case and shall run right through when the wall is not more than 600mm thick when the wall is more than 600mm thick a line of two or more headers shall be laid from the face to face which shall overlap each other by at least 150mm. A header shall have a length of at least thrice its height.

(f) Stones shall break joint at least half the height of the course. Quoins shall be formed of stones at least 45 cm long laid stretcher and header alternately. They shall be laid square in their beds, which shall be fair dressed to a depth of at least 100mm. The corner shall be chiesel dressed for a width of 25mm.

(g) The work on the interior face shall be precisely the same as on the exterior face unless the work is to be plastered in which case the side joints need not be truly vertical.

(h) Hearting shall consist of flat bedded stones carefully laid on their proper beds and solidly bedded in mortar chips and spauls of stone being wedged in wherever necessary so as to avoid thick beds or joints of mortar. Care shall be taken so that no dry work or hollow spaces shall be left anywhere in the masonry. The face and backing shall be brought up every bed. The backing should not be levelled up at each course by the use of chips.

Mortar

The mortar for the work shall be as specified in the respective item of work. Curing of masonry shall continue for a minimum of ten days.

3.11 **Providing and constructing coursed rubble masonary in superstructure.**

The specification shall be same as item no 3.10.

SECTION 4.0

WOODWORK

Applicable Codes

IS:4021 - Timber door, window and ventilator frames

IS:2202 - Wooden flush door shutters (solid core type) partI

IS:1003 - Timber panelled and glazed shutters(part I & II)

IS:4020 - Method of tests for wooden flush doors: Type tests.

IS:1761 - Transparent sheet glass for glazing and framing purposes

IS:3097 - Specification for veneered particle boards (Exterior Grade)

4.01 **Providing & Fixing panelled or glazed or partly panelled & partly glazed door shutters of specified thickness with frame of specified size**

a) Wood used for all work shall be the best of the respective class specified, and properly seasoned, suitable for joiner work should be of natural growth, uniform in texture, straight grained, free from sapwood, dead knots, open shakes, rot, decay and any other defects and blemishes.

b) For joints following principles to be observed:-

At the joints the weakness of pieces must be minimum as far as possible. To place each abutting surface in a joint as neatly as possible, perpendicular to pressure. To form and fit accurately every pair of surface that come in contact.

All joining shall be wrought on all faces and finished off by hand with sand paper with slightly rounded arises.

The joints shall be pinned with hard wood pins and put together with white lead. Jointing shall be by means of mortice and tenon or dovetailed joints as approved. For external work the joints shall be coated with white or red lead before the members are put together. For internal joints where there is no chance of moisture the joint shall be glued. **Driving of screws with hammer is prohibited** The screws shall be soaked in oil before driving them home. The heads of the screws and nails shall be sunk and puttied.

Any joinery work which shall split, fracture, shrink or show flaws or other defects due to unsoundness, inadequate seasoning or bad workmanship,

shall be removed and replaced with sound materials at the contractor's expense.

c) Door frames shall be rivetted. All dimensions shall be as per drawings. The verticals of door frames shall project about 50mm below finished floor, surface coming in contact with brick work shall be painted with bitumen or solignum as directed by the engineer. The door frame shall be provided with 3 nos MS 230x30x3mm flat split hold fasts on each side, respectively. These hold fasts shall be embedded in masonary or concrete work with concrete block of mix 1:2:4 and size 230 x 300 x 250. The work shall conform to IS:4021.

d) The door shall be panelled or solid flush doors as described in the item of work. All doors shall be supplied with approved fittings such as hinges, mortice lock of approved make with handles on both sides, oxidized brass tower bolts and latch arrangements door stops etc, and as shown in drawings. External flush doors shall be made of weatherproof plywood as per item description in the Schedule of Quantities.

e) The workmanship of all doors and window shutters shall conform to the requirements of IS:1003 (Parts 1 & II) and IS:2202 (Part 1). Flush door panels shall be got tested as per IS:4020 in standard Laboratories..

f) Beading and architraves shall conform to the shapes shown on drawings or as approved and fixed by means of screws (counter sunk or otherwise) or bolts.

g) **Glass**

Sheet glass or plate glass shall be of Indian make as specified in the Schedule of Quantities/ as directed. It shall be free from waves and bubbles and all defects The thickness of the glass shall be as follows:-

2mm thick glass for panes upto 900 sq.cm area

3mm thick glass for panes from 900 - 5500 sq.cm area

4mm thick glass for panes 5500-8400 sq.cm area

5.5mm thick glass or plate glass for panes above 8400 sq.cm

It should be clearly understood that glass which does not have uniform refractive index or which is wavy, will be rejected. The glazing shall be fixed with teak wood beading and putty.

It shall conform to IS:1761. The putty shall be made up of one part of white lead, 3 parts of finely powdered chalk and adding boiled linseed oil to make a stiff elastic paste. No voids shall be left in the putty. Woodwork shall not be painted oiled or otherwise treated before it has been approved by the engineer.

4.02 **-Do- same as per item 4.01 but for 19 mm NOVA TEAK panelled or equivalent make board as filler material**

The specification shall be same for item 4.01 but for NOVA TEAK or the board shall be of ISI approved make.

4.03 **-Do- same item 4.02 but without frame**

The specification shall be same as item 4.01 but the measurement of the actual size of the shutter shall be taken.

4.04 **Providing and fixing Composite door and window partly openable, partly fixed with frame of specified size**

The specification for the door shutter shall be as per item 4.01. The specifications for the windows shall be as given below:-

The window frame shall be provided with 2 nos MS 230 x 30 x 3 mm flat split hold fasts on each side, respectively. These hold fasts shall be embedded in masonary or concrete work with concrete block of mix 1:2:4 and size 230x300x250 mm.

The type of windows shall be as specified. Each leaf of the shutter shall have one pair of hinges for a width of less than or equal to 2 feet, for width more than 2 feet extra nos. of hinges shall be provided as directed by the Engineer at no extra cost. The glazed windows shall be provided with glass of thickness as specified in the item description. Architraves shall be provided as per drawing.

4.05 **Providing and fixing windows and ventilators Fixed type**

The specification for windows shall be same as given in item 4.04 Ventilators shall have two MS holdfasts. Ventilators shall be provided with glass of thickness as specified in the item description. Architraves for the ventilator shall be provided as per the drawing.

4.06 **-Do- same as item 4.05 but for fully openable type**

The specification shall be same as item 4.05 but with necessary hinges as per item description/ drawing. The work shall be carried out as per the drawing/ as instructed by the Engineer.

4.07 **-Do- same as item 4.05 but for partly openable and partly fixed**

The specification shall be same as item 4.05 but with necessary hinges as per item description/ drawing. .

4.08 **Providing & Fixing musquito/fly proof shutter**

The specification for frames and the shutter shall be same as item 4.05 and for the fly wire mesh the following specification shall be applicable:-

Fly/Mosquito proof netting of 100G or 140G (22 to 23 SWG), rust proof , galvanised as specified in the item description shall be used. Mosquito proof of 100 G (23 SWG), 0.60mm wire dia and 1mm average distance between the wire or Fly proof of 140 G (22SWG), 0.71mm wire dia and 1.40mm average distance between the wire shall be used.

4.09 **Providing & Fixing fixed glass louvres in TW frame of specified size**

The frame shall be fixed to the masonry or RCC elements with 2 nos hold fasts. The louvre shall be provided with glass of thickness as specified in the item description. The glass shall be fixed at an angle in the frame as shown in the drawing. The frame shall be painted/polished as specified in the item description.

4.10 **-Do- same as item 4.09 but with wired glass**

The specification shall be same as per item 4.09. The thickness of the wired glass shall be as specified in the item description.

4.11 **Providing & Fixing built in cupboard**

These shall be made of block board/particle board as specified in the item description. The shutter shall also be made of 19mm or 25mm thick block board or particle board or marine ply as specified in the item. 6mm thick and of suitable width teak wood lipping shall be provided on all edges. Horizontal partitions shall be provided as per the drawings/instructions. The size of the frame shall be as specified in the item description. The inside shall be painted with paint of ISI approved make and exterior shall be painted/polished as specified/directed.

4.12 **Providing & Fixing Meter box cupboard on wall**

The frame shall be of specified size and class of wood. It shall be fixed with 2 no. of holdfasts and the same may be grouted with CC 1:2:4 blocks of size 230x230x300. The shutter shall be of 19mm thick Nova teak. A slit shall be provided in the shutter as directed by the Engineer. 3mm thick glass shall be fixed in the slit. Architrave shall be provided as directed by the Engineer. Fixtures as specified shall be provided. The shutter, frame and the architrave shall be painted with 3 coats of ISI approved enamel paint.

4.13 **Providing and fixing TW baluster (moulded hand rail)**

The hand rail shall be of specified quality of teak wood. The size, shape and the design shall be as per the Architect's drawing. The rounding at the landing shall be made up of monolithic one piece . The hand rail shall be fixed on MS flats with screws/anchor bolts as specified . It shall be applied with three coats of paint/polish as specified.

4.14 **Extra for making vision panel/venetian in flush door**

These shall be provided as shown in the drawings. The inside of the opening shall be lippped. The glass shall be braced with beading and putty. The lipping and the architrave shall be painted with 2 coats of approved paint or polished as directed. Opening upto 0.259 sqm shall not be deducted from the shutter area for payment.

4.15 **Providing & Fixing cupboard below platform**

TW frame of specified size and class of wood shall be provided. The shutter shall be of 19mm thick block board/ particle board/ marine ply shutter as specified. The frame and both the sides of shutter shall be duly painted as directed. Architrave shall be provided as specified and the same shall be painted as directed.

SECTION 5.0

FINISHING WORKS

Applicable Codes

IS:2394 - Code of practice for application of lime plaster finish.
IS:1477 - Code of practice for painting of ferrous metals in buildings and allied finishes (part I &II)
IS: 427 - Distemper, dry colour as required
IS:2395 - Code of practice for painting concrete, masonry and plaster surfaces
IS:428 - Distemper, oil emulsion, colour as required.

5.01 **Providing & Applying Cement plaster 12 mm thick**

The surface to be plastered shall be washed with fresh clean water free from all dirt, loose material grease etc. and thoroughly wetted for 6 hours before plastering work is commenced. Concrete surfaces to be plastered will however be kept dry. The wall should not be too wet but only damp at the time of plastering the damping shall be uniform to get uniform bond between the plaster and the wall. **The junction between the brick work and RCC should be fixed with chicken wire mesh/ PVC strip as directed before plaster.**

The proportion of the mortar shall be as specified under the respective items of work. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as mentioned in the Specifications for Concrete & allied works. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to stand for more than 30 minutes after mixing with water. The plaster shall be laid in a single coat. The mortar shall be splashed on the prepared surface with a trowel and finished smooth by trowelling. The plastered

surface shall be rubbed with iron plate till the surface shows cement paste. The work shall be in line and level. Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

The plaster shall be carried out on jambs, lintel and sill faces top and undersides, etc. as shown in the drawing or as directed by the engineer.

5.02 **Providing & Applying Cement plaster 19 mm thick**

The general specification is same as item 5.01 but for the thickness of the plaster.

5.03 **Providing & Applying lime punning to the plastered surface**

The plastered surface shall be finished smooth by trowelling on the surface with neeru (lime cream). Neeru shall be properly slaked fat lime. The neeru shall be applied at the rate of 2.2 kg per sqm.

5.04 **Providing and Applying 19mm sand faced plaster**

a) This shall be applied in 2 coats. The first coat or the base coat should be approximately 12 mm and shall be continuously carried out without break to the full length of wall or natural breaking points such as doors, windows etc. The base coat shall be splashed on to the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar proportion for this base coat shall be as specified in the respective item of work. The base coat shall be cured for at least seven days

b) The second coat shall be 6mm thick. Before application of the second coat, the base coat shall be evenly damped. This coat shall be applied from top to bottom in one operation and without joints, finish shall be straight, true and even. The mortar proportions of this coat shall be as specified under the respective item work. Sand to be used for the second coat and for finishing work shall be as specified in the item description. The second coat shall be finished with sponge. Grooves shall be made as per the drawings.

5.05 **Providing & Applying rough cast plaster**

This shall be carried out in two layers. The base plaster shall be of 12 mm thick and of specified proportion of CM. It shall be roughened to receive the top layer. the top layer shall be 7mm thick. It shall be of 3 parts cement, 6 parts coarse sand & 4 parts of 6mm to 10mm single or crushed stone aggregate. The plaster shall be cured atleast for 7 days.

5.06 **Providing & Applying water-proof cement plaster**

The plaster shall be of specified thickness and of mortar proportions. The contractor shall use approved waterproofing admixture made by reputed manufacturer in the mortar for plaster work. The quantity to be used shall be in accordance with the manufacturer's instructions, however subjected to the approval of the Engineer. The use of Calcium chloride shall be prohibited unless specifically allowed by engineer and shall conform to IS:2645. The plaster shall be cured at least for 7 days.

5.07 **Providing & Applying neat cement**

The specification same as per item 5.03 except that neat cement is applied to the plaster surface in place of neeru.

5.08 **Providing & Applying cement pointing**

a) The dust shall be brushed out of the joints and the wall be washed with water.

b) The mortar shall consist of one part of cement to one part of fine sand. Mortar shall be filled into joints and well pressed with special steel trowles. The joints shall not be touched against after it has once begun to set.

c) The joints of the pointed work shall be neat. The lines of false joints shall be allowed.

d) The work shall be cured for a week after the pointing is complete. Whenever coloured pointing has to be done the colouring pigment of the colour required shall be added to cement in proportion as recommended by the manufacturer and as approved by the engineer.

5.09 **Providing & Applying White washing on new works - 3 or more coats**

Walls to be thoroughly scrapped with sand paper before white wash is applied. White wash shall be prepared from a good quality fat lime. Lime shall be slaked with water to the consistency of a cream and allowed to remain under water for 2 days. If shall then be strained through a cloth and 2 kg of clean gum of approved make , as specified in the item specification or by the Engineer , shall be added for every cubic metre of lime and indigo upto 3gm per kg of lime dissolved in water shall then be added and stirred well.

Each coat to be applied with a brush. It shall be applied with a stroke of the brush from the top downwards, another from bottom upwards over the first stroke and similarly one stroke from the right and another from the left over the first brush, before it dries. Minimum three coats shall be applied on the plastered surface for desired finish. If the desired finish is not obtained extra coats shall be applied without any extra cost.

5.10 **Providing & Applying Plastic Emulsion paint**

Paint to be used for the various items of work should be of approved make. The painting work shall be carried out as directed by the engineer, keeping however in view the recommendations of the manufacturer. Where painting with plastic emulsion is specified, all uneven surfaces shall be thoroughly cleaned of all dust dirt and sand papered. One primer coat with cement putty and minimum 2 coats of emulsion paint shall be applied. It shall be applied with rollers. Workmanship shall conform to the requirements of IS:2395.

5.11 **Providing & Applying Cement paint**

This may be of approved make. The surface shall be prepared as specified in the specification for white wash. This shall be applied with brush on the plastered wall. The strokes shall be even and it shall be cured atleast for 7 days. No patch or brush stroke shall be seen. Three coats shall be applied.

5.12 **Providing & Applying silicon paint**

This shall be applied over the external plaster for rendering it water-proof. This shall be applied with brushes. The paint shall be of approved quality.

5.13 **Providing & Fixing chicken wire mesh**

The wiremesh shall be of 24 gauge and it shall be fixed with nails at the junction of brick masonry and RCC elements. The chicken wiremesh shall not sag in between the nails. This shall be done before the application of plaster.

5.14 **Providing & Applying dry distemper**

Distemper shall be of approved make. It shall be applied by a broad stiff brush in two coats over a coat of primer. The first and second coat shall be applied only after the primer coat has thoroughly dried. The first coat shall be of a lighter tint. The shade of the distemper shall be got approved by the Engineer. Water bound and oil bound distemper shall conform to the requirements of IS:427 and IS 428 respectively.

5.15 **Providing & Applying Colour Wash**

Colour wash shall be applied the same way as white wash. Necessary and approved colouring chemical shall be added to the white wash which has been strained. Only colour wash required for the day's work shall be prepared. If the finished surface is powderly and comes off easily or the general appearance is streaky, the work shall be rejected. The Contractor has to redo the work at no extra cost.

SECTION 6.0

FLOORING

Applicable codes

IS:1443 - Code of practice for laying and finishing of cement concrete flooring tiles.
IS:2114 - Code of practice for laying in situ terrazzo floor finish.
IS:777 - Glazed earthenware tiles

6.01 **Providing & Fixing precast Mosaic tile flooring**

The type, quality, size, thickness, colour etc. of the tiles for flooring shall be as per the item description given in the Schedule of Quantities and of best quality . The contractor shall provide the Engineer with necessary sample for approval.

Before the tiling work is commenced, the sub-surface shall be thoroughly cleaned and washed of all loose material, dirt, and scum and then shall be wetted without forming water pools on the surface. The tiles shall be laid on cement mortar or lime mortar bedding of thickness and proportion as specified in the item description. The mortar shall be evenly spread on the sub-floor. Over this mortar bed, 4.4 kg of cement per sq.m of floor area shall be spread. The tiles shall be fixed on this bed one after another. Each tile being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be perfectly straight and uniform in thickness. The tiles shall be laid perfectly in level unless otherwise specified by the Engineer. After laying the tiles the joints shall be finished with white cement or ordinary cement as specified.

For lime mortar-bedding lime from burnt stone shall be used. It shall be free from ash and impurities and be in the form of lumps and not powder when brought to site, lime which is damaged due to rain, soaking, moisture or air slaking shall be rejected.

Floor tiles laid adjoining the wall shall project 12mm or as specified under the plaster, skirting or dado as directed by the Engineer. Half tiles and pieces shall be avoided as far as possible. After laying the tiles, it shall be cured for atleast 14 days. About a week after laying the tiles each and every tile shall be lightly tapped with a small wooden mallet to find out if it gives a hollow sound, if it does, such tiles along with any other cracked or broken tiles shall be removed and replaced with a new tile to proper line and level. The same procedure shall be followed again after the tiles are finally polished. For the purpose of ensuring that such replaced tiles match with those earlier laid it is necessary that the Contractor order enough extra tiles from the factory to meet this contingency. The tiles shall finally be cleaned and polished by using dilute oxalic acid or any other method recommended by the manufacturer and approved by the Engineer.

After the joints have attained sufficient strength, the floors shall be machine polished to the desired finish approved by the Engineer. Sufficient quantity of water shall always be used during polishing to prevent scratches.

6.02 **Providing & Fixing precast Mosaic tiles in skirting, dado and risers**

For dado and skirting work, the vertical surface shall be thoroughly cleaned and wetted. Thereafter it shall be evenly and uniformly covered with about 12mm thick 1:3 cement mortar. For this work the tiles as obtained from the factory shall be of the size required and practically fully polished. The back of each tile to be fixed shall be covered with a thin layer of neat cement paste and the tile shall then be gently tapped against the wall with a wooden mallet. This shall be done from the bottom of the surface upwards. The joints shall be as close as possible and the work shall be truly vertical and flush. The tiles shall be fixed flush with the plaster or projected as specified by the Engineer. The junction of the plaster and the skirting or dado shall be neatly finished. The joints shall be filled with ordinary cement unless otherwise specified. After the tile has set, hand polishing with carborundum stones shall be done so that the surface attains a glossy finish. Corners and junctions be finished true.

6.03 **Providing & Laying cast-in-situ Marble chips flooring**

The marble chips shall be of approved size, colour and shade. The cement used may be white cement or cement mixed with coloring pigments as directed by the Engineer. The proportion of marble chips to cement shall be as specified in the item description, but in no case it shall be less than 2.5:1. Samples of terrazzo/mosaic work shall be prepared for approval of Engineer. The entire work shall conform to the approved samples. The terrazzo chips shall be laid after placing the base. The base shall consist of a layer of 28 mm thick 1:2:4 cement concrete (1 cement, 2 coarse sand, 4 19mm and down graded stone aggregate) spread and leveled. While laying the flooring dividing strips of glass/PVC/aluminum of specified thickness shall be inserted in the mortar bed according to the design of the floor. Care being taken to see that no panel exceeds 1.5 sq.m in area. The top of strips shall be 10mm above the surface of the under bed and shall conform to the finished level of the floor. Chips shall be thoroughly mixed dry and then white cement or cement of approved colour shall be added in specified proportion. Chips and cement shall be thoroughly mixed and evenly spread on the platform and not heaped. Water shall then be added to obtain a plastic mix of suitable consistency as directed by the Engineer. Terrazzo layer shall be placed as soon as the screed coat has set sufficiently but in no case than the day thereafter. The thickness of terrazzo topping shall not be less than 10mm. The surface shall be rammed to obtain the consolidation and a leveled surface. Additional chips shall be sprinkled on the surface and rammed in until surplus cement is checked out and chips forced together so that the finished floor will show not less than 70% aggregate. The surface is finally trowelled lightly. The Contractor shall keep the floor moist for not less than seven days. The surfaces shall then be machine polished. Voids shall be filled with neat grouting of same kind and colour as matching. This grouting shall remain at least 72 hours before being removed for final cleaning. The floor shall be refinished wherever necessary to leave the work in first class condition.

6.04 **Providing & Laying cast-in-situ marble chips in skirting and dado**

The height of the skirting/dado shall be as per the drawing. The base layer shall be 12mm cement mortar of 1:3 proportion (1 cement, 3 coarse sand) and top 7 mm thick layer shall be of approved marble chips in proportion 1:2 (1 cement, 2

marble chips). While laying the skirting/dado glass strips of specified width shall be provided. The skirting/dado shall be flush with the plaster or projected as specified by the Engineer. The junction between the skirting/dado and the plaster shall be finished properly. The skirting/dado shall be hand polished.

6.05 **Providing & Laying polished green kota stone flooring**

Stones shall be of approved quality ,size and uniform thickness, edges shall be chisel dressed and the top surfaces shall be machine polished with joints running true and parallel from side to side. Stones should be laid on a bed of cement or lime mortar. The pattern of the flooring shall be as per the Architect's drawing. Thickness of mortar bedding shall be as specified in the item specification. The stone slabs shall be thoroughly wetted with clean water. Neat cement shall be spread over the mortar bed and the slabs shall be placed one by one , keeping in check the level and line of the flooring. The slabs are then gently tapped with wooden mallet till it is firmly and properly bedded. There should be no voids left. The joints should not be more than 2 mm thick. The joints should be struck smooth. If specified terrazo filling of specified thickness shall be done in the joints between the kota stone slabs. The floor should be kept covered with damp sand or water for a week. Slabs should be of sizes as specified . The stone shall be machine polished and then cleaned with oxalic acid. If the Contractor is asked to mop the floor with kerosene and water by the Engineer, the same shall be done without any extra cost. This shall be carried out daily atleast for 10 times for 7 days.

6.06 **Providing & Laying kota stone in skirting and dado**

The stone shall be of required sizes and the thickness shall be as mentioned in the item specification. The stones shall be pre-polished and machine cut. The stone's edges shall be dressed fine true , straight and at right angles to each other. The stones shall be fixed over cement mortar bed 1:4 (1 cement; 4 coarse sand) . The joints are filled with ordinary cement and its hand and wax polished. The joint between the top of skirting/dado and plaster shall be finished properly. The joints in the flooring shall be continued in the skirting/dado also. The work shall be cured properly.

6.07 **Providing & Laying pre-polished, machine cut Kota stone in treads**

Polished green kota stone of specified thickness with machine cut edges shall be fixed for treads of steps in single piece or on the kitchen platform or open shelves and window sills as directed. The stones shall be hand and wax polished. The laying procedure is same as specified in the item 6.06 above. Curing shall be done properly.

6.08 **-DO- as above for stones upto 1.5m in length in single piece**

Same as per item 6.07.

6.09 **Providing & Fixing kota stone shelves**

The stones shall be pre-polished on both the sides and the thickness shall be 25 to 30mm. The stones shall be placed in the brick masonary zarries and the same shall be finished properly.

6.10 **Providing & laying rough chiselled Kota stone flooring**.

The stones shall be of specified thickness and size. The stones shall be placed on 20 thick CM bedding or lime mortar bedding and the joints shall be with CM 1:2 (1 cement, 2 stone dust). The joints shall be finished flush or with "V" grooves of 5 to 8 mm wide & 8 mm deep. The slope shall be maintained as given in the drawing or as directed.

6.11 **Providing & laying 40mm thick IPS flooring**

The mix shall be 1 part cement, 2 parts coarse sand and 4 parts graded stone aggregate. The flooring shall be laid in panels of uniform sizes not exceeding 2 sq.m. They shall be laid in alternate panels on alternate days. The edges shall be provided to separate the panels, as per the item description in the Schedule of Quantities. The slope shall be maintained as directed by the Engineer.

The mix shall be prepared by volumes. Mixing shall be done in mixers. The concrete shall be placed in position and leveled up with the help of wooden straight edge and trowel and beaten up well till slurry comes on top and holes filled up with concrete.

If IPS has to be laid directly on RCC slab, the surface of the RCC slab shall be roughened up with brushes while the concrete is green. Before laying the floor, the laitance, loose materials, cake of mortar dropping shall be removed and the surface of the slab hacked and coat of cement slurry @2.75 kg of cement per sq.m. shall be applied so as to get a good bond between the slab and IPS. IPS has to be provided on lean concrete no slurry is required.

The flooring shall be finished with 12 mm thick (1:1) cement-sand mortar and cement slurry @2.2kg of cement per sq.m. and water shall be applied on top with wooden float till the voids in the concrete are filled with mortar cream. The surface must be uniform and even in colour. Dry cement or cement sand mixer shall not be sprinkled to absorb excess moisture in the flooring. Colour pigments shall be added to the flooring if instructed by the Engineer. Curing shall be done for seven days. The edges of the panels shall be protected from damage.

6.12 **Providing & Laying IPS flooring of 50 thick**

-DO- same as item 6.11 but for 50mm thick.

6.13 **Providing and laying 15-20 mm thick IPS in skirting/dado**

The specification shall be same as the item 6.11 but for the work is to be done on vertical surfaces. It is of two layers the base layer shall be of 12mm thick PCC 1:2:4(1 cement; 2 sand: 4 graded stone aggregate of size 12mm and down). Then it shall be finished with 6mm thick plaster with CM 1:1.

6.14 **Extra for providing , mixing and laying of IRONITE**

The ironite shall be consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease, sand and soluble alkaline compounds. This shall be mixed with with cement in proportion of 4 cement and 1 compound by weight. The laying procedure is same as per the specification for IPS flooring.

6.15 **Providing & Laying PVC tiles flooring**

This shall be laid over IPS flooring . These shall be of approved make. The tiles shall be fixed as per the Manufacturer's specifications.

6.16 **Providing & Laying acid and alkali proof, non-skid ceramic tile Flooring**

Ceramic tiles of 20mm thick in sizes and quality as specified in the item description shall be shall be laid on floor on 37mm thick concrete bed of 1:2:4 (1 cement, 2 sand, 4 coarse aggregate of nominal size 12 mm and down). The floor shall be first applied with a coat of acid alkali primer and then the bed concrete is laid. The acid alkali proof powder shall be added to the bed concrete in proportions specified by the manufacturer. The tiles shall be laid in proper line, level and slope and with joints of thickness 6-10mm even all around. It shall be cured for 7 days. Then the joints shall be filled with acid alkali proof powder and epoxy resin as specified in the item description. All joints shall be finished neat and it shall be kept dry for atleast for 48 hours.

6.17 **Providing & Laying Mandana in flooring, skirting and dado**

The sizes of the stones shall be 600 mm x 600 mm or 600 mm x 450 mm or 450 mm x 450 mm or 450 mm x 300 mm or 300 mm x 300 mm, as directed, and the thickness shall be 37mm for flooring and 15-20mm for skirting and dado. The stone shall be acid and alkali resistance shall be approved by the Engineer.

The approved quality of acid and alkali preventive primer shall be applied uniformly in two coats over the slab or the concrete surface. The acid-alkali proof powder shall be mixed with the cement in the proportion 2:1 (2cement ; 1 powder) or as per the manufacturer's specification. The cement-powder mix and the sand shall be mixed in the ratio 1:3 and the mortar shall be prepared. The stones shall be laid on the mortar bed in level and line with even thickness of 6mm to 10mm joints all around.

The joints shall be raked to 12-19mm deep and filled with epoxy based resin. The resin is mixed with quick drier and acid-alkali proof powder. As the resin is an atmospheric hardening agent, it does not require curing. The work place shall be kept dry for the joint filling operation. The stones shall be either hand polished or machine polished cleaned with oxalic acid and then wax polished.

6.18 **Providing & Laying Ceramic tiles in flooring, skirting and dado**

The ceramic tiles in flooring and dado shall be of first class quality as specified in the item specification and shall be approved by the Engineer. The tiles shall be of standard size without warp and with straight edges, true and even in shape and size and of uniform colour. The tiles surface shall be of fine grained texture, dense and homogeneous. The thickness of the tile shall be as per the item specification. The tiles shall be submerged in water till the bubbles cease.

They should be laid on a base of 12 mm thick mortar bed (cement or lime 1: 3 sand) and cement (3 kg/sq.m) paste. They shall be laid truly vertical on walls and truly horizontal on floors or to slopes as directed. The joint shall be very thin, uniform and perfectly straight. The tiles in dado shall be finished in such a way that, only the tile thickness projects over the finished plaster or as specified otherwise. Where full tiles are not possible, the same should be cut or sawn to the required size and their edge rubbed to ensure straight and true joints. After the tiles are laid extra cement grout shall be removed. The joints shall be cleaned with wire brush and then the joint shall be floated with white or grey cement as approved by the Engineer. The tiles shall be cleaned after the work is complete.

6.19 **Providing & Laying glazed tiles**

-DO- same as item 6.18.

6.20 **Providing & Laying Coloured glazed tiles**

-DO- same as above.

6.21 **Providing Special Mirror Finish Polish on Kota Stone**

This shall be carried out by using 500 to 2000 grit emery polishing in six stages and final finishing with 2000 grit tin oxide and felt pads. The work shall be carried out with polishing machine with vibration free rubber lined mounting wheels.

6.22 **Providing & Laying Marble Flooring**

The stone shall be of specified quality, hard, sound homogeneous in texture, free from cracks, weathering and flaws. **All stones shall match each other**. All edges shall be true, square and free from chippings, the surface shall be level smooth and machine rubbed. The stones shall be laid on a cement mortar bedding of 37mm thick 1:2 (1 cement, 2 sand). No cement slurry shall be applied after each grinding. The flooring in skirting, dado and treads and platforms shall be hand polished.

6.23 **Providing & Laying Shahbad stone in flooring**

The specification is same as item 6.05.

6.24 **Providing and Laying Shahbad stone in skirting and dado**

The specification shall be same as item 6.06.

6.25 **Providing & Applying 115mm thick water proofing treatment**

First a layer of about 20mm thick in CM 1:3(1 cement, 3 coarse sand) mixed with waterproofing compound of approved make shall be laid as instructed by the Engineer. Then brickbats shall be laid over this the required slopes and levels as per the drawings and the instructions of the Engineer. The surface of the brickbats shall be finished smooth with another layer of water proof plaster and the gaps between the brickbats shall also be filled with CM mixed with water proof plaster . Finally the surface is finished smooth and desired patterns are formed on the surface with thread. All openings, sleeves, drains, pipes etc. shall be specially treated and made sure that they are watertight.

6.26 **Providing & Laying 75mm thick water proofing**

-DO- same as item 6.22 but for 75mm thick.

6.27 **Providing & Laying Cast Iron Tiles Flooring**

Cast iron tiles of specified size shall be supplied to the Contractor and he has to take the delivery from the Project Authority stores without any extra cost. The tiles shall be stored safely as any loss or damage shall be at the Contractor's cost. The tiles shall be laid over a bed of 37mm thick 1:2:4, (1 cement : 2 coarse sand : 4 graded stone aggregate of nominal size 12mm and down). The tiles shall be fixed in line and level as per the drawing and as directed by the Engineer. The joints shall be filled with 1:1 cement mortar (1 cement : 1 sand). Curing shall be done at least for 15 days. The tiles shall be hand/machine polished and the entire surface shall be smooth and all joints shall be filled properly.

6.28 **Providing & Laying pre-polished Cuddappah stone in treads**

The specification is same as for item 6.07.

6.29 **Providing & Laying Cuddapah stone in shelves**

Same as per item 6.09 .

SECTION 7.0

STEEL/ ALUMINIUM WORK

Applicable Codes

IS:4351 - Steel door frames
IS:1038 - Steel door, windows and ventilators.

7.01 **Providing & Fixing Pressed steel frames for doors**

They shall be made of hollow metal pressed section of approved make. They shall be single/double rivetted as per the Architect's drawing. It shall be made of CR sheet and size 65x125x1.25 mm thick. It shall be provided with four hinges of 125x2 mm thick of friction type. Four hinges shall be provided per leaf of the door. The frame shall be provided with 4 holdfasts of size 150x20x3 mm for each side and the same shall be embedded in brickwork with CC 1:2:4 blocks of size 300x23x230 mm. The hollow portion of the frame shall be filled with CC 1:2:4 before it is fixed.

The frame shall be painted with red oxide primer. There shall be provision in the frame for fixing of towerbolts, aldrop, louvers, mortise lock etc. The frame shall be painted with two or more coats of approved synthetic enamel paint to get a uniform finish.

7.02 **Providing & Fixing pressed steel section windows for fully openable windows**

The frame shall be of size 100x60x1.25 mm thick and it shall be of approved make. The frames shall be double rivetted. The frame shall be provided with 3 holdfasts of 100x15x3 mm long and the same shall be grouted with CC 1:2:4 in the brickwork or to RCC member. Shutters shall be made of standard steel sections style F7d, sash bsr of T6 and locking bar of F4b section. The hollow portion of the frame shall be filled with CC 1:2:4 before fixing the frame.

Glass of 4mm or 5.5mm shall be fixed with beading as per the Architectural drawing. The beading shall be of MS I hollow square pipe of 10 sq.mm and wall thickness 1.25 mm.

The section shall be provided with arrangement for fixing the MS or aluminum oxidised handles and washers. The window section shall be painted with one coat of primer and two coats of synthetic enamel paint of approved make and shade.

7.03 **-DO- same as item 7.02 for partly openable and partly fixed windows**

-DO- same as item 7.01

7.04 **-DO- same as item 7.02 for fixed windows**

-DO- same as per item 7.01.

7.05 **-DO- same as item 7.01 but for for louvred ventilators**

-DO- same as above but provision shall be given for fixing 4/ 5.5 mm thick glass

7.06 **Providing & Fixing fly proof shutter**

This shall be fixed to the existing pressed steel frame. The wirenetting shall be 22 to 23 SWG and galvanised. The beading shall be of MS flat 25x3 mm with screws. The shutter shall be provided with 4 nos. of friction type hinges. The section shall be provided with arrangement for fixing towerbolts and handles. It shall be painted with one coat of primer and 2 coats of approved synthetic enamel paint.

7.07 **Providing & Fixing GI BRC fabric**

This shall have a GI rectangular or square shape 75, 50, 25mm size as per requirement. The gauge of the wire shall be 8x10. The gap size shall be 75x25mm in general unless specified otherwise. This shall be welded/bolted to the MS frame made of angle iron 40x40x6 and tee 40x40x6 mm with a MS beading of 30x3 or 12x6 mm or as specified in the item description in the Schedule of Quantities. This shall be painted with one coat of primer and 2 coats of approved synthetic enamel paint of first quality as specified in the item description.

7.08 **Providing & Fixing Rolling shutters**

The rolling shutters shall be of 18 gauge MS solid laths or grill with all the accessories such as top cover (conform to the size indicated in drawings and shall be of quality specified in the item specification. The rolling slats shall be in one piece and be made of heavy gauge steel sheets minimum 18 swg in thickness. A cylindrical hood shall be provided on the top to enclose the shutter when it is open. The rolling shutters shall be provided with suitable locking arrangements and deep channel guides. In case galvanised rolling shutters are specified the rolling shutter shall be made of hot dip galvanised slats hood, deep channel guides all preferably in one piece. The channels, guides shall be fixed with holding down bolts with PCC 1:2:4 (1 cement, 2 sand, 4 coarse aggregate of nominal size 12mm and down).

In case of hand operated pull and push type rolling shutters and very large gear operated rolling shutters of sizes larger than 10 sq.m in area, they shall be provided with ball bearings for smooth and efficient operation. In case of large rolling shutters and depending upon local wind conditions, the rolling shutters should be provided with special locking type of wider channel guides or it shall be provided with central movable channel supports to take up the design wind pressures in the area.

ii) The rates quoted shall be inclusive of providing and fixing of rolling shutter with push and pull arrangement, two coats of approved paint over 2 coats of approved primer coat (one shop cot and one coat after erection). Fixing lugs to be provided to guide channel to suit actual site conditions or as directed by

the engineer at no extra cost. The mechanical arrangement provided for the opening and the closing of the shutter shall be paid for separately in sq.m of the shutter area as specified in the item description.

7.09 **Providing & Fixing Mechanically operated rolling shutters**

-DO- same item 7.08.

7.10 **Providing & Fixing partly grilled Rolling shutters**

-DO- same as item 7.08.

7.11 **Providing & Fixing in position grill, railing, steel ladder etc.**

This work shall be carried out as per the detailed drawing of the Architect. The MS sections shall be of approved quality. The welding shall be perfect and the junctions shall be ground properly. The frames shall be provided with holdfasts and the same shall be grouted with CC blocks of 1:2:4 in brickwork. It shall be painted with one coat of primer and 2 coats of approved synthetic enamel paint.

7.12 **Providing & Fixing MS inserts in RCC and Brick work**

Inserts, bolts etc shall be provided in masonry and concrete works as indicated on the drawing. It is imperative that all inserts, bolts fixtures and fittings shall be provided in their position very accurately. Such inserts and bolts be fixed with necessary templates. If due to negligence on the part of the contractor, the inserts, bolts fixtures, and fittings etc, are out of alignment the contractor shall make arrangements to have the inserts and bolts removed and refixed in their proper position as directed by the engineer, at no extra cost. The exposed parts shall be painted with one coat of primer and two coats of approved synthetic enamel paint.

7.13 **Providing & Fixing MS gate**

It shall be as per the drawing. The welding shall be perfect and the junctions shall be ground properly. The gate shall be provided with locking arrangements, hinges and it shall be painted with one coat of primer and two coats of approved synthetic enamel paint.

7.14 **Providing & Fixing GI pipe railing**

It shall be done with the specified class of GI pipe as per the item in the Schedule of Quantities. The design shall be as per the drawings/instructions. All necessary specials, bends, elbows, tees and holdfasts or clamps shall be provided. If the pipe railing is to be fixed on ground or brick work, it shall be done by embedding the holdfasts, as directed by the Engineer, in concrete blocks PCC 1:2:4 (1 cement, 2 sand, 4 graded coarse aggregate of size 12 mm and down). If it is to be fixed to a RCC member, the pipe shall be welded to the steel plate by embedding it in the RCC member.

7.15 Providing & Fixing MS door frame

It shall be fabricated from structural steel as per the details and drawings. All the members shall be free from rust, flakes, cracks and other fabricational defects. All holes for hinges, bolts, locking plates etc. shall be provided as per drawings/instructed. The welding shall be smooth. The frame shall be erected and fixed with MS holdfasts of specified size and grouted with cement concrete 1:2:4(1 cement, 2 sand, 4 graded coarse aggregate of nominal size 12mm and down) The frame shall be painted with a coat of primer before erection and 3 coats of synthetic enamel paint of specified quality after erection.

7.16 Providing & Fixing MS sheet door

The frame shall be of MS as specified above. The door shall be as per the Architects design. The specified gauge MS sheet door shall be welded to the frame. it should have 3 to 6 hinges depending on the shutter size. It shall have fittings as specified in the item/ Architect's drawings. The door shall be applied with a coat of primer and 2 coats of synthetic enamel paint of quality as specified.

7.17 Providing & Fixing GI barbed wire fencing

This fencing shall be either be made with RCC posts and struts or with MS posts and struts. RCC posts and struts shall be of size and length as specified in the item description in the Schedule of Quantities. It shall be free from cracks, twists and honey combing.

MS posts and struts shall be of size and section as specified in the item description. One end of the angle shall be forked to have grip in the concrete and the other side shall have a hole to receive the fencing wire. It shall be applied with a coat of primer and 2 coats of synthetic enamel paint.

GI wire

It shall be 12 to 14 gauge with 4 points barb with two wires twisted together or as specified in the item description. It shall be circular in section, free from scale and other defects and uniformly galvanised. The type, length and standard weight of the GI barbed wire shall be as specified in the following table:

Table:

Nominal dia of wire		Nominal distance between two barbs	Length in M/100Kg		
Line wire	Point wire		Nominal	Min.	Max.
2.5mm	2.24mm	75mm	1000	934	1066
2.5	2.24	150	1134	1066	1200
2.24	2.24	75	1576	1490	1668

2.24	2.24	150	1890	1778	2000

The GI barbed wire shall be well stretched in number of rows as specified with two diagonals. The spacing shall be at least 15cm from the ground and the rest shall be equidistant. The posts and struts shall be embedded in PCC 1:2:4 or as specified. It shall be fixed in line, level and plumb. The grouting concrete shall be cured for 7 days. The barbed wire shall be held to posts by means of GI staples, U slips or GI binding wire as specified. Turn buckles and straining bolts shall be used at the ends. Two struts shall be provided at the corners and at every 28M. The length of the strut shall be 1.5 times the length of the post.

8.0 PIPING

8.1 General

a. All piping work shall be in conformation with the requirements of the applicable drawings and this specification. Where specific details of fabrication are not shown on the drawings of specified there in fabrication shall be in accordance with relevant IS.

b. Piping shall also comply with applicable ate, local and other Governmental laws and codes. In case of conflict with this specification the more stringent specification shall govern.

c. All work shall be performed in accordance with the best modern practice for this type of work and shall be of the highest quality workmanship.

d. Any deviation from the specification must have the approval of Engineer-in-Charge.

8.2 The relevant applicable standards

1.	IS 1537 & IS 1538	Centrifugally Cast (spun) iron pipes and fittings for wastages and sewage.
2.	IS 1239	GI pipes & fittings.
3.	IS 9984	HDPE pipes
4.	IS 8008	HDPE fittings
5.	IS 7534	Code of practice for laying HDPE pipes
6.	IS 3114	Code of practice for laying cast iron pipes.
7.	IS 780	Cast iron sluice valves
8.	IS 638	Rubber for flanged joints

9. IS 1867 MS hexagonal bolts and nuts

10. IS 6392 Steel pipe flanges

11. IS 7634 Testing of HDPE pipes

8.3 **Cast Iron piping**

a. Transportation and stacking

The transportation of materials to the work site and stacking shall be done in a manner to cause minimum in- convenience to the traffice and other construction works. Pipes shall be protected during handling against impact shocks and free fall, to avoid cracks and damage.

b. Lowering

The pipes shall be lowered cautiously to prevent disturbance of the bed and sides of the trench. The heavy pipes shall be lowered by means of proper shear legs, chain pulley or as directed by Engineer-in-Charge.

c. Laying

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe-laying team cannot put the pipe into the trench and in place without getting earth into it, the Authority may require that before lowering the pipe into the trench, a heavy tightly woven canves bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

The pipe shall be secured in place with approved backfill material tamped under it except at the end. Pipe and fittings which do not allow sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to ensure such space. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying in not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Authority.

d. Joining

Flange faces shall be in a plane perpendicular, true and square to the centreline of the pipe to which they are welded.

Whenever screwed flanges are used the pipe shall extend to within 1.5mm to 3 mm of the face of the flanges but not beyond.

Bolt holes shall straddle normal centrelines in the vertical and horizontal planes unless otherwise specified.

The jointing material used between flanges of pipes shall be compressed fibre board or rubber (see IS:638-1955*) of thickness between 1.5mm to 3 mm. The fibre board shall have impregnated with chemically, neutral mineral oil and shall have a smooth and hard surface. Its weight per sqm shall be not less than 112 g/mm thickness.

Each bolt should be tightened a little at a time taking care to tighter diametrically opposite bolts alternatively. The practice of fully tightening the bolts one after another is highly undesirable.

e. Testing

The pipe line shall be tested to double the working pressure. Pipe line shall be tested in suitable section before backfilling. After all the lines are tested in section, afina test shall be performed before commissioning the system.

Test manifolds, connection piping and all other necessary appurtenances for testing shall be installed by contractor at the time of test. On completion of testing the test appurtenances shall be removed.

After satisfactory test, the contractor shall remove water from the pipe line and clean it after testing at his own cost, without flooding and adjoining areas.

f. Procedure of Tests

The pipe shall be completely filled with water and it shall be ensured that no air is left in the line. Pressure shall be applied with a calibrated pressure gauge. Upon reaching the test pressure it shall be maintained for a sufficient time to permit complete inspection of the system under test but in no case shall the time be less than 10 minutes.

If the pipe line fails to maintain the specified test pressure, contractor shall determine the location of the leak and shall repair the leak by replacing pipes, re- caulking joints, etc. to the satisfaction of Engineer-in- Charge and retest the same.

8.4 **M.S. Piping**

A. Transportation and stacking

Refer clause 8.3 a. above

B. Lowering

Refer Clause 8.3 b. above

C. Fabrication

Layout, cutting and fitting-up.

a. Templates shall be used in laying out headers, laterals and other irregular details to ensure accurate cutting and proper fit-up.

b. Machine cut bevels to form the welding groove are preferred, but smooth, clean, slag-free falme cut bevels are acceptable.

c. In fitting up details preparatory to fina welding, spacers shall be used while tack welding the pipe and connections in position so that a proper gap is made for full penetration of welds. The following are the recommended gaps:

For pipe size below 150 mm	1.5 mm weld gap
For pipe sizes 150 mm (inclusive) and above.	3.0 mm weld gap

d. Only small tack welds which penetrate to the bottom of the welding groove shall be used and shall become a part of the fitting weld. Tack welds lacking penetration are not acceptable and must be chipped out. Each weld shall be cleaned of all scalpe, slag, flux and other foreign matter before additional welding beads are applied.

e. In general, permanently welded-in rings shall not be used. If back-up rings should be necessary or desirable, they may be used only specific approval of Engineer-in-charge. If used, they shall be streamlined to minimise turbulence and resistance to flow through the pipe.

Bending:

a. Completed bends shall have smooth surfaces and shall be free of flat spots and corrugations.

b. Fabricated pipe.

i. Hot bending shall be done with the pipe filled with tamped sand. Following the bending operation, the bend shall be allowed to cool slowly in still air before the sand is removed. The minimum radius shall be six times the nominal pipe diameter.

ii. Cold bends to a radius of six times the nominal pipe diameter or greater may be made without subsequent stress relieving. No cold bending is allowed on pipe larger that 50mm nominal diameter.

Welding:

a. Welders and welding procedures shall be qualified in accordance with the requirements of the codes and IS:817-1966. Horizontal and/ or vertical welding qualifications shall be shown on qualification papers.

b. All welding shall have full thickness penetration and shall be done by the Electric Arc Process. Gas welding may be done if necessary to prepare a bead for the next phase.

c. The completed weld shall be cleaned of slag and spatter metal on all surfaces, and when possible the inside bead shall be ground smooth.

d. No undercutting of pipe adjacent to the completed weld will be permitted.

e. Finished welds shall project not less than 1.5 mm but not more than 3mm from the outer surfaces of the pipe.

f. Electrodes:

Welding electrodes with a suitable coating shall be in accordance with IS specifications and of a recognized quality. Electrodes shall be preserved in an electrode oven and only those electrodes which are so preserved shall be used in the welding. The electrodes shall have to be approved by the Owner.

D. Laying

Refer Clause 8.3.c.above.

E. Joining

Refer Clause 8.3.d above

F. Testing

Refer Clause 8.3.e above.

G. Procedure of Test

Refer clause 8.3.f above.

8.5 **G.I. Piping**

a. Transportation and Stacking

Refer Clause 8.3.a above

b. Lowering

Refer Clause 8.3.b above

c. Laying and fixing

Screwed GI pipes shall be jointed with screwed sockets, joints, using screwed fittings. Care shall be taken to remove any burn from the ends of the pipes. After screwing, white lead with a few stands of fine hemp shall be applied while tightening.

Compounds containing red lead shall not be used. All pipes above ground shall be fixed with GI holder bat clamps clear of the walls. If the pipes are fixed in chasses or embedded in wall, they shall be secured properly in position by grounding and pipe inside chase will be panted thickly with bituminous paint.

All underground pipes shall have aluminium cover of 600 mm or as directed by Engineer-in-charge.

d. Testing

Before any pipes are panted or veered up they shall be tested to required hydrostatic pressure.

In addition to the sectional testing of water supply piping, the contractor shall test entire installation on completion of the job to the satisfaction of the Engineer--in-Charge.

8.6 **HDPE Piping**

A. Transportation and Stacking

A vehicle with a flat bed, free from nails and other projections which may not cause damage to the pipe, should be used while tansporting these pipes.

Black polyethylene (PE) pipes may be stored either under cover or in the open. They are protected from ageing due to sunlight by the addition of appropriate type and quantity of carbon black.

Coils may be stored either on edge, or sacked flatly one on top of the other.

Straight lengths should be stored on level ground.

Available storage space can be further saved by 'nesting' i.e., storing smaller diameter pipes inside pipes of relatively larger diameter.

B. Handling:

Polyethylene is a tough, resilient material which is easy to handle. However dragging pipes/coils over rough surfaces should be avoided. Unlike other plastic materials, this materials is not affected by low temperature and there is no need for special precautions in handling during cold weather or even in freezing conditions.

C. Laying

a. Underground Installation:

While trench work is in progress, extensive excavation should be discouraged and advance excavation, as far as possible, should be limited to about one day's pipe laying work. This reduces traffic hazards and lowers risk of soil caving in. Whenever gradual curves are involved in pipe alignment, care should be taken to see that the curvature radius of the trench alignment is about 20 to 40 times the diameter of the pipes, depending on the size. These methods maximise benefits of the pipes, flexibility and hereby, reduce the occurrence of any sharp bends.

When laying smaller diameter pipes, considerable savings in time and labour can be effected by using longer lengths of pipes in coils. These longer lengths in coils are available in diameters from 20mm OD to 90mm OD.

In a trench, the pipe may be laid in a curvilinear pattern i.e., snaking the pipe in the trench. This curvilinear laying of pipe allows for thermal contraction/expansions, subsequent to back-filling the trench without creating any additional stresses during seasonal changes.

Trench preparation:

Trench width at the crown of the pipe should be as narrow as is practicable. But it should not be less than the outside diameter of the pipe plus another 300mm too allow proper connection of the side fill. Above the crown of the pipe, the trench may be of any convenient width.

Pipes, especially higher series of pipes, may be laid directly on the trimmed bottom of a trench. However, this should be done in uniform, relatively soft fine-graned soils free from large flints or stones or other hard objects. And where the bottom can readily be brought to an even finish to provide uniform support for the pipes over their length. In other cases, the trench should be excavated to a sufficient depth below the bottom of the pipe, to allow for the necessary thickness of the selected bedding material.

Bedding and Side-filling :

Clay is a unsuitable material for bedding or side-filling. Other soils excavated from the trench, such as free-draining coarse sand, gravel,

loam and soils of suitable nature with adequate compaction fraction for providing support to the pipe are more suitable. Soils such as hard chalk, which break up when wetted, should not be used.

If the material excavated from the trench is unsuitable, then granular material like coarse sand, or sand and gravel from outside sources, should be used for bedding and back- filling.

The thickness of the bedding, under the barrel of the pipe should be of a minimum 100 to 150mm depending upon the irregularity of the trench bottom. The bedding should be properly compacted to provide a uniform bed for the pipe. Bricks or other hard materials should not be placed under the piper even as temporary supports.

After the pipes have been laid and tested, additional material should be placed around the pipe and compacted in 75 mm layers up to a level of at least 100 mm above the top of the pipe.

Back-filling:

Material excavated from the trench may be used for the remainder of the back-filling. It could be compacted in 30mm layers. Alternatively, it should be in compliance4 with the special requirements of local or other authorities.

b. Above ground Installation:

A high rate of linear expansion of exposed pipe section can be expected.

D. <u>Joining:</u>

Welded Permanent Joints:

These are effected by butt welding employing of fusion technique. Clean, leak-proof and permanent joints can be effected through the following steps.

a. Cut the pipes cleanly as required for the joint to be made.

b. Bevel and clean the inner edge.

c. Bring the cut surfaces together, and check for alignment.

d. Heat the welding mirror to 210 Deg. C, either electrically or with a blow torch or other external heat sources.

e. Verify the temperature of the mirror with the help of thermochrome chalk. The chalk mark will turn from blue to black in about 3 seconds.

f. Bring the freshly cut surfaces, to be joined, into contact with the mirror.

g. The material will melt. Permit the weld rims to form.

h. Take the heated ends away from the mirror, and bring them together under slight pressure, to permit them to fuse.

Detachable Flange Joints:

i. Slip the HD/MS sandwich flange over the pipe ends.

ii. Weld the collar (pipe end) to the pipes.

iii. Bring the flange faces together and tighten with bolt.

8.7 General notes on erection of piping

a. All piping shall be erected as shown on the approved-for- construction drawings and in accordance with this specification.

b. Arrangement drawings shall now general location and will indicate special dimensions, location of valves, fittings etc.

c. Special attention shall be given to the handling and erection of piping to prevent damage and ensure the continued cleanliness of such piping.

d. All assembled piping shall be installed in place without sparing or forcing.

e. Piping connections to equipment shall be made in conformity with details on the drawings.

f. Mill-wrighting and grouting of pumps shall be done after the connected piping has been installed and properly anchored or supported.

g. Slopes of piping specified on drawings shall be maintained. Where no slope is required or where a required slope approaches the horizontal, piping shall be checked for slag with a level not less than 1 meter long equipped with a graduated bubble vial. All low points where liquid may be entrapped shall be removed.

h. After piping is erected in final position, it shall be cleaned, tested for tightness and dried out where required as described in this specification.

i. Necessary piping supports and expansion loops shall be provided.

8.8 General notes on cleaning of Fabricated Piping

i. All piping and fittings shall be cleaned thoroughly inside and outside, from loose scales and foreign materials by wire brushing or using a rotary cleaning tool, before erection.

ii. All field fabricated piping shall be cleaned at the completion of fabrication. Care shall be taken to see that all burn, welding in icicles and weld spatter are removed by reaming, chipping, or other suitable means. All foreign materials such as cement, mortar, sand, heavy oil and loose scale shall be removed from the interior of by thoroughly flushing with water detergent where necessary. To avoid large branch lines from a larger diameter header line, special precautions should be taken to disconnect at branches or selectively black them off. After thorough cleaning, the fabricated pipe is to be dried completely with dry oil free air and the ends plugged to prevent contamination.

8.9 General notes on Cleaning of Erected Piping

a. A record shall be kept of cleaning of each line or section of erected piping. Cleaned lines shall be tagged.

b. Strainer baskets and similar items shall be removed or by- passed before cleaning operations are started and replaced immediately after cleaning is completed.

c. Proper temporary drainage for flushing water shall be provided so that no damage is done to permanent facilities.

8.10 RC Pipes/Hume Pipes

i. Handling Pipes

At every point offloading or unloading, pipes or castings must be handled by approved lifting tackle. Unloading by rolling down planks or any other form of inclined ramp will not be allowed unless the written consent of the Engineer to the method proposed has been obtained. Pipes are to be carefully stacked on site with timber packings under and between the pipes.

ii. Laying of Pipes

a) The pipes are to be laid up the gradients beginning at the lower end. No pipe is to be laid until the trench has been excavated to is required depth for a distance of 20M, in front of the pipe to be laid. (This distance may vary as directed by the Engineer).

All the pipes are to be laid perfectly true, both in line and on gradient. The pipes in a trench shall be all laid and fitted previous to the jointing being commenced.

b) Properly fitted temporary wooden stopper shall be provided and constantly used to close the ends of all incompleted pipe lines. The stoppers are only to be removed when pipe are being laid and jointed.

iii. Foundation of RC pipes

a) The foundation for the RC pipes drain or sewer if required shall be formed of cradle block or full encasement of M 100 concrete of the shape and dimensions shown on the drawing.

b) Encasing/Bedding.
The pipes shall be provided with encasement/bedding etc. as specified in drawings.

iv. Jointing of RC pipes with Collar joints

The RC pipes shall be carefully laid in position over the concrete bedding or over the firm ground at the required level and their abutting faces shall be coated with hot bitumen in liquid condition by means of a brush. The wedge-shaped groove in the end of the pipe shall then be filled with sufficient quantity of a special bitumenous plastic compound. The collar then shall be slipped over the end of the pipe and the next pipe butted well against the plastic ring by suitable appliance approved by the Engineer so as to thoroughly taken that the concentricity of the pipes and the levels are not disturbed during this operation.

This collar shall be placed symmetrically over the end of the two pipes and the space between the inside of the collar and the outside of the pipe filled with 1:1 mixture of cement and sand tempered with just sufficient water to have consistency of the semi-dry conditions, well packed and thoroughly rammed with caulking tools. The joints shall be finished off with a fillet sloping at 45 Deg to the side of the pipe and of days or as directed.

Any plastic solution or cement mortar that may have been squeezed into the inside of the pipe shall be removed so as to leave the pipe perfectly clean.

v. Depth of Excavation of Trenches

The depth for the trenches will be calculated from the surfaces to the bed of the pipes and in case when a layer of concrete and/or precast blocks are required to be placed below the pipe line, the depth to the bottom of the concrete and/or of the block below the underside of the pipe line will be considered. The depth of the excavation for manhole shall be measured from the surface of the existing ground level to the bottom of the foundation.

vi. Measurement of Pipes

a) All pipes will be measured according to the work actually done by them and no allowance will be made for any waste in cutting to the exact length required.

b) A band, junction, or any separate piece of fitting which may have necessary been cut for the exigencies of the work will be taken into

account as if whole, provided that the cutting has been done properly and that portion used in the work in any circumstances. In measuring the lengths of the pipes laid, deductions shall be made for the lengths of channels between the inside face of the walls of manholes.

vii. Manholes, depth of manholes

The manholes on the sewers shall be constructed in the form and of the dimensions shown on the drawing. The depth of the manholes shall be measured from the top of cover to the invert level of the manhole.

viii. Construction of brick masonry manholes

The walls of the manholes shall be built in brick work in cement mortar and walls and the ca plastered both from inside and outside with cement plaster 1:3. In case of conical manholes, the walls, shall be brought up and 15 cm thick concrete cap of M 150 truncated conical shape as shown in the drawing and cast in situ and shall be covered over with a cast iron frame and cover or a cast iron plate with a cast iron frame and cover as may in each case be required by the Engineer. Whenever rectangular manholes are to be constructed the brick walls shall be brought up and shall be covered with a reinforced cement concrete slap with an opening in the position as directed by the Engineer.

ix. Pipe entering and leaving manholes

Whenever a pipe enters or leaves manholes, bricks n edge shall be laid around the upper half of the pipe so as to form an arch all around the pipe. There shall be joint of cement mortar 13mm thick between it and the bricks or cement concrete. The ends of all pipes shall be properly built in and neatly finished with cement mortar. The pipe projections are to be cut so that the ends are flush with plastered surface.

x. Frames and Covers

Cast iron frames are to be bedded in cement mortar on the brick work or cement concrete with splayed fillet all around and in such position that the top may be 13mm above the original surface of the road. The covers are to be placed in position and the whole left neat and dry.

Covers shall be of cast iron, circular or other required pattern. They shall be of three varieties heavy, medium and light according to their weight. Heavy type shall be used in places exposed to very heavy traffic, medium one for medium traffic and light one in fields and lanes.

xi. R.C Pipe Brands

1. Indian Hume Pipe Co.
2. Premier Pre-stressed Construction Co.

3. Spun Pipe
4. Any other equivalent approved brand.

9.0 VALVES

9.1 General

1. Whenever practicable and except as otherwise shown on the drawings, valve stems shall be installed in a direction suitable for easy operation.

2. Where not otherwise specified on drawings, control valves shall be located and installed so as to provide the following clearance.

   a) Below valves - 30mm minimum
   b) Above valves - sufficient to remove bonnet with wedge.

3. A minimum of 50mm clearance shall be kept between the surface of insulation and the adjacent surface either insulated or uninsulated. Exceptions shall have the approval of the Engineer-in-Charge.

9.2 Cleaning of valves

Valves will be cleaned before installation. All possible precautions shall be taken to prevent contamination and valves shall be inspected immediately prior to installation. If a valve is found to be contaminated in anyway, it shall be cleaned as follows:

1. Remove all foreign particles by wiping with a clean lintless cloth.

2. Wipe interior of valve with a clean lintless cloth moistened with clean trichloroethylene.

   If contamination is excessive:

   Suspend the valve in a degreasing tank with hand wheel uppermost. Direct a stream of liquid trichloroethylene into the rim of the valve, through both ends and against all inside surfaces. Flush thoroughly to remove all foreign matter.

10.0 CONCRETE IN WATER RETAINING STRUCTURES

General

This specification defines the materials, construction and performance requirement for water tight concrete necessary for water retaining structures. The work shall be done in accordance with his specification together with IS:3370 (Part I to Part IV).

Materials

Materials for concrete namely cement, sand, aggregate, water etc., shall be as per specification given in earlier paragraph for plain and reinforced concrete together with the following.

Concrete

For water retaining structures where watertightness in addition to structural strength is of prime importance special care shall be taken to get the most suitable grading of aggregates so as to produce the densest possible concrete. Water cement ratio shall be controlled consistent with the requirements of workability to produce an impervious concrete.

Concrete shall be minimum M200 grade and shall have atleast 395 Kg, of cement per cum of concrete.

The concrete between the reinforcement and the formwork on the water face shall be well compacted on the board joints, made tight so as to produce a face free from honey combing or pores through which no vibrators shall be used after the approval of Engineer-in-charge.

Construction, Contraction and Expansion Joints

Joints are potential position of leakages. Where possible in circular structures of small or moderate diameter, vertical joints shall be avoided. This shall be done by completing a ring of about 80-100 cms deep in a continuous operation, working around the circumference in both directions from the starting point.

It is also advantageous to avoid horizontal joints by using continuously moving forms or by providing sufficient form work of ordinary type of ensure the entire will to be constructed without interruption. Where days work joints are formed whether horizontally or vertically, they shall be rebated as called or on approved drawings. Care shall be taken to remove from the earlier lift all loose places of gravel/stone chips, wooden chips, country nails, or any other foreign material. All laitance shall also be thoroughly removed. If necessary, the face of the old concrete shall be well backed to expose the aggregate and after washing the surface, a thin coat of mortar of grout (1 cement: 1 sand) shall be applied immediately before resuming concrete. A water bar shall be placed through the joints specially where the tanks walls bond into the floor, where an effective bond cannot be assured at horizontal joints, a method that has been successful is to form spigot-and-socket joint well and caulked with asphalt or a bitumen filler, and arranged to ensure that the water pressure tends to force the filling into, rather than out of, the joint. Joint shall not be made at changes of concrete section if they can be conveniently placed elsewhere. Moving them even a few centrimeters is often sufficient to prevent the secondary stresses being concentrated in one place leading to cracks.

In long walls of the water retaining structures design often incorporates permanent joints which assist in preventing cracks due to shrinkage and temperature changes. When these joints are not indicated in relevant drawings it

is best to concrete the wall in short sections and provide spaces as per drawings between sections, as long as possible.

After completing the sections, the intervening spaces shall be filled in taking care to bond the old with the new work.

Water bar installation along the joints shall be done by embedding one half of the water in each side of the joint between the adjacent sections of the concrete as per the manufacturers specifications and directions of the Engineer- in-Charge. Water bars shall be properly aligned and placed in position during embedding. To achieve the continuity of the water bar all along the joint at crossing and at change of alignment, the water stops shall be welded (in T, X or L shapes as the case may be) as per manufacturers specifications and directions of Engineer-in-Charge.

Fittings

Pipes or other fittings passing through the walls and bottoms of water retaining structures are another potential source of weakness and shall be on site in time to erect them in position in the shuttering before concreting commences. They shall be well embedded in the concrete and
if provided with normal water bar flanges, there is little risk of leakage. An objection to building in fittings is that if the Flanges are not in line with connecting flanges, extra labour is required in making adjustments. Some engineers prefer to have holes and fix the pipes fittings subsequently after completing the concrete work. However, it is difficult to ensure that this construction shall definitely be leak proof.

Fittings built into concrete shall preferably be of non-corrosive material, so as to avoid frequent replacements leading to water leakage. If made of ferrous metals the sections should be sufficiently substantial to prevent weakening by small corrosion, care shall be taken that corrosive metal coming in contact with portland cement shall receive a bitumen or equivalent anti corrosion paint.

Rendering of cement with addition of water proofing compound (ACCO or equivalent) shall be used with the object of covering weak patches in the concrete. The rendering shall be applied to the concrete, which is still roan, the formwork being struck as early as possible and the rendering applied immediately. The concrete surface shall be wetted and if necessary backed or otherwise treated to form a key. If the rendering is applied in two coats, the joints shall be broken. The mortar shall be steel trowelled, but finished with a wooden flat.

Hydraulic Testing:

All the water retaining tanks shall be tested in accordance with IS:3370 (Part I) for water tightness. For underground tank the total maximum drop in water surface level over 7 days shall not exceed 40 mm.

No separate item of rate is allowed for testing, but the price quoted lump sum will be deemed to include water testing with contractors testing appliances and rectification if any.

If the test proves the structure defective, the contractor shall rectify and repair the structure at his own cost. In the event, water tightness test and rectification fails, 12mm thick cement plaster with addition of water proofing compound shall be carried out as approved by Engineer-in- Charge, at contractor's own cost. Even after the application of plaster, if the test fails, the contractor has to dismantle and rebuild the structure at his own cost.

Testing water will be allowed free to the contractor in the first instance only. If any leakage is observed, the contractor shall bear the cost of water for all subsequent tests. The contractor shall make his own arrangements for filling the reservoir with water and no payment shall be made on this account.

Back filling around background reservoir shall be allowed only after the test is found satisfactory by Engineer-in- Charge.

11.0 ELECTRICAL WORK

11.1 Scope of Work

Supply, installation and commissioning of the following:

a. Electrical motors required for the various equipment.

b. Motor control centre (MCC) for all electrical drives & controls, capacitors & lighting alongwith rubber mat.

c. LT power & control cables of suitable sizes from MCC to all the motors, from MCC to main lighting DB and from MCC to remote controls/push buttons etc.

d. Push button and isolators to be located near all the motors.

e. Lighting of MCC room/Laboratory building and ETP area lighting, including distribution board, wiring, light fittings and 15/5 A plug points etc. as per details.

f. Two nos. plate type earthing pits and earthing network for MCC, motors, push buttons, lighting distribution boards etc.

g. Power capacitors for improving power factor.

Contractor shall test all electrical installation and submit electrical test report for submission to local Electrical Inspector/Electricity Supply Authority by Owner/OMFED. Contractor shall arrange approval of electrical installation from Electrical Inspector/Electricity Supply Authroity. Any statutory fee paid by Contractor for such approvals shall be reimbursed by the Owner/Purchaser on submission of documentary proof.

11.2 Technical Specifications

11.2.1 Electrical Motors

All electrical motors shall be TEFC, squirrel cage induction type, with class B insulation, as per IS 325 – 1996 or amended as on date, having IP 54/55 class protection, suitable for 415 Volts + - 5%, 50 hz. + - 3%, 3 phase AC supply as per equipment specifications. No single phase motor shall be acceptable even for small motors. All motors installed in buildings/area not having roof for rain protection shall be provided with removable type GI sheet 20 gauge thick rain water hood.

11.2.2 Motor Control Centre (MCC)

a. **Functional requirements**

To receive, control and distribute electrical power at 440V, 50 Hz., AC in a sheet steel housing.

b. **Design requirement and Scope of Supply:**

Statutory Requirements

Motor control centre is to be manufactured/assembled as per the latest ISI Specification, Indian Electricity Rules, including special requirements of concerned State Electricity Inspectorate and the detailed specification mentioned below.

Housing Details :

THE SWITCH BOARD SHALL BE FABRICATED OUT OF 14 SWG SHEET STEEL and shall consist of free standing front openable panels arranged to form a continuous line-up of uniform height. Cold rolled sheets shall be used for doors and front covers. Front doors shall be hinged type and bus bars and cable alleys covers shall be bolted type.

Switch Board shall be extensible at both the ends by addition of vertical sections. Ends of the busbars shall be suitably drilled for this purpose.

The switch board shall be totally enclosed, dust, weather and vermin proof. Gaskets of durable material shall be provided for doors and other openings. Suitable hooks shall be provided for lifting the boards. These hooks when removed, shall not leave any opening in the board.

All hardware shall be corrosion resistant. All joints and connections shall be made by galvanised zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers secured against loosening.

THE SWITCHBOARD SHALL BE IN CUBICAL DESIGN (EACH FEEDER COMPONENTS ARE HOUSED IN INDIVIDUAL CUBICAL). Suitable cable and busbar alleys shall be provided. In case plant room dimensions prohibit provision of cable/bus alleys in front, panel depth may be increased suitably to accommodate cables/buses on back of MCC. All components of the switch board shall be approachable from front. The maximum and minimum operating handle/push button height of any feeder shall not be more than 1900 mm or less than 300 mm with reference to panel bottom. Supporting arrangement for dressing of power and control cables in cable alleys also shall be provided. The maximum shipping length of MCC shall be 2500mm.

Provision of level switch controller shall be made for the raw effluent pump motor feeders, in case level switch is included in the specifications.

Painting:

All metal surfaces shall be thoroughly cleaned and degreased to remove all scales, rust, grease and dirt. Fabricated structures shall be pickled and treated to remove any trace of acid. The under-surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under-surface shall be made free from all imperfections before undertaking the final coat.

After preparation of the under surface, the panel shall be spray painted with final two coats of approved shade of powder coating.

The finished panels shall be dried in staving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run-off paint, etc.

All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust, corrosion, etc.

Name Plates :

Name plates for all incoming and outgoing feeders shall be provided on doors of each compartments of MCC and distribution board. Name plates shall be engraved on metallic plates and fixed by screws / ribets only and not by adhesives. Special danger plates shall be provided as per requirement.

Inside the panels, stickers/ferrules should be provided for all components giving identification no. as per detailed wiring diagram.

Busbar Sizing Connection and Supports :

The busbars shall be made from high conductivity electrolytic aluminium conforming to grade E91E of IS 5082. The busbars and supports shall be capable of withstanding the rated and short circuit current stated in the approved single line diagram/feeder details. Minimum size of main power bus bars shall be 200 Amps. rating for MCC and 100 amps. for lighting DB. Maximum current density permissible for Aluminium bus bars shall be 1.0 Amps./Sq.mm for busbar area below 500 sq.mm. An earthing busbar of minimum 150 Sq.mm section aluminium shall be provided outside panel at bottom throughout the length of the panel.

The busbars shall be provided with heat shrinkable insulating sleeve. Supports for busbars shall be made of suitable size hylem sheets/epoxy compound blocks and these should be adequate in number so as to avoid any sag in the busbars.

Minimum clearance between phase to phase shall be 25 mm and that between phase to neutral/earth shall be 20 mm.

Power Connection :

***For power interconnection within the panel board* :**

Copper conductor 1100 volts grade, PVC insulated cables of adequate cross section shall be used. FOR CURRENT RATING ABOVE 63 AMPS ALUMINIUM BUSBAR STRIPS OF ADEQUATE RATING SHALL BE USED. MINIMUM SIZE OF COPPER CONDUCTOR TO BE USED SHALL BE 4.0 SQ.MM. Cable lugs/sockets of suitable size and type shall be used for all interconnections.

For all aluminium to copper connections :- The copper surface will be silver plated and the aluminium surface will be properly cleaned and supplied with oxide inhibiting grease.

For incoming and outgoing feeders of the MCC aluminium conductor cable will be used and hence the panel is to be designed for receiving these and wherever required cable boxes shall be provided in panel by supplier. Removable gland plates shall be provided on top/bottom of panel, for cable entries.

To prevent accidental contacts, all interconnecting cables/busbars and all terminals also shall be shrouded.

Standard colour code of red, yellow and blue for phases and black for Neutral to be followed for all busbars/conductors.

***Auxiliary wiring and Terminals* :**

Wiring for all controls, protection, metering, signalling etc. inside the swithboard shall be done with 1100 volts grey colour PVC insulated copper

conductors. Minimum size of these conductors shall be 1.5 Sq.mm. Control wiring to components fixed on doors shall be flexible type.

Each cubicle shall have its own control circuit with fuse and indication. Terminal block (Minimum 3-ways) for control wiring shall be provided for each outgoing Motor feeder in its cubical. 10% spare terminals shall always be available in each terminal block. Control wiring upto these terminal blocks shall be done by supplier.

All control wiring should be provided with necessary cable sockets/lugs at both ends.

Conductors shall be terminated using compression type lugs. Each termination shall be identified at both the ends by PVC ferrules. The identification termination numbers should match with those on drawings.

Control wiring for motor feeders should be such that the "green" light of motor feeder is "ON" only when control as well as power circuit of feeders is "ON" and it shall have its own fuse.

Switchgears :

***Moulded Case Circuit Breakers (MCCB)* :**

MCCBs shall be provided with separate operating handle mechanism with door interlocking. The MCCBs shall be of triple pole and neutral construction arranged for simultaneous three pole and neutral manual closing or opening and automatic instantaneous tripping on short circuits. Closing mechanism shall be quick make , quick break and trip free type. Operating handle shall give a clear indication `ON' `OFF' & `TRIP' indication. The ratings shall be as specified in feeder details.

Rated breaking capacities shall be as under:
MCCBs upto 100 Amps : 35 KA
Above 100 Amps : 50 KA

Control voltage shall be 240 V.

***Switches* :**

Switches shall be switch disconnector fuse units conforming to IEC 947-3 and IS 13147-3. Mechanical interlock shall be provided to prevent opening of door in switch 'closed' position and prevent closing of switch in door 'open' position. However, it should be possible to defeat this arrangement for testing purpose.

Fuses :

These shall be HRC cartridge link knife blade type. Operation indicator shall be visible without removing fuses. These shall be complete with moulded phenolic fuse base and cover.

Contactors :

The rating of the power contactors shall be as required depending upon the feeder rating indicated in the specifications and as per the table given below. Contactors coils shall be suitable for 240 volts, 50 Hz. unless otherwise specified. All contactors shall be supplied with minimum 2 NO+2NC auxiliary contacts. Additional contacts if required for interlocking etc. shall also be provided. All contactors of automatic star delta starter shall be of same rating.

Protective Devices :

Bimetal overload relays shall be provided for all motor feeders. The relays shall be adjustable, with inbuilt single phase protection, and self reset type. Any other relays, if required for motor feeders shall be specified in the feeder details.

Timers :

The timers shall be electronic type, suitable for 240 V, 50 Hz. supply.

Push Buttons (PBs) :

Push buttons shall be with contact elements, shall be generally mounted on openable covers. Colours shall be as follow :

Stop/open/emergency - Red

Start/close - Green

It should have minimum 1 NO + 1NC contacts.

Indication Lamps :

These shall be LED type having cluster of LEDs of size 22.5mm dia operating on 240 volts AC

Colours shall be as under :

Phases	:	Red, Yellow & Blue
Open/Stop/Emergency	:	Red
Close/Start	:	Green

Bulbs shall be suitable for 240 volts AC supply.

Current Transformers (CTs) :

CTs shall be cast resin insulated type. Primary and secondary terminals shall be marked indelibly. CTs shall preferably be mounted on stationery parts. CT rating and ratios shall be as per feeder ratings. These shall be capable of withstanding momentary short circuit and symmetrical short circuit current for 1 second. Neutral side of CTs shall be earthed. Protection CTs shall be below reactance, accuracy class "SP" and an accuracy limit factor greater than "10". Instrument CTs shall be of accuracy class "1.0" and accuracy limit factor less than "5.0".

SEPARATE CTs SHALL BE PROVIDED FOR PROTECTION & METERING

Measuring Instruments:

These shall be of square pattern having approximate dimensions 96 mm x 96 mm, flush mounting type. Necessary auxiliary instruments like CTs, VTs, etc. are also included in the scope of supply.

All AC meters shall be of Moving Iron type having class 1.0 accuracy. Ammeters for motor feeders shall have a non-linear compressed scale at the end to indicate starting current.

Voltmeter shall be suitable for direct line connection. Voltmeters shall be connected through fuses only.

Energymeters shall be electronic digital type suitable to measure unbalanced loads of 3 phase, 4 wire system.

Ammeters provided for feeders units shall be with rotary selector switches and those for motors shall be without selector switches.

All voltmeters shall be provided with selector switches.

Ammeters for 20 Amps. and above shall be CT operated.

Special Requirements :

All motor feeders above 7.5 KW shall have automatic Star-Delta Starters and 7.5KW & below shall have DOL starters unless specified otherwise.

All the power contactors of Star-Delta starters shall have same current rating.

The following selection table shall be followed for starters of motor feeders unless otherwise specified :

Sr. No.	415 V. Motor HP	Contactors Rating Amps.	Switch/ MCCB Rating Amps	Type of Starter
1.	0 to 10 HP	16	63	DOL
2.	12.5 to 15 HP	25	63	Star/delta
3.	20 to 25 HP	32	63	"
4.	30 HP	32	100	"
5	40 to 45 HP	40	100	"
6.	50 to 60 HP	70	100	"

For capacitors, rating of contactors/ switch shall be double of rated current of capacitor.

For incoming feeder MCCB shall be provided unless otherwise stated in the feeder details.

For all motor feeders ON/OFF control is to be provided in MCC. At MCC for all motor feeders red indication light LED type to be provided for ON only.

Motor starters shall be suitable for AC 3 duty unless specified otherwise.

Every MCC shall be provided with an energy meter to record the total power consumption by the panel.

All incoming and outgoing feeders above 10 HP shall be provided with Ammeter.

All feeders of a section shall be provided with electrical inter-locking if required by the process flow. However, for test purpose, switch may be provided for defeating inter-locking.

c. MCC shall be provided with the following feeders:

- **Incoming feeder**

  MCCB of suitable rating to take care of full load of the effluent treatment plant including all motors and lighting.

  Three phase, 4 wire, electronic digital Energy meter suitable for full load.

  CT operated ammeter of suitable rating with selector switch.

  Voltmeter with selector switch protected through HRC fuses. Range 0 - 500 V.

LED type Indication lamps for 3 phases, protected through HRC fuses.

Necessary current transformers

- **Bus bar chamber with bus bars of suitable capacity**

- **Outgoing feeders**

The no. and capacity of each outgoing feeder to be decided by the bidder depending upon all electrical requirement of the complete effluent treatment plant. In addition to motor feeders, 1 no. 3 phase and neutral MCCB of suitable capacity to be provided for meeting the lighting requirement of ETP. One feeder with switch disconnector fuse unit and contactor of suitable capacity to be provided for power capacitor of effluent treatment plant to improve the power factor of MCC. In addition to this following spare outgoing feeders to be provided.

TPN switch disconnector fuse 25 A - 1 No.
(for general use)
TPN switch disconnector fuse 63 A - 1 No.
(for welding)

Each outgoing feeder shall have one indication lamp.

DRAWINGS OF MCC SHALL BE GOT APPROVED FROM PURCHASER BEFORE MANUFACTURING.

11.2.3 **Power Cables (LT)**

Power cables for use on 415 V system shall be of 1100 volt grade, Aluminium conductor, PVC insulated, PVC sheathed, armoured and overall PVC sheathed, strictly as per IS : 1554 (Part I) - 1976.

The size of these cables shall be as specified in approved erection drawings. **NO CABLE OF SIZE LESS THAN 4 SQ.MM SHALL BE USED**. FOR MOTOR UPTO 5 HP, COPPER CONDUCTOR CABLE AS PER ABOVE SPECIFICATION OF SIZE 2.5 SQ.MM TO BE USED.

11.2.4 **Control Cables**

Control cables for use on 415 V. system shall be of 1100 volts grade, copper conductor, PVC insulated, PVC sheathed, armoured and overall PVC sheathed, strictly as per IS : 1554 (Part I) - 1976.

The size of these cables shall be as specified in approved erection drawings. **THE MINIMUM CONDUCTOR DIAMETER SHALL BE 1.5 SQ MM.**

11.2.5 **Cable Trays**

These shall be channel type, fabricated from slotted MS. sheets (height to be minimum 50mm and thickness of plate to be min. 1.5mm upto 300mm cable tray width) hot dip galvanised, complete with all accessories such as bends, tees and reducers. Only Aluminium flat clamps with G.I./Chrome plated bolts-nuts/screws to be used for clamping cables. Sizes of these trays shall be as specified in approved erection drawings.

11.2.6 **Cable Glands**

Cable glands shall be of heavy duty, double compression type of brass, chrome plated. These shall have a screwed nipple with conduit electrical thread and checknut. These shall be suitable for armoured/unarmoured cables which is being used.

11.2.7 **Cable Connectors**

Cable connectors, lugs/sockets, shall be of Copper for copper conductor cable and of Aluminium for al. Conductor cable, suitably tinned, solderless, crimping type. These shall be suitable for the cable being connected and type of function (such as power, control or connection to instruments, etc.)

11.2.8 **Cable Route Markers**

These shall be of galvanised Cast Iron plate with marking (LT) diameter 150 mm, with 600 mm long 25x25 mm MS. angle riveted/bolted with the plate.

11.2.9 **Cable Indicators**

These shall be self-sticking type and of 2 mm thick lead strap for overall outer diameter of the cable. PVC identification numbers, ferrule shall be used for each wire.

11.2.10 **G.I. Pipes for Cables**

For laying of cables (armoured or unarmoured) under floor, G.I. class 'A' pipes shall be used. MS. conduits are not acceptable for this purpose. All accessories of pipes shall be threaded type. Size of pipe shall depend upon the overall outer diameter of cable to be drawn through pipe. **NO G.I. PIPE LESS THAN 40 MM DIA SHALL BE USED FOR THIS PURPOSE.** To determine the size of pipe, assume that 40% area of pipe shall be free after drawing of cable.

11.2.11 **ON/OFF Stations/Isolators/Remote Operation Stations**

These shall be robust construction having al. Cast housing and shall have IP 54/ 55 protection to make them weather proof. Sample of these to be got approved before use.

11.2.12 **Earthing Network**

i. 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 thereunder. The Contractor shall carrry out any changes desired by the electrical inspector or the Owner/OMFED in order to make the installation conform to 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.

ii. Earth Pit with Electrode

GI Plate 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:3043-1987 (code of practices for Earthing). For ready reference, sketches for plate type earth electrode earthing pit have been shown in the sketch attached. All earth electrodes shall preferably be driven to a sufficient depth to reach permanent moist soil.

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 centres of 2 earth pits.

iii. Earth Bus, Earthing Lead and Earth Wire/Strip

All electrical equipment is to be doubly earthed by connecting two earthstrip/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. Earth conductor size for connection to various equipment 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 galvanised. Spring washers shall be used for all earthing connections of equipment having vibrations.

Size of earthing lead/wire shall be as specified below/unless otherwise specified :

Control switches	PVC insulated, 2.5 Sq.mm copper conductor wire.
Motor upto 10 HP	PVC insulated, 10 Sq.mm Al. conductor wire.

Motor above 10 upto 125 HP	G.I. strip 25 x 3 mm
MCC	G.I. strip 25 x 6 mm

Copper wire/Al. wire shall be connected to the equipment by providing crimping type socket/lug.

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

11.2.13 **Laying of Cables**

While laying cable underground, it shall be 750 mm below ground level, sand bedding 75 mm thick shall be made below and above the cable. A layer of bricks shall be laid over the cable to completely cover it. Excavation for cable laying, supplying and laying of sand & bricks and refilling the earth etc. is in contractor's scope. Route markers shall also be used for cable.

For laying of cables above ground, GI pipe or cable trays shall be used.

11.2.14 **Lighting of MCC/Laboratory Room and plant units**

a. For this purpose one distribution board shall be supplied and installed. This DB shall be wall mounted, flush type, totally enclosed with hinged door, vermin & dust proof, made of 16 G MS sheets. For incoming to this DB a combination of MCB and earth leakage circuit breaker shall be used. Minimum rupturing capacity of MCB shall be 10 KA. For all outgoing feeders MCB, single phase shall be used. Load on each circuit shall not be more than 10 A for lighting and 20 A for power points. Only copper bus bars and interconnecting wire shall be used. There shall be 2 nos. MCB of 10 A spare in this DB. **Drawing of this distribution board shall be got approved before manufacturing.**

b. Lighting level in the building shall be minimum 150 Lux. Only light fittings similar to Philips TMC 55/136 HPF shall be used for all indoor lighting. Size of circuit wiring shall be 2.5 Sq.mm copper for lighting and 4 sqmm. Copper conductor for power points. Point wiring from lighting switch board to light point shall be of 2.5 sq.mm copper. All wires shall be PVC insulated, unsheathed, single core, FRLS (fire resistance low smoke), copper conductor (stranded), of 1100 V grid. A drawing showing the location of light fittings, control switch board etc. shall be furnished for approval.

c. All lighting distribution shall be done in concealed MS conduit system.

d. Area lighting for ETP plant area shall be done with weather-proof street lights with high pressure sodium vapour lamps. These light fittings can be installed on brackets on the walls of the building or on suitable street light poles. The location of such lighting fixtures to be shown in a drawing and

approval taken from purchaser. Power to these street light poles to be done from lighting DB through armoured aluminium conductors cables, laid under ground.

The power supply for this lighting shall be taken from the lighting distribution board in the MCC room.

11.2.15 **Power Capacitor**

Suitable size power capacitor shall be provided and connected by Armoured Al. conductor cable from MCC to improve power factor of the Effluent Treatment Plant. Power capacitor shall be suitable for 415 V, 3 phase 50 Hz. AC supply. These capacitors shall be installed on the wall adjacent to MCC.

SECTION IV 'B'

SCHEDULE OF REQUIREMENTS

CONTENTS

1.0 SCOPE OF CONTRACT

The tender is invited on turn key basis for the Construction of Effluent Treatment Plant (ETP) and Commissioning the same to give treated effluent quality as per Orissa State Pollution Control Board standards as well as those specified in the Guarantee Clause attached herewith and includes the following items which are within the scope of the contract. The drawings attached herewith are preliminary. The detailed working drawings shall be prepared by the Contractor and submitted to OMFED/Owner for approval. Structural drawings prepared and certified by a qualified registered structural engineer only shall be accepted. Work will be carried out as per final valid for construction drawings and instructions issued from time to time at site by engineer/owner.

1.1 Clearing the site/s from all vegetation, tree roots etc. All the civil works and structural steel fabrication works for the effluent treatment plant shall be carried out as per the detailed description of the civil works, generally as per hydraulic profile and schematic flow diagram enclosed. All the units shall be given plinth protection 0.60 m wide and shall be joined by 1.2 m pathway and steps as required, as per site conditions.

1.2 Internal electrification of the MCC, Operator room cum lab, if any as per the details, unit and general lighting of the ETP area.

1.3 Complete interconnecting piping between various units as per piping details given herewith including supply of all materials like pipes, fittings, valves, gaskets, flanges, nuts and bolts and all material required for necessary pipe supports and associated civil works, etc. complete.

1.4 Supply, erection, testing and commissioning of all the equipment required for the effluent treatment plant as per the individual equipment specification and general details given herewith.

1.5 All electrical works including electrical motors for the various equipment, cabling, Motor Control centre, starters, earthing conductors and earth pits etc. will be provided by the Contractor. The scope of work includes all necessary civil works like panel foundations, cable trenches, cable supports, unit lighting, etc. complete. Commissioning of all the equipment after the electricity is supplied shall be within the scope of contract.

1.6 Arrangement of all temporary sheds, office, godowns etc. required for storage of materials, equipment and for Contractor's supervisory personnel at site.

1.7 Approval & Consent from relevant authorities like State Pollution Control Board, Chief Electrical Inspectorate, all Statutory agencies etc. However, any statutory fees paid by the contractor shall be reimbursed against submission of documentary proof.

1.8 Operating & maintaining the plant for a period of one month after successful commissioning and guarantee test run for fulfilment of performance guarantees.

2.0 BASIC DATA

The primary purpose of this section is to provide basic data such as the wastewater quantity & quality, and the treatment plant scheme. The rationale behind the selection of treatment system is also presented. This section shall be read in conjunction with Section IVC and Tender drawings attached with the bidding document.

2.1 Effluent Quantity

The quantity of the combined effluent discharged from the plant is likely to be as indicated in the Table 1 of Section IV-C. This shall be taken as the design capacity of the Effluent Treatment Plant in cu.m. per day. The peak and hourly flow rate is also indicated in Table 1 of Section IV-C.

2.2 Characteristics of Effluent

The characteristics of raw effluent from the processing plant is presented in Table 1 of Section IV-C. The desired treated effluent characteristics which the Contractor shall guarantee are also specified in Table 2 of Section IV-C.

2.3 Treatment Plant - Brief description

On the basis of the characteristics of the combined effluent, location of the processing plant, the climatic factors for treatment and performance of similar treatment systems, the following treatment scheme is proposed:

The raw effluent generated at the plant shall be led from the last manhole at the proposed new ETP site by a gravity line to the inlet of the Effluent Treatment Plant. The combined effluent shall be passed through an piped line where on-line flow measurement would take place with flow meter /volumetric calculation of sump, as the effluent would flow further through the non-mechanised coarse & fine bar screen for removal of large floating impurities. After screening, the effluent shall get collected at collection tank & then pumped with SS submersible open impeller to a Fat removal unit for removal of floatable fatty material by mechanised belt scrapper mechanism, the tank will be provided with fine pore air grid at the bottom .The collected scum from the tank shall led to sludge drying bed by maintain self

cleaning velocity of a piped arrangement till upto SDB. From this unit, the effluent would be led to the inlet of one homozoniser tank with rapid mixing arrangements of the influent with fixed surface mixer; with coagulant & neutraliser chemical dosing, the Effluent in the homozoniser tank shall be agitated by rapid mixer continuously only to the extent that it keeps the organic impurities in suspension. And then passed to the inlet of the anaerobic digester based on the Upflow Anaerobic Sludge Blanket (UASB) process or its improved version. The effluent shall be uniformly distributed at the digester bottom by using appropriate mechanism. The methane gas generated from the digester shall be led to the flare stack through a gas holder, with a provision of a tapping for future usage. The outlet from the tank to be collected to one fill-and-draw type tank provided for balancing the hydraulic. After partial stabilisation of the organic matter in the anaerobic system through microbial action, the effluent shall flow to the splitter box at the inlet of the aeration tank. The box has been provided for recirculation of 20 % of the effluent quantity to the Raw collection tank & then through the homoniser tanks to UASB tanks. Therefore, the raw effluent pumps have been designed to cater to this quantity as well. The average design flow would be led from the splitter box by overflow weir into the aeration tank (extended aeration type) where it shall undergo aerobic biological treatment with addition of pro-biotic products resulting in stabilisation of the residual organic matter. The mixed liquor from the aeration tank shall be taken to the tube settler clarifier for the settlement of the sludge solids, which shall be recirculated to the inlet of the aeration tank to maintain the MLSS in the aeration tank. The clear supernatent (treated effluent) from the clarifier shall flow through a V-notch chamber for manual flow measurement and there from to a fixed surface aerator fitted aerobic digester & to a collection tank led for disposal to the soil & a pumping arrangement is made with multimedia filtration system for effluent reuse. The Owner shall make further arrangements for final disposal/reuse within the dairy premises for horticulture/fodder farm. The effluent at the outlet of the V-notch chamber shall conform to the treated effluent characteristics specified in the tender. The system shall treat the effluent to the extent suitable for disposal with PH, O& G ,TSS, BOD and other relevant parameters as per Orissa State Pollution Control Board.

Excess sludge from the UASB digester shall be withdrawn periodically for sampling/disposal through the sludge pump to be provided inside the tank with minimum level control, the position of the pump at different levels in the digester. Sludge for disposal shall be taken under hydrostatic pressure to the sludge drying beds. Excess sludge from the aerobic treatment shall also be conveyed from the Clarifier under hydrostatic pressure to the drying beds. Dried sludge from the beds shall be carted off for land filling / fertiliser. The sludge liquor from the beds shall flow under gravity to collection tank.

3.0 UNITS AND EQUIPMENT

A summary of the various units and equipment required is presented in Tables 3 of Section IV-C.

3.1 Civil Work

The various units required for the proposed effluent treatment plant with the description of civil work and type of treatment required are as described hereunder:

3.1.1 Inlet channel & Screen Chamber

An inlet channel as well as the attached screen chamber with bar racks (coarse & fine screens) shall be constructed in RCC M20 with a support system for coarse & fine screens and comprising of a perforated slab to drain effluent from the screenings. The channel shall be suitable for installation of flow measuring unit as specified. The screen chamber in turn, shall be attached to the inlet side of the Fat & grease removal unit provided also in RCC M20. While the inlet channel would be covered by pre-cast blocks, except in the flow meter portion, a 1 m high standard handrail in 32 mm dia. MS "B" class pipes, synthetic enamel painted shall be provided all around the outer walls of the screen chamber. For this, necessary cut-outs, insert plates etc. shall be provided. CI steps of minimum weight 2.5 Kg each at 300 mm c/c spacing shall be provided so as to reach the perforated slab to clean off the dried screenings.

100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides. All internal surfaces will be provided with 20 mm thick smooth cement plaster in CM 1:3 with waterproofing compound. All external surfaces upto 300 mm below ground level shall be plastered with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make and shade. Plinth protection 600 mm wide shall be provided all around the unit.

3.1.2 Fat Removal unit Unit with coagulant and flocculent polyectrolyte

The Fat Removal unit shall be constructed in RCC M20. It shall be provided with necessary baffles at the inlet and outlet ends, a side trough 200 mm wide along the length for carrying the motorised belt/chain scrapper mechanism to skim floatable solids into a collection launder of clear width 300 mm X 300 mm height with bottom to match out let pipe fitted on it for disposal of scum to SDB. A suitable arrangement shall be provided for the removal of the collected fatty material for disposal from SDB. The collection chamber shall be attached to the unit with pumping arrangement for transfer of effluents to fat & oil removal unit. The tank will

have the Air grid at the bottom of the tank to disperse the maximum floatable material from the effluent.

A 1 m high standard handrail in 32mm dia. MS "B" class pipes, synthetic enamel painted shall be provided all around outer walls of the units. For this, necessary cutouts, insert bolts etc. shall be provided. @ 300 mm c/c in staggered manner shall be provided along the inner wall of the tank at a suitable location. The mechanised scrapper shall have the provision of covers to avoid rain damage.

100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides. All internal surfaces will be provided with 20 mm thick smooth cement plaster in CM 1:3 with waterproofing compound. All external surfaces upto 300 mm below ground level shall be plastered with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make and shade. Plinth protection 600 mm wide shall be provided all around the unit as per the SBL of the area.

3.1.3 Homozoniser tank UASB with Fill & Draw Tank .

The one homozoniser tank shall be provided in RCC M20 con-struction adjacent to each other with a common wall. 100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides. The tanks shall have a flow control arrangement at the inlet side for provision of inlet valves. The floor of homozoniser tank shall have a nominal slope towards the UASB digester drain sump in the base raft. The tank shall be provided with motorised mixer with base support arm & pipe inserts with puddle flanges at effluent inlet/ outlet points uniformly finished. A 1 m high standard handrail in 32mm dia. MS "B" class pipes, synthetic enamel painted shall be provided all around outer walls of the units. For this, necessary cutouts, insert bolts etc. shall be provided. @ 300 mm c/c in staggered manner shall be provided along the inner wall of the tank at a suitable location.

All internal surfaces of the unit shall be provided with 20 mm thick smooth cement plaster in CM 1:3 with water proofing compound. All external surfaces upto 300 mm below finished ground level shall be finished with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make & shade. Plinth protection 600 mm wide shall be provided all around the unit. The one UASB tank shall be provided in RCC M20 construction adjacent to each other with a common wall. 100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides. The out let from the tank will have the provision of launders on its circle around and then water will be colleted at fill & draw tank. The UASB tank will have the arrangements for gas disposal and cover from the top. The UASB will also be provided with sludge dewatering pump of SS with open impeller oil filled submersible type. This will complete the anaerobic digestion process of the effluents .

3.1.4 Effluent Transfer pump

The effluent transfer pump shall be provided of size as required for installing the equalised effluent pumps near the bottom side of the equalisation Tanks. The pump pad shall be constructed in RCC M 20 with necessary excavation, PCC 1:3:6 base 100 mm thick extending on all the sides etc. The effluent transfer pump will be of SS with open impeller oil filled submersible type. This will have the piping arrangement for transfer of semi treated effluent from UASB overflow collection tank to the aerobic digestion tank along with 20% excess for recirculation back to the collection tank..

3.1.5 MCC, Operator room cum Lab

The MCC, Operator room cum Lab shall include the MCC located in the room, with a working space for the operator and a suitable platform with acid resistant top for testing of effluent samples. The room shall be provided with internal lighting, ceiling fan arrangement etc. complete. The room shall be constructed with RCC M20 framed structure with reinforcement, necessary excavation, columns with spread footings, plinth beam, 50mm thick, DPC, walls in 250mm thick brick work in CM 1:6, necessary RCC M20 lintels and chajjas, floor beams, slab with roof beams at 4m height from the plinth level. The plinth height shall be 450mm above the surrounding finished ground level.

The entire flooring of the MCC, Operator room cum lab shall be with good earth filling 300mm with anti termite treatment, PCC 1:3:6 100mm thick, finished with 50mm thick IPS laid in alternate panels with PVC strips 3mm thick.

The structure shall be provided with suitable pressed steel frame for doors, windows and ventilators. Windows shall be provided with standard steel section shutters with plain glass of 4mm thick. Doors shall be of commercial type flush shutter minimum 35mm thick. Doors, windows and ventilators shall be provided with approved brass oxidised fittings. The door frame shall be of pressed steel section 125mm x 65mm x 1.25mm thick and window frame of pressed steel section 100mm x 60mm x 1.25mm thick.

The top of the roof slab of the structure shall be given waterproofing treatment with brick bat coba 115mm thick as per tender specifications. A brick masonry parapet wall 450mm high and 230mm thick in CM 1:6 shall be provided all along the external walls. Suitable rain water drainage arrangement through rain water pipes of 100mm dia. GI class ‘B’, leading to the ground level with shoe shall be provided. Necessary RCC M20 weather shed shall be provided to all the doors and windows.

All internal RCC and masonry work shall be finished with plain smooth cement plaster 2mm thick in CM 1:4 with lime neeru finish, and external surfaces with sandface plaster 19mm thick in CM 1:4 as directed. The room shall be painted externally with cement paint of approved make and

shade and internally with white wash. All the doors and windows shall be painted with synthetic enamel paint of approved make and shade two coats, over a coat of suitable primer. Plinth protection 600mm wide shall be provided all around the room. Necessary trenches / pedestal shall be provided for mounting the MCC with MS angle nosing and 6mm thick MS chequered plate cover.

3.1.6 **UASB digester with anaerobic bacteria's**

The digester shall be constructed in RCC M20, 100 mm thick PCC 1:3:6 shall be provided below base raft extending 100mm on all the sides. It shall include a standard, peripherial approach ladder in MS and a cantilever RCC M20 inspection platform all around the unit at the wall top level. A standard 1m high handrail in 32mm dia MS class 'B' pipe shall be provided along the outer periphery of the platform, and along the periphery of the digester top. The tank shall be provided with inlet line extending to the tank bottom with suitable type and number of diffusers to evenly distribute the effluent to attain an appropriate design velocity. It shall be provided with the Settler arrangement for the three-phase separation with suitable corrosion resistance treatment on inside as per tender specification for metallic parts. An outlet weir in RCC M20 shall be constructed along with an additional baffle in MSEP/RCC construction to collect the partly treated effluent but to prevent the carry-over of any flocculant sludge coming with the liquid. The effluent outlet line shall be provided with a 'U' shaped water seal arrangement. The gas collection system shall include the header.
Necessary arrangement for access into the digester shall be included in the form of removable Settler or a side manhole at least 1000mm dia. In either case, bolted rungs @ 300mm c/c in staggered manner shall be provided along the inner wall of the tank at a suitable location. At minimum three intermediate locations along the height of the digester, sludge outlets connected to a common sludge line for sampling/excess sludge disposal to the drying beds shall be provided. Pipe inserts with puddle flange shall be provided at all effluent/sludge inlet and outlet points. The base of the digester shall be finished with 40mm thick IPS with water proofing compound. All internal surfaces shall be plastered with 20mm thick smooth cement plaster in CM 1:3 with water proofing compound. External exposed surfaces upto 300mm below finished ground level shall be plastered with 12mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make and shade. Plinth protection 600mm wide shall be provided all around the unit the unit to be constructed as per the SBL of the area..

3.1.7 Fill & Draw Tank

All internal surfaces of the unit shall be provided with 20 mm thick smooth cement plaster in CM 1:3 with water proofing compound. All external surfaces upto 300 mm below finished ground level shall be finished with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of

approved make & shade. Plinth protection 600 mm wide shall be provided all around the unit. The tank shall be provided in RCC M20 construction adjacent to each other with a common wall to the UASB digester . 100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides.

3.1.7 **Flare stack**

If desired for gas utilisation after study of the gas potential at the outlet of the UASB digestor.

3.1.8 Primary Aeration Tank (with splitter box & addition of pro-biotic products)

The splitter box and aeration tank shall be constructed in RCC M20. The splitter box shall be attached to the aeration tank at the inlet side located just above the inlet channel. The splitter box shall have three compartments. The central compartment for receiving the effluent, and the two side compartments with suitable width over flow weirs so as to split the flow in the proportion of 1:5. The lesser flow shall be returned to the collection tank while the higher quantity shall flow in the inlet channel of the aeration tank.

The aeration tank shall be provided with 100 mm thick PCC 1:3:6 below base raft extending 100 mm on all the sides. It shall include a standard MS approach ladder and a concrete walkway slab at a level depending upon the minimum freeboard requirement for the aeration equipment supplied. The tank will have the extended aeration system with fine pore PVC tubular diffused material for air grid and the supply of the air from air blower.

A standard 1m high handrail in 32 mm MS ‘B’ class pipe shall be provided along both sides of the ladder and on sides of the inspection/working platform, with necessary cutouts, insert plates etc. complete.

The tank shall be provided with pipe inserts & puddle flanges at effluent inlet/outlet points, uniformly finished & plastered rectangular chamfered overflow weirs at inlet and outlet, baffle arrangement etc. complete. Bolt rungs @ 300 mm c/c in staggered manner shall be provided along the inner wall of the tank at a suitable location.

All internal surfaces shall be plastered with 20 mm thick smooth cement plaster in CM 1:3 with water proofing compound. The floor shall be provided a gradual slope towards the drain line located at a corner of the tank. While all external exposed surfaces upto 300 mm below finished ground level shall be plastered with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make and shade. Plinth protection 600mm wide shall be provided all around the unit.

3.1.9 Clarifier

The tube settler clarifier shall be constructed in RCC M20, 100mm thick PCC 1:3:6 shall be provided below base rack 100mm on all the sides and HDPE tubes with sludge transfer pump of SS oil cooled open impeller type . It shall include a standard MS approach ladder, an RCC M20 inspection platform at the wall top level, with a standard 1m high handrail in 32mm dia MS 'B' class pipe along both sides of the ladder and on sides of the platform, with necessary cut outs, inserts plates etc. complete. The tank shall be provided with pipe inserts & puddle flanges at effluent/sludge inlet/outlet points, uniformly finished & plastered rectangular chamfered overflow weirs and baffle arrangement. The base of the tank shall be provided with IPS floor having a slope of 1 in 12 towards the central sludge pocket. All internal surfaces shall be plastered with 20mm thick smooth cement plaster in CM 1:3 with water proofing compound. While all external exposed surfaces upto 300mm below finished ground level shall be plastered with 12mm thick smooth plaster in CM 1:4 and provided with cement paint of approved made and shade. Plinth protection 600mm wide shall be provided all around the unit.

3.1.10 Sludge recirculation pump & dosing pad

The sludge recirculation pump pad shall be provided of size as required for installing the sludge recirculation pumps. The pump pad shall be constructed in RCC M20 with necessary excavation, PCC 1:3:6 sub-base 100 mm etc. complete. Anchor bolts, shall be provided as per the requirement of pumps supplied. The top surface of the dosing pad shall be provided 60mm PCC 1:1.5:3 self finished smooth, after installation of the pumps.

3.1.11 FILTERPRESS & FILTER ROOM

The CGI Surface roofing with structure as mention in technical sheet for the sizes with CGI sheet roofing and MS roof supporting structure, Periphery walling with brick machinery 10" of 4 ft height from floor and then MS weir netted covering around of size having opening Door and windows etc. One drain channel on Filter press and theFilter. All internal surfaces shall be provided with 20mm thick smooth cement plaster in CM 1:4 and external surfaces upto 300mm below finished ground level with smooth plaster 12mm thick in CM 1:4 and provided with cement paint of approved make & shade. Plinth protection 600mm wide shall be provided all around the unit.

3.1.12 Secondary Aeration Tank (with splitter box)

The splitter box and aeration tank shall be constructed in RCC M20. The splitter box shall be attached to the aeration tank at the inlet side located just above the inlet channel. The splitter box shall have three compartments. The central compartment for receiving the effluent, and the two side compartments with suitable width over flow weirs so as to split the flow in the proportion of 1:5. The lesser flow shall be returned to the equalisation tank while the higher quantity shall flow in the inlet channel of the aeration tank.

The aeration tank shall be provided with 100 mm thick PCC 1:3:6 below base raft extending 100 mm on all the sides. It shall include a standard MS approach ladder and a concrete walkway slab at a level depending upon the minimum freeboard requirement for the aeration equipment supplied.
A standard 1m high handrail in 32 mm MS 'B' class pipe shall be provided along both sides of the ladder and on sides of the inspection/working platform, with necessary cutouts, insert plates etc. complete. The Base frame shall befitted to the top of the tank with reduction gear motor and fixed surface aerator.
The tank shall be provided with pipe inserts & puddle flanges at effluent inlet/outlet points, uniformly finished & plastered rectangular chamfered overflow weirs at inlet and outlet, baffle arrangement etc. complete. CI rungs of minimum weight 2.5 Kg each @ 300 mm c/c in staggered manner shall be provided along the inner wall of the tank at a suitable location.
All internal surfaces shall be plastered with 20 mm thick smooth cement plaster in CM 1:3 with water proofing compound. The floor shall be provided a gradual slope towards the drain line located at a corner of the tank. While all external exposed surfaces upto 300 mm below finished ground level shall be plastered with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make and shade. Plinth protection 600mm wide shall be provided all around the unit
.

3.1.13 Treated Effluent Collection Tank

The Treated Effluent Collection Tank shall be provided in RCC M20 construction. 100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides. The floor of Treated Effluent Collection Tank shall have a nominal slope towards the drain sump in the base raft. The tank shall be provided with pipe inserts with puddle flanges at effluent inlet/ outlet points uniformly finished.

A 1m high standard handrail in 32 mm dia. MS "B" class pipe, synthetic enamel painted shall be provided all around the outer walls of the tank. For this, necessary cutouts, insert plates etc. shall be provided. The Treated Effluent Collection Tank shall be provided with necessary pipe inserts & puddle flanges for the inlet/outlet pipes. CI rungs of 2.5 (minimum weight) Kg. each @ 300 mm c/c in staggered manner shall be provided along the inner wall of the tank at a suitable location.

All internal surfaces of the unit shall be provided with 20 mm thick smooth cement plaster in CM 1:3 with water proofing compound. All external surfaces upto 300 mm below finished ground level shall be finished with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make & shade. Plinth protection 600 mm wide shall be provided all around the unit.

3.1.14 V-Notch chamber

A V-Notch chamber shall be provided in RCC M20 construction, 100 mm thick PCC 1:3:6 shall be provided below base raft extending 100 mm on all the sides, with internal partition as required, calibrated MS epoxy

painter graduated weir plate properly grouted in the side walls of the unit, pipe inserts etc. complete. All internal surfaces shall be plastered with 20 mm thick smooth cement plaster in CM 1:3 with water proofing compound. While all external exposed surfaces upto 300 mm below finished ground level shall be plastered with 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make & shade. Plinth protection 600mm wide shall be provided all around the unit.

3.1.15 Final Treated Effluent Disposal Pump

The Final Treated Effluent Disposal Pump Pad shall be provided of size as required for installing the Final Treated Effluent Disposal Pump. The pump pad shall be constructed in RCC M20 with necessary excavation, PCC 1:3:6 sub-base 100 mm etc. complete. Anchor bolts, shall be provided as per the requirement of pumps supplied. The external surface except top of the pump pad upto 300 mm below finished ground level shall be finished in 12 mm thick smooth plaster in CM 1:4 and provided with cement paint of approved make & shade. The top surface of the pad shall be provided 60mm PCC 1:1.5:3 self finished smooth, after installation of the pumps.

3.1.17 Tertiary Treatment

One MMF (Multi Media Filter) in CPA (Composite Poly Amide) Pressure vessel, size 36" x 72" of 10 kg/ cm2 as DP (design pressure) with base frame, PVC frontal Pipe Work, White Multi port valve (imported).The filter shall be placed under roof and protected from outside mis-handling. The room structure shall be provided with suitable pressed steel frame for doors, windows and ventilators. Windows shall be provided with standard steel section shutters with plain glass of 4mm thick. Doors shall be of commercial type flush shutter minimum 35mm thick. Doors, windows and ventilators shall be provided with approved brass oxidised fittings. The door frame shall be of pressed steel section 125mm x 65mm x 1.25mm thick and window frame of pressed steel section 100mm x 60mm x 1.25mm thick.

3.1.18 Internal Electrification of MCP cum operator Room

Lighting of MCP room shall consist of following: (i) Supply, fixing, wiring and commissioning of approved make of Distribution board with suitable DP incomer and enough number of SP outgoing MCB's. MCC room : 2 Nos. Light points suitable for 1x40 W TLD lamps. 2 no. 1400 mm ceiling fan with electronic regulator 1 No. 5A plug point 1 15 A Power point with plug & socket 1 No. Light point suitable for 100 W incandescent lamp Bulk head fittings. 2 No. No. Exhaust fan 450mm,1400 RPM size, point wiring. 6 Nos.Street light poles made from GI heavy gauge pipes, 12 ft.high with foundations,junction boxes etc. complete Supply, installation & commissioning with necessary wiring, of following fixtures is in the scope of the contractor for internal electrification work. Decorative type Tube light fittings (with tube) of approved make - 2 Nos. Bulk-head fittings approved make - 1 No. Exhaust fan 450 mm, 1400 RPM approved make - 2 Nos. Ceiling fans 1400mm - 2 nos. Street Light Fitting equivalent to Phillips HRC 125 LPF with accessories. The work includes complete point and circuit wiring in concealed MS conduits, MS boxes, hylem sheets covers, piano switches, insulated stranded FRLS copper wires (2.5

Sqmm for points and earthing, 4 Sqmm for circuit & 4 Sqmm for power point wiring), check nuts etc. as per the instructions of the Engineer/ Owner.(The work shall be done in accordance with detailed specifications of Electrical works as per Technical Specifications) in Section IV 'A'.

3.2 Piping work

The piping work covered under this contract is the complete interconnecting piping for the effluent treatment plant between various units. The piping shall be provided as per Piping schedule given in Table 5 of Section IV C. The piping will be generally underground with MSEP for surface runs and UPVC for all wetted parts.

3.2.1 Last Manhole to Inlet Channel and Channel to Screen Chamber

The pipeline from the last manhole at the ETP site to the Inlet channel will be laid below and / or above the ground. Necessary pipe fittings, specials, flanges etc. shall also be provided. The length of this line in the Contractor's scope shall be limited to 100 m. (with suitable brick masonry chamber at all change of direction) or as instructed by engineer as per specification given under technical specifications Section IV A. The inlet piping channel shall directly terminate at the inlet end of the Screen Chamber. Since the inlet channel shall be attached to the Screen Chamber, the effluent after flow measurement and passing through the pipeline shall flow directly into the unit.

3.2.2 Screen & Collection chamber to Fat & Grease removal unit

Since the Screen chamber shall be attached to the Fat removal unit, the effluent after passing through the screens shall have pumping arrangement piping directly into the unit.

3.2.3 Fat removal unit to Homozoniser tanks The pipeline from fat removal unit to the homozoniser tanks shall be provided. The line as one outlet shall be taken to a valve chamber, shall be provided with a PP ball valve before entering the respective equalisation tanks. The valves shall be located in an attached brick masonry valve chamber as per specifications. One PVC pipeline of minimum 6kg/cm2 sud be provided of adequate capacity to discharge all the scum collated from the tank to the SDB.

3.2.4 Homozoniser tanks to Equalised effluent pumps (Discharge)

The pipeline from the suction pocket located at bottom of the fill & draw tank upto the aerobic tank effluent pump discharge nozzle shall be provided with coupler connections. The pipeline from each tank shall be provided with a valve before it joins the suction header. The vertical portion of the line located in the tanks shall be provided plumb & with industrial grade clamps firmly fixed to the wall.

3.2.5 Equalised effluent pumps to UASB unit / bye pass line

The pipeline from pump nozzle onwards upto delivery header and delivery header to the bottom of the UASB unit and the bypass lines shall be provided. Each branch from the pump delivery nozzle upto delivery header shall be provided with necessary concentric reducer, PP swing type non return valve, PP ball valve etc. Before entering the UASB unit, the line shall branch out towards the V notch chamber as a bypass line. This branch shall be further split into the two lines one with a valve to the Splitter box at the inlet end of the aeration tank, and another with a valve shall be taken to the V notch with necessary valves located in brick masonry valve chamber as per specification.

3.2.6 UASB digester to Splitter box at the Aeration tank

The effluent outlet pipe from the UASB unit shall be provided with a water seal arrangement before the line goes to the Splitter box at the aeration tank inlet launder. A branch from the line shall be connected to the bypass line through a tee joint and a reducer, if necessary. Both the main & branch line shall be provided with a valve. Necessary pipe fittings, specials, flanges etc. shall also be provided.

3.2.7 UASB digester to Sludge drying beds

Each of the sludge lines provided to withdraw sludge from the digester of levels when necessary for sampling or disposal, shall be equipped with a valve and shall be combined and taken upto the inlet of the feed channel of the sludge drying beds. Before being led to the beds, a branch shall be provided near the digester for sampling, with a suitable sampling valve. Necessary pipe fittings, specials, flanges etc. shall also be provided.

3.2.8 **Gas Exhaust piping,**

The gas outlet pipe from the UASB digester shall be provided with safety provisions like pressure relief valve, moisture trap, etc. complete.

3.2.9 Aeration tank to Clarifier & Aeration tank to Equalisation Tank

The outlet pipe from the aeration tank to the inlet feed well of the clarifier shall be provided. Necessary pipe fittings, specials, flanges etc. shall also be provided. A line located at the bottom of the Aeration tank shall be provided with a drain valve and led to one of the equalisation tanks. Necessary pipe fittings, specials, flanges etc. shall also be provided

3.2.10 Sludge outlet from Clarifier to Sludge Holding Tank with Sludge recirculation pumps.

The sludge line from sludge pocket of the Clarifier to the inlet of the feed channel of the Sludge holding tank shall be provided. Before being led to the filterpress, it shall branch out to the suction header of the Sludge recirculation pumps. Each branch shall be provided with a PP ball valve. The suction pipe network for the pumps shall comprise of the pipeline from the suction header to the pump suction. The header shall branch out to individual pump suction nozzle and each branch shall in turn be provided with necessary concentric reducer and a valve to enable interchange ability of pumps.

3.2.11 Sludge recirculation pumps to Aeration tanks

The pipeline from pump nozzle onwards upto delivery header and delivery header to the inlet end of the Aeration tanks and the feed channel of sludge drying bed shall be provided. The lines shall be so laid as to enable recirculation of sludge from Clarifier to Aeration Tank. Each branch from the pump delivery nozzle upto delivery header shall be provided with necessary concentric reducer, PP swing type non-return valve, PP ball valve etc. The discharge line from the delivery header shall lead to the inlet of the Aeration tank as a sludge line.

3.2.12 Sludge tank to collection tank

The sludge tank liquor line from the sludge liquor chambers shall be laid from the last chamber to one of the collection tanks. Necessary pipe fittings, specials, flanges etc. shall also be provided. **3.2.13 V Notch Chamber to final disposal/reuse** The line from the outlet of the V Notch chamber to the final disposal/reuse shall be provided with necessary pipe fittings, specials, flanges etc.

NB:- All necessary piping of the specs as required for plant commissioning and smooth running of the system included.

3.2.13 Last Manhole to Inlet Channel and Channel to Screen Chamber

The pipeline from the last manhole at the ETP site to the Inlet channel will be laid below and / or above the ground. Necessary pipe fittings, specials, flanges etc. shall also be provided. The length of this line in the Contractor's scope shall be limited to 130 m. (with suitable brick masonry chamber at all change of direction) or as instructed by engineer as per specification given under technical specifications Section IV A. The inlet channel shall directly terminate at the inlet end of the Screen Chamber.

Since the inlet channel shall be attached to the Screen Chamber, the effluent after flow measurement and passing through the channel shall flow directly into the unit. Hence no separate line is envisaged

3.2 Details of equipment and their data sheets

3.3.1 Piped /Channel Flow measuring Unit

Duty	To measure online, the flow of raw effluent through the inlet channel. Calculate and display the instantaneous flowrate, as well as integrated flow of effluent in cu.m.
Type	Piped channel flow meter with sensor mounted on a pedestal to measure the depth of flow, velocity & calculate by Area velocity method the flow rate in cu.m/hr
No. of units required	One No.
Calibration and parameters	Preferably, As per manufacturer's specifications.
Make	Eureka/Adwin Instruments or equivalent approved make
Location of installation	At inlet of the ETP over the inlet channel provided preceding the Screen chamber

Accessories to be supplied with the flow meter

a) Support system for the sensor
b) GI weather protection hood

Note :

All metallic parts of the mechanism/supports not powder coated or finished otherwise shall be painted with a coat of Zinc rich primer followed by two coats of enamel paint for corrosion resistance.

Contractor shall make all necessary provisions for mounting the meter at the inlet channel in a manner that does not obstruct movement for inspection

3.3.2 Bar Screens (Coarse & Fine)

Duty	To remove floating solids & prevent them from choking piping components, specials, clogging pump impellers & abrasion to equipment
Type	Bar rack fabricated from MS bars to cover the width of the screen chamber. Each bar shall be 10 mm wide and 50 mm deep arranged with a clear spacing of 20 mm between bars. Over the bar rack, a

	removable SS mesh fixed in SS angle frame with SS stiffeners/flats shall be placed
- Angle of inclination	45 degrees with the horizontal
- No. of units required	One No.

Accessories to be supplied with the screens

c) Support system comprising of a perforated concrete slab to drain effluent from the screenings.

Note:

All metallic parts of the mechanism shall be sand blasted and painted with a coat of Zinc rich primer followed by two coats of epoxy paint for corrosion resistance.

Contractor shall make all necessary provisions for mounting the bar rack in the civil work.

3.3.Homozonised effluent Pumps

- Duty	To mix raw effluent from collection tanks to UASB digester in normal operation, and to Aeration tank /V notch chamber during bypass .
- Driving method	Directly coupled
- Driving machine	Electric motor, TEFC, IP55,Class B Industrial squirrel cage induction type, suitable for 230 V, 50 Hz. A/C supply
- Type	SS Vertical, centrifugal, non-clog open impeller type, self priming pump
- Material of construction	SS
- Capacity	Impeller Dia. ; Ø750 mm Impeller Type ; Axial No. of impellers. ; 01 nos. Impeller speed ; 40 RPM Shaft dia. at Brg. ; Ø 45 mm Shaft Length ; 2350 mm Power ; 1.0 HP, 4 pole, CGL/BBL make Gear Box ; Worm/Helical Type, Bonfiglioli make M.O.C ; SS 304
- No. of units required	2 Nos. (1 working, 1 standby)

3.3.4 Diffused Air Blower for Primary Aeration Tank

- Duty	To agitate the tank contents, only sufficient enough to keep the solids in suspension and thus to prevent septicity of the effluent in the equalisation tank .
- Driving method	Coupled through a reduction gear box (Horizontal mounting) Compact sturdy design for 24 hrs of running. Computer calculated Profile, the profile is such that it creates least pulsation and smooth flow.All rotating parts like Rotor/ Impeller, pulleys are dynamically balanced Piston rings are used to reduced air leakage through the shaft opening in the side plate. Higher casting thickness results in longer life of the machine as well as good sound damping capability and low noise level. Leg in casing allows less vibration.
- Driving machine	Electric motor, TEFC, IP55,Class B Industrial squirrel cage induction type, suitable for 415 V, 50 Hz. A/C supply
- Type	SS Vertical, centrifugal, non-clog open impeller type, self priming pump
- Material of construction	SS
- Capacity	Using SGI casting grade 500/7 for better strength and higher toughness. Normally other manufacturer uses either FG260 / SGI 400/18 Air by pass hole is provided to vent out the excess air which tend to enter in the oil chamber and pressured it, which prevent oil leakage. Bigger oil sumps gives excellent lubrication. Less diameter of rotor allows to go for higher RPM, lower torque level for rotation and lower geometric C.G. of machine, Which in turn creates less vibration and more smooth sound at higher RPM and creates less pulsation.
- No. of units required	5 HP 2 Nos. (1 working, 1 standby)

a. Support system for mechanism.
b. Necessary anchor bolts, base frame anchorage etc.
Note

All metallic parts of mechanism and support shall be sand blasted and painted with one coat of Zinc rich primer followed by two coats of epoxy paint for corrosion resistance.

Contractor shall make all necessary provisions for mounting the Blower in position including Base frame and platform MSEP on civil work portion etc. complete.

3.3. 5 Settler mechanism for UASB digester

Duty	To enable separation of the three phases : liquid effluent, gas and sludge solids, suitable to fit into digester 7.2 m dia and 5.0 m liquid depth.
Type	Suitably supported in the digester/fixed with the digester/ removable with gas dome/s or cone/s, gas piping, effluent channels and weir plates etc. complete. Supplier to specify details.
Material of construction	Mild steel epoxy painted
No. of unit required	One set

NOTE:

1. All metallic parts of mechanism and support shall be sand blasted and painted with one coat of zinc rich primer followed by two coats of epoxy paint for corrosion resistance.
2. Vendors shall make all necessary provisions for mounting the settler on the civil work portion including walkway with handrails.

3.3.6 Fixed surface slow speed Agitator for aeration tank

- Duty	To supply 1.15 to 1.2 kg of oxygen/ hr. per connected HP at standard conditions i.e. tap water at 20 deg. C and 0.0 mg/l oxygen concentration. The surface aerator is to be installed in the Aeration Tank
- Driving method	Coupled through a reduction gear box (vertical mounting)
- Driving machine	Electric motor, TEFC, IP55, Class B insulation, industrial squirrel cage induction type, suitable for

	415 V 50 Hz. A/C supply
- Type	Floating low speed agitator with buoys
- Material of construction	Mild steel epoxy painted
- No. of units required	Two Nos (one for each tank).
- RPM of agitator	60 –90
- Motor HP, each	12.5 HP

3.3.3 (I) Homozoniser effluent Mixture

- Duty	To supply 1.15 to 1.2 kg of oxygen/ hr. per connected HP at standard conditions i.e. tap water at 20 deg. C and 0.0 mg/l oxygen concentration. The surface aerator is to be installed in the Aeration Tank
- Driving method	Coupled through a reduction gear box (vertical mounting)
- Driving machine	Electric motor, TEFC, IP55, Class B insulation, industrial squirrel cage induction type, suitable for 415 V 50 Hz. A/C supply
- Type	Floating low speed agitator with buoys
- Material of construction	Mild steel epoxy painted
- No. of units required	Two Nos (one for each tank).
- RPM of agitator	60 –90
- Motor HP, each	12.5 HP

Accessories to be supplied with floating agitator :

a) Support system for mechanism.
b) Necessary anchor hooks & tie-ropes for anchorage.
c) Leak-proof buoys.
d) Submersible cable

Note:

2. All metallic parts of mechanism and support shall be sand blasted and painted with one coat of Zinc rich primer followed by two coats of epoxy paint for corrosion resistance.

3. Contractor shall make all necessary provisions for mounting the agitator in position including min. 12 mm dia.PP/Nylon mooring rope, anchorage hooks in civil work portion etc. complete.

4. Motor shall be provided with GI sheet 20 gauge thick covers for protection from rain and dust.

5. Submersible cable with copper conductor shall be used for connecting to the floating aerator from the isolator.

3.3.7 Sludge recirculation Pumps

- Duty	To transfer sludge from the Settling tank to the inlet of the Aeration Tank under normal operation
- Driving method	Directly coupled
- Driving machine	Electric motor, TEFC, IP 55, Class B insulation, industrial squirrel cage induction type, suitable for 415 V, 50 Hz. A/C supply
- Type	Sludge Transfer pump at Clarifier Capacity 15m3/ hr at 12 mtr Head Type- Submmersible MOC- SS, Solid Handling up to 40mm single phase automatic run with float attachment
Material of construction	SS
- Capacity	15 cu.m/hr, 6-8 m WC total head
- No. of units required	2 Nos. (1 working, 1 standby)

Accessories to be supplied with each pump :

- Pressure gauge
- Flexible coupling with guard
- Gauge cock

Note:

1. Contractor shall make all necessary provisions for mounting the pumps in civil work portion of the pump pad including fixation of base plate and anchor bolts.
2. Drive coupling shall be provided with a guard and motor shall be provided with GI sheet 20 gauge thick covers for protection from rain and dust.

3.3.8 Final Treated Effluent Disposal Pump

- Duty	To transfer treated effluent from Final effluent collection tank.
- Driving method	Directly coupled through a flexible coupling
- Driving machine	Electric motor, TEFC, IP 55, Class B insulation, industrial squirrel cage induction type, suitable for 415 V, 50 Hz. A/C supply
- Type	Horizontal, centrifugal, non-clog open impeller type, self priming pump
- Material of construction	Cast Iron
- Capacity	18 cu.m/hr, 20 m WC total head
- No. of units required	1 No.

Accessories to be supplied with each pump:

- Flexible coupling with guard
- Common steel base frame for pump and motor with grouting bolts.

3.3.7 Sludge recirculation Pumps

- Duty	To transfer sludge from the Settling tank to the inlet of the Aeration Tank under normal operation
- Driving method	Directly coupled
- Driving machine	Electric motor, TEFC, IP 55, Class B insulation, industrial squirrel cage induction type, suitable for 415 V, 50 Hz. A/C supply
- Type	Sludge Transfer pump at Clarifier Capacity 15m3/ hr at 12 mtr Head Type- Submmersible MOC- SS, Solid Handling up to 40mm single phase automatic run with float attachment
Material of construction	SS
- Capacity	15 cu.m/hr, 6-8 m WC total head
- No. of units required	2 Nos. (1 working, 1 standby)

Accessories to be supplied with each pump :

3.3.6 Final treated Filter Press

- Duty	To filter treated effluent from Final effluent collection tank as tertiary treatment as per SPCB norms.
- Positioning	Fitted on Floor having grouting of leg supports and the foundation bolts with anchoring to pedestal made for the same.
machine	MMF (Multi Media Filter) in CPA (Composit Poly Amide) Pressure vessel, size 36" x 72" of 10 kg/ cm2 as DP (design pressure) with base frame, frontal Pipe Work, White Multi port valve (imported) with different grades of medias line pebbles, coarse silex, anthracite, grades and washed quartz sand etc
- Type	Vertical Cross flow with liver operated single valve system
- Material of construction	CPA for Vessels and ABS Plastic for Multiport valve. Frontal PW UPVC of Sch and above
- Capacity	10 Cum / Hr , 20 mtr WC total head
No. of units required	One No.

Accessories to be supplied with each pump:

- Flexible coupling with guard
- Common steel base frame for pump and motor with grouting bolts.

3.3.9 Final Clarifier

Duty	To assist in settlement and separation of biological sludge from treated effluent
Driving method	Centrally located motor and gearbox coupled through a flexible coupling
Driving machine	Electric motor, TEFC, IP 55, Class B insulation, industrial squirrel cage induction type, suitable for 415 V, 50 Hz. A/C supply
Type	Centrally driven. Equipped with MSEP shaft, structural framework for scrapper arm blades and rubber squeeges firmly fastened to the blades
Material of construction	MS EP
Capacity	Suitable for installation in RCC clarifier 7 m dia. 2 m SWD
No. of units required	1 No.
HP	As per manufacturers specification
RPM	As per manufacturers specification

3.3.9 Clarifier with sludge transfer pump

Duty	To assist in settlement and separation of biological sludge from treated effluent
Driving method	Centrally located motor and gearbox coupled through a flexible coupling
Driving machine	Electric motor, TEFC, IP 55, Class B insulation, industrial squirrel cage induction type, suitable for 415 V, 50 Hz. A/C supply
Type	Centrally driven. Equipped with MSEP shaft, structural framework for scrapper arm blades and rubber squeeges firmly fastened to the blades
Material of construction	MS EP
Capacity	Suitable for installation in RCC clarifier 7 m dia. 2 m SWD
No. of units required	1 No.
HP	As per manufacturers specification
RPM	As per manufacturers specification

3.3.10 V Notch plate

A calibrated brass V Notch plate of suitable size and minimum 3mm thickness, with necessary graduations clearly marked, shall be firmly grouted at the correct level in the V Notch chamber.

3.3.11 Motor Control Centre

- Duty	To receive and distribute 415 V, 3 phase, 50 Hz power supply for ETP plant
- Type	Cubicle type made from 14 SWG sheet steel, floor mounted, front operated
- Incoming feeder	100Amp. MCCB 4 pole type with CT operated ammeter with selector switch, voltmeter with selector switch, LED type indication lamp for 3 phases, electronic type energy meter
- Outgoing feeder	• 1 feeder for each motor/power consumption point of ETP plant having switch disconnector fuse

	unit, and a starter with LED indication for feeder ON Motors of rating 7.5 hp and above must have star / delta starters • 1 DP MCB feeder for lighting • 1 TPN switch disconnector fuse unit and contactor for 10 KVAR power capacitor • 1 TPN switch disconnector fuse unit of 25 Amp. to act as a spare • 1 TPN switch disconnector fuse unit of 63 Amp. for welding machine

3.3.12 Power capacitor

- Duty	To improve the power factor of the ETP plant at MCC level
- Type	Suitable for 415 V 3 –phase, 50 Hz AC supply, two layer di-electric design, non self healing type
- Capacity	Minimum 10 KVAR

4.0 GENERAL NOTES

1. Smooth plastering of all external surfaces wherever specified shall be provided in one coat. Double scaffolding shall be done wherever necessary.

2. MS pipe railing shall be of 32mm dia MS Class B pipes. For bends in railing, regular bends shall be used and no elbows shall be used for this purpose. For supports of railings, MS pipe of class 'B' 32mm dia shall be used. The joints shall be well ground, smoothened. Then the pipe surfaces and supports shall be applied with one coat of anti corrosive red oxide primer followed by one coat of synthetic enamel paint of approved make & shade, for corrosion resistance immediately after fabrication. One coat of synthetic enamel paint shall be again applied on all railings and their supports after testing and commissioning.

3. Water proofing compound wherever used as per manufacturers specification shall ensure chemical and acid resistance to the concrete structures.

4. The piping work described in the above scope of work shall include all necessary pipe inserts required to be provided at various places and all the inserts shall be of suitable construction

with puddle flange in the centre and properly grouted so as to prevent leakage.

5. The piping work shall also include all necessary excavation of pipe trenches for underground pipe with bedding of sand and shall also include all necessary pipe supports, plate inserts, etc. HDPE piping shall conform to all the relevant BIS codes, especially BIS 9984, 8008, 7534 & 7634.

6. Pipe anchoring works, Brick masonary pillars, RCC pedestals etc. as required to support the pipe due to site conditions etc. or as may be required for supporting the various pipes above the ground level within the treatment plant area and upto the disposal point, are included in the scope of work.

7. All the necessary valves for the entire treatment plant piping as required shall be provided. The valves shall conform to the relevant BIS standards and shall be provided as per Valves schedule given in Table 5 of Section IVC.

8. The scope of work includes construction of necessary valve chambers of suitable size in brick masonry with excavation, PCC 1:3:6 sub-base, inside & outside smooth plaster (1:4), IPS floor 50 mm thick, hinged MS grating frame covers fixed in the RCC M20 cover slab 100 mm thick and spindles for valves on under ground lines extended above finished ground upto the operating level.

9. The general specifications applicable for the piping work shall be as given in the piping work specification in the tender.

10. All necessary pipe fittings, specials, flanges, etc. shall be supplied as required.

11. The RCC wall thicknesses of UASB digester, Equalisation tank, Fat Removal unit, Aeration tank, clarifier shall be minimum 200mm. The raft thickness for UASB, equalisation tank, fat Removal unit, Aeration tank and Clarifier, shall be minimum 250 mm. However for screen chamber, V-notch and pump pads wall/raft thickness can be minimum 150mm. It is the responsibility of the successful bidder to check the design and increase the thickness as required, for which nothing extra shall be paid for. No reduction in these minimum thicknesses of RCC is allowed at all.

12. The Reinforcement steel shall be considered as minimum 60 kg/cu.m of RCC. However it is the responsibility of the successful bidder to design and increase the reinforcement if required for which nothing extra shall be paid for. No reduction less than minimum 60 kg/cum. steel consumption in RCC is allowed at all.

13. All the structural details shall be designed, checked & verified by a chartered registered structural engineer and stability certificate shall be issued by him for the same. The structure designed shall be earthquake proof for the project area zone. A certificate to this extent shall be furnished from the registered Structural consultant. If asked for the design calculation shall be made available to OMFED

14. A plinth protection of 600mm width shall be provided all around the units with a nominal outward slope. Plinth protection shall be done with base PCC 1:3:6, 60mm thick and PCC 1:1.5:3, 50mm thick self finished.

15. The level of inlet line before Screen Chamber shown in the Flow Diagram is tentative and may vary as per the actual site conditions. As per the actual level of the inlet line the levels of all other units will be modified accordingly. Nothing extra shall be paid for such modifications.

16. All the units of the plant shall be joined with a pathway 1.2 m width with a nominal slope on both the sides. Pathway shall be made with minimum 60 mm thick PCC 1:1.5:3, self finished over 100mm thick CC 1:4:8. Where the site may be in contours necessary steps, side walls etc. as required may be provided in brick work, Concrete and IPS etc. Bidder shall assess this at site and the prices shall be inclusive of such requirements.

17. The bidder must, along with the bid, furnish the List of Spares required for normal operation of the plant for two years after commissioning and quote optionally for the spares.

18. The bidder must quote optionally for operation & maintenance of the entire plant for a period of one year after successful commissioning. The bidder must furnish full details along with the terms and conditions etc.

19. RCC M20 shall be volumetric mix of concrete 1:1.5:3 (one part cement : 2 parts of coarse sand : 4 parts of stone aggregate of size 20mm & down by volume).

20. Floors of all effluent water structure shall be provided with 40mm thick IPS (1:1.5:3) flooring with floor PVC strip of size 25x3 mm as directed.

5.0 BATTERY LIMITS FOR THE EFFLUENT TREATMENT PLANT WORK

The scope of work described in the Schedule of Requirements shall be governed by the following battery limits :

5.1 Raw effluent line from the last manhole at the atmospheric condenser to the Inlet channel, length not exceeding 130m.

5.2 Valve at the tee junction on the reuse branch of the gas line between the gas holder and the flare stack. Further necessary connection shall be done by Owner.

5.3 Gas burner end of the flare stack.

5.4 Treated effluent line from the V - notch outlet, line length not exceeding 10 m. This treated effluent could be used for irrigation purposes within the dairy plant. Supply and installation of further piping shall be arranged by Owner at their own cost and shall not be in the scope of the bidder.

5.5 Supply, erection and charging of the Motor Control Centre shall be in the Contractor's scope. The supply, laying, connection and charging of 3½ x 35 sqmm. armoured Aluminium conductor, PVC insulated and sheathed power cable for main incomer of MCC is included in contractor's scope of work. This cable shall be laid underground from the existing Panel at ETP site and its length shall not exceed 120 m. Termination of this cable at both ends with suitable glands and lugs is included in the contractor's scope. Supplying and providing necessary earthing system including two number GI plate type earthing pits, GI strip/wires from MCC to all electrical equipment/ controls is included in contractor's scope.

5.5 Unit lighting and yard lighting in the ETP area including conduits, wiring, cables, light fittings, poles/brackets of approved design is included in Contractors scope.

6.0 TESTING, TRIAL RUNS, COMMISSIONING & HANDING OVER

6.1 Testing and Trial runs

The contractor shall have to test each equipment used for the plant for atleast 72 hrs continuous running with designed load and to the full satisfaction of the Engineer-in-Charge. After testing the individual equipment and stabilization of the plant, the contractor shall run the whole plant at no extra cost to the OMFED/Owner for at least one month as directed by the Engineer-in-Charge. Any defects found in design, workmanship or in any of the equipment shall be rectified by the contractor at his own cost within a reasonable time to be decided by the Engineer-in-charge, and beyond this period suitable penalty shall be levied and the plant shall be tested again for

faultless running for one month to the entire satisfaction of Engineer-in-Charge.

Necessary instruments, gauges, supervisory personnel etc. shall be furnished/provided by the contractor free of cost for conducting the tests. The recording of tests result shall be as per formats to be approved by the Engineer-in-Charge and will form part of the completion documents.

6.2 Commissioning and handing over

During trial runs as described above, the contractor shall satisfy the Engineer-in-Charge in all respects regarding the satisfactory quality of effluent, quality of materials, equipment and workmanship used in the plant. Only after satisfying himself, regarding the above points, the Engineer-in-charge will take over the plant and such date of taking over shall be deemed as date of commissioning. The guarantee period described above will start from this date. For specific details, refer the General Conditions of contract clause 87.0. The contractor shall have to obtain necessary statutory approval for setting up of ETP to its commissioning/handing over. The charges for this shall be all included in bid prices.

7.0 PLANT GUARANTEES

The undermentioned clauses shall be read in conjunction with Warranty/Guarantee provisions given elsewhere in this document.

7.1 Manufacturer's Guarantees

The manufacturer's guarantee for design, workmanship and performance for all bought out items shall be made available to the purchaser/owner and shall be valid at least for the entire defects liability period.

In the event of failure of any particular equipment which fails more than three times during the guarantee period as mentioned in clause below, the contractor shall replace at his own cost that equipment. Manufacturer's/Contractor's guarantee, as mentioned in clause above, for such replaced equipment shall also be made available to the purchaser/owner and should be kept at least for one year from the date of last replacement.

7.2 Performance Guarantee

The contractor shall give guarantee for a period of one year from the date of successful commissioning for the treatment plant against design, defective materials, workmanship, performance and guaranteed effluent quality. In the event the commissioning of the

plant is not possible due to non-availability of effluent, contractor shall be issued mechanical completion certificate by Engineer-in-Charge provided each equipment is tested satisfactorily as directed by Engineer-in-Charge. However, the contractor shall have to maintain the plant at his own cost, in such a case for a period of three months beyond which period, if he is required to maintain further, he will be paid extra at mutually agreeable rate. However, testing and commissioning of the plant shall be carried out by the Contractor during the Defects Liability period. Any defects found in the workmanship materials or performance of the plant shall be made good by the contractor at his own expense within the time specified by Engineer-in-Charge.

For this purpose the performance guarantee furnished by successful bidder, as per general conditions of contract shall be retained till the completion of the guarantee period as stated above. The contractor, at his own expense shall start and commission the plant and prove that it is giving satisfactory service and desired characteristics of the treated effluent, for one month before handing over the plant to the Owner. During this start up and commissioning period the contractor shall train the Owner's operational staff without any extra cost to the Owner.The contractor shall also have to guarantee the quality of the treated final effluent to meet the specification in Table-2 of section IVC. For given design quantity and quality of untreated effluent, if the Contractor fails to achieve the treated effluent criteria, the Contractor shall rectify the plant at no extra cost, so as to achieve the requisite performance guarantee and satisfy commissioning of the plant to the Engineer-in- Charge.

All the above guarantees will be based on collection and analysis of samples as mentioned in clause below.

7.3 Oxygenation Capacity of Surface Aerator

If required by the Engineer-in-Charge to do so, the supplier shall at his own cost prove the Oxygenation capacity guaranteed by him for the Surface Aerator provided by conducting oxygenation capacity tests on the surface aerator by any standard and internationally recognised method to be approved by the OMFED.

7.4 Collection and analysis of samples

The guaranteed effluent shall be based on complete analysis of composite samples of raw and treated effluent collected after stabilization of the plant as per Special Conditions of Contract.

SECTION IV 'C' - DESIGN DATA TABLES

CONTENTS

Table 1. Expected Design Characteristics of Untreated Effluent

Sr. No.	Parameter	Concentration
1	Flow, cum/day	200
2	Average flow rate, cu.m/hr	10
3	Peak flowrate, cu.m/hr	18
4	pH	6 – 8.5
5	Total Solids, mg./litre	2850
6	Total Dissolved Solids mg./litre	2400
7	Total Suspended Solids mg/litre	450
8	Biochemical Oxygen Demand (BOD), mg/litre	1600
9	Chemical Oxygen Demand(COD), mg/litre	2200
10	Oil & Grease, mg/litre	350

Table 2. Desired Design Characteristics for Treated Effluent

Sr. No.	**Parameter**	Concentration
1	Flow, cu.m/day	200
2	Average flow rate, cu.m/hr	10
3.	Peak flow rate, cu.m/hr.	18
4	pH	6.5 – 8.5
5	Total Dissolved Solids, mg/litre	<2100
6	Total Suspended Solids, mg/litre	< 100
7	Biochemical Oxygen Demand (BOD), mg/litre	< 30
8	Chemical Oxygen Demand(COD), mg/litre	< 100
9	Oil & Grease, mg/litre	< 10

Note:
All parameters from 4 to 9 (Table 2) shall conform to State Pollution Control Board norms for the project / plant.

Table 3. Units and Equipment

Unit Size summary

Sr. No.	Unit	No.	Size, type and material of construction
1	Inlet flow meas. channel	1	UPVC PIPE 6" DIA 6 KG /SQM OF 100 FT
2	Screen chamber	1	2.0 m x 1.0 m x 1.0 m liquid depth, RCC M 20
3	Collection Chamber	1	2.0 m x 3.0 m x 3.0 m liquid depth, RCC M 20
4	Fat removal Unit	1	4.0 m x 2.0 m x 4.5 m liquid depth, RCC M 20
5	Equalization / Homosoniser tanks	1	3.0 m x 3.0 m x 2.0 m liquid depth, RCC M 20 each
6	UASB digester with fill & draw Tank	1+1	6 m dia. x 5.0 m liquid depth, RCC M20 3 m dia. x 2.5 m liquid depth, RCC M20
7	Splitter box at Aer. tank	1	0.50 m x 1.0 m 0.5 m liquid depth, RCC M20
8	Aeration Tank - I	1	7.0 m x 5.0 m x 3.0 m liquid depth, RCC M20
9	Aeration Tank - II	1	5.0 m x 4.0 m x 3.0 m liquid depth, RCC M20
10	Clarifier & Sludge Thickness Holder Tank	1+1	4.0 m x 3.0 x 3.5 m liquid depth, RCC M20 2.0 m x 3.0 x 3.0 m liquid depth, RCC M20
11	MCC cum operator room	1	4.0 m x 4.0 m x 4.0 m ceiling ht. Brick work frame structure door and windows, rest frame etc.
12	Filter Press room & filter room.	1	6.0 m x 6.0 m x 4.0 (clear ht.) as per detailed specs, meeta Sheet Roofing , Frame structure
13	V Notch Chamber	1	1.0 m x 1.0 m x 1.0 m liquid depth, RCC M 20
14	Raw Effluent /Sludge pump pads	2	1.0 m x 1.0 m each, as per specs
15	Gas Holder Tank with accessories etc.	1	As per design of Manufacturer / supplier.
16	Treated Effluent Collection Tank	1	3.0 m x 3.0 m x 1.50 m liquid depth in RCC M20
17	Treated Water Disposal Pump Pad	1	1.0 m x 1.0 m in RCC M20
18	Sludge drying bed	2	3.0 m x 3.0 m x 1.0 m in Brick masonary with 50 mm thick IPS flooring.
19.	Interconnectig path way / steps / stair for the entire plant including lighting.	01 lot	As per specication.

Note : For details and type of material of construction, section IVB to be referred. The contractor shall have to to submit the details design for the same & get approved.

Equipment Summary

Sr. No.	Equipment	No.	Rating and capacity
1	flow measurement and integration instrument	01 set	Inlet water flow mounting at inlet pipe. Flow measurement based on A-V method
1A	on / off Auto system for all inlet chambers Motor	02 set	As per manufacturer and supplier specification
2	Bar rack (coarse and fine) for screen chamber	01	to fit into Screen chamber as above
3	Diffused air blower & Slow speed floculator with scrapper mechanism for fat , oil removal tank & Homozoniser	02+01	Air blower (2) of specification mentioned along with slow speed floculator with scapper (1) No mechanisim for Homosinser tank/
4	Homonised effluent pumps	02 set	Pump to Capacity1 5m3/ hr at 12 mtr Head, open impeller & oil filled, MOC- SS, Solid Handling up to 40mm automatic run with float attachment.
5	Settler arrangement for UASB digester	01+01	6 m. dia RCC Pump to Capacity 12 m3/ hr at 12 mtr Head, open impeller & oil filled, MOC- SS, Solid Handling up to 40mm single phase automatic run with float attachment.
6	Fixed Aerator for Aeration Tank	02	Low speed floating surface aerator , .5.0 HP motor and gear , 60-90 RPM

7	Clarifier / Tube settler	01+01	4 .0X 3.0 X 3.5m SWD and 2.0 X 3.0X 3.0m SWD with rack and tubes , Pump to Capacity 10 m3/ hr at 12 mtr Head, open impeller MOC- SS, Solid Handling up to 40mm automatic run motor (ON/OFF) with float attachment
8	Sludge recirculation pumps	03	Pump capacity 12m³/hr at 12mtr Head,opening impeller & oil filled ,MOC-SS ,solid Handling upto 40mm automatic run with float attachment with self priming .
9	Filter Press recede type 16 plate manual operated.	01	MS Filter press suitable for 4 stay bosses special design P.P. Recessed Plates special design manual Power pack unit. Plate size- 610mm x 610mmNo. of chambers- 16Plate thickness- 16mm +/ - 2mm Filtration area 8mtr sqr. Zero plate - 1 No. Dummy plate- 2 Nos.Operating temperature_ Max 750 C at 4 kg/ Cm2OP- Max 4 kg/ CM2, DP- 5 kg/ CM2Filter press Structure- MSEP, lever operated Filter cloth - PP 9900(Micron 10 to 15)
10	Calibrated V Notch plate for V Notch Chamber	01	MS Epoxy painted with graduations
11	SS rising spindle type gates for Sludge Drying beds	8	200 mm clear width x 300 mm mm each complete with guide channels
12	Motor control center	01	For receiving and distributing LT power
13	Power and control cables	1 lot	for connecting MCC with all motors and controls
14	Earthing system, isolators/PB station etc.	1 lot	For safety and operation
15	Lighting DB	1 no.	For Effluent Treatment Plant Lighting
16	Power capacitors	1 no.	10 KVAR
17	Final treated water disposal pump	2 nos.	CI Horizontal Centrifugal Non-clog , Self – priming Pump, 12 cum/hr Cap. At 20 m total head
18	Sludge transfer pump with all fitting and accessories as required	02 nos	Sludge dewatering system ,Pump to filter press Capacity 10 m3/ hr at 12 mtr Head ,open impeller & oil filled ,MOC- SS, Solid Handling up to 40mm single phase automatic run with float attachment.
19	Air Blower	02 no	Compressor with motors, Base frame pully driven, anchor bolt, NRV, Silensor, Suction with filter etc. Twin lobe with rotary gears, SGI casting grade 500/7, Shaft - EN-9/070 M55, Gear- EN 353/815M,flow 20m3/hr @3.5mwc Bearings- SKF Make
20	Chemical Dosing System	01 no	Pro-Biotic Dosing system with PP Tank- 200 ltr. With dosing pump- 5 LPH at 5 Kg/ Cm2 BP- 2 Nos. with suction discharge arrangement with NRV

21.	Valve,pipes & fitting and fixture with all accessories	01 lot	As per the detail design and specification for completion and hand over of ETP.

NOTE: For details of rating, type and capacity etc., section IVB to be referred And the detailed layout plan drawing of the system

.

Table 4. Piping Schedule

Sr. No.	From (name of the unit)	To(name of the unit)	Dia./OD	Material
1	Last Manhole	Inlet Channel	200 dia.	UPVC
2	Inlet channel	Screen Chamber	Direct	-
2	Screen chamber	Fat Removal Unit	Direct	-
3	Fat Removal Unit	Equalisation Tanks	140 OD	HDPE Sr. II
4	Equalisation tanks	Equalised eff..pumps	63 OD	HDPE Sr. III
5	Equalised effluent pumps	UASB digester	63 OD	HDPE Sr. III
6	EE pumps	Splitter box at AT	63 OD	HDPE Sr. III
7	EE pumps	V Notch Chamber	63 OD	HDPE Sr. III
8	UASB digester	Splitter box	110 OD	HDPE Sr. II
9	Splitter box	Equalisation Tank	50 OD	HDPE Sr. II
10	Splitter box	Aeration tank	Direct	-
11	UASB digester	Bye pass line	110 OD	HDPE Sr. II
12	UASB digester	Sludge drying beds	50 OD	HDPE Sr. II
13	Aeration tank	Clarifier	140 OD	HDPE Sr. II
14	Aeration tank (drain)	Equalisation Tank	110 OD	HDPE Sr.II
15	Clarifier	V notch chamber	110 OD	HDPE Sr. II
16	Clarifier	Sludge drying beds	63 OD	HDPE Sr. III
17	Clarifier	Sludge recirc. Pump	63 OD	HDPE Sr. III
18	UASB digester	Gas holder	40 dia.	CI
19	Gas holder	Flare stack	40 dia.	CI
20	Gas holder	Usage line	40 dia.	CI
21	Sludge rec.pumps	Aeration tank	63 OD	HDPE Sr. III
22	V Notch Chamber	Existing Settling tank inlet	110 OD	HDPE Sr. II
23	V Notch Chamber	Treated Effluent Collection Tank	150 dia	SWG
24	Sludge drying beds	Equalisation tanks	100 dia.	SWG
25	Treated Effluent Collection Tank	Treated Effluent Disposal Pump Suction	40 dia	HDPE Sr. III

Note : This schedule indicates the minimum requirement of the pipe segments for the plant. However, in case, any additional piping is felt essential during the bidding/ work execution to complete the ETP works, the same shall be provided by the Contractor without any extra cost. OD implies outer diameter of the pipe wherever specified. HDPE Sr II implies 4.0 kg/sq.cm pressure rating pipes HDPE Sr III implies 6.0 kg/sq.cm pressure rating pipes

Table 5. Valves Schedule

Sr. No.	From (name of the unit)	To (name of the unit)	No.	Dia	Type & Material
1.	Fat removal unit	Equalisation tank	2	125	PP Ball
2	Equalisation tank	Equal.eff.pumps suction header	2	63	PP Ball
3	Suction header	Equal. pumps suction	2	63	PP Ball
4	Equal.eff.pumps (EEP)	EEP Delivery Header	2	50	PP NRV
5	Equal.eff.pumps (EEP)	EEP Delivery Header	2	50	PP Ball
6	Delivery header, EEP	UASB digester	1	50	PP Ball
7	Delivery header, EEP	Splitter box at Aer. Tank)	1	50	PP Ball
8	Delivery header, EEP	Bypass line	1	100	PP Ball
4.	UASB digester	Splitter box (at Aer. tank)	1	100	PP Ball
5.	UASB digester	Bye pass line	1	100	PP Ball
6.	UASB digester	Sampling point & Drying beds	2	125	PP Ball
7.	Aeration tank	Clarifier	1	125	PP Ball
8	Aeration tank (drain)	Equalisation Tank	1	110	PP Ball
9	Clarifier	Sludge drying beds	1	50	PP Ball
10.	Clarifier	Sludge Rec. pump suction	1	50	PP Ball
11.	UASB digester	Gas holder	1	40	CI Butterfly
12.	Gas holder	Flare stack	1	40	CI Butterfly
13	Suction at Final Treated Effluent Collection Tank	Final Effluent Disposal Pump	1	40	PP Ball

Note : This schedule indicates the minimum requirement of the valves segments for the plant. However, in case, any additional valves are felt essential during the bidding/work execution work execution to complete the ETP works, the same shall be provided by the Contractor without any extra cost.

SECTION V

FORM OF BID

The Appendices (I to IV) of form of bid is a part of the bid. Bidders are required to fill up all the blank spaces in this Form of Bid and Appendices.

Bid Reference No. : **OMFED: BHUB-D: ETP:**

Name and Address of Employer : THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., D - 2, SAHID NAGAR, BHUBANESWAR PIN – 751 007.

Description of Works : Effluent treatment plant including building, Equipment and piping at**.** **SALAPADA DAIRY,**

Dear Sirs,

1.0 Having examined the Drawings, Conditions of Contract, Specifications and Schedule of Quantities for the execution of above mentioned works, we, the undersigned offer to execute, complete and maintain the whole of the said works in conformity with the said Drawings, Conditions of Contract, Specifications and Schedule of quantities for the sum of Rs. _____ _(Rs_____) or such other sum as may be ascertained in accordance with the said conditions.

2.0 We undertake, if our bid is accepted to commence the Works within _____ days of receipt of the Letter of Acceptance, and to complete and deliver the whole of the above said works comprised in the Contract within _____ months calculated from the last day of the aforesaid period in which the Works are to be commenced.

3.0 If our bid is accepted, we will furnish a performance security in the form of a bank guarantee in approved format / Demand draft to be jointly and severally bound

with us in amount of 5% of the above named sum in accordance with the Conditions of Contract .

4.0 We agree to abide by this bid for the period of 90 days from the date of bid opening prescribed in clause 13 of the Instruction to Bidders, and it shall remain binding upon us and may be accepted at any time before the expiry of that period.

5.0 Unless and until an Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding Contract between us.

6.0 We understand that you are not bound to accept the lowest or any Bid you may receive.

Date ----------

Signature of bidder

with seal

Witnesses:

1. Signature:

   Name:

   Address:

2. Signature:

   Name:

   Address:

BIDDING TERMS DEVIATION STATEMENT FORM

1.) The following are the particulars of deviations from the requirements of the bidding conditions/ terms:

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

The terms and conditions prescribed 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.

Dated :- Signature and seal of Bidder

Note :-

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “NO DEVIATIONS”.

TECHNICAL DEVIATION STATEMENT FORM

1.) The following are the particulars of deviations from the requirements of the tender specifications :

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

The technical specification 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.

Dated :- Signature and seal of Bidder

Note :-

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “NO DEVIATIONS”.

LIST OF APPROVED MAKES

The following is the list of products and name of the approved manufacturer against each product. The contractor shall quote rates for the various items of works using these products based on maximum two makes out of these approved manufacturers selected & filled up in format given below by the bidder. Any other make of product, not approved below, shall not be allowed for use in this work unless specifically approved in writing separately by the purchaser after establishing its technical suitability, price availability & effect on price quoted by contractor for the item where this item is being used. If no make has been selected by the bidder, the purchaser shall be at liberty to advice the contractor to use any of the approved manufacturer given below for any product of this contract.

SL. No.	ITEM DESCRIPTION	STANDARD MANUFACTURER/MAKES	(MAX. TWO)
	CIVIL ITEMS		
1.	GREY CEMENT	ACC/JK/LAKSHMI/VIKARM/ LT/ KONARK	
2.	REINFORCEMENT STEEL	SAIL/TISCO/KAMDHENU/RATHI/ VIZAG STEEL	
3.	CONCRETE ADMIXTURES	SIKA/FOSROC/CHEMISTIC/FRC/METCONETE/CICO	
4.	PAINTS	ASIAN/BERGER/J&N	
	CEMENT PAINT	SUPER SNOCEM/NITCOCEM	
5.	CI PIPES & FITTINGS MANHOLE FRAMES	RIF/SRIF	
6.	GI / MS PIPES	TATA/JINDAL/BST/SURYA ROSHNI	
7.	GI FITTINGS	'R' BRAND/UNIK/KS	
8.	RCC HUME PIPES	INDIAN HUME PIPE CO.	
9.	PRESSED STEEL DOOR/WINDOWS FRAMES	PERFECT INDUSTRIAL PRODUCTS/TIL	
10.	STANDARD ROLLED	AGEW/AHMEDABAD STEEL CRAFT	
11.	GLAZED TILES	SOMANI/ORIENT/JOHSON & JOHNSON	
12.	PVC WATER STOPS	MARUTI	
13.	PP BALL VALVES	DINESH PLASTIC/JYOTI PLASTIC/VISHAL/POLY VALVES	
14.	HDPE PIPES AND FITTINGS	PIL/HASTI/KWH/ORIPLAST HELIPLASTICS/EQUIVALENT	
15.	HDPE PIPES AND FITTINGS	PIL/HASTI/KWH HELIPLASTICS/EQUIVALENT/ ORIPLAST	
16.	FLAME ARRESTOR	HGE/EQUIVALENT	
17.	LEVEL SWITCHES	PREMIER/LEVCON/CHEMTROLS/RICH SYSTEMS/EQUIVALENT	
17.	PRESSURE GAUGE	H.GURU/GLUCK/BELLS/FIEBEG	
18.	CI BUTTERFLY VALVE	AUDCO/KSB/LEADER/BDK	
19.	CI SLUCE/ CHECK VALVE	AUDCO/LEADER/BDK	
20.	CI PIPES AND FITTINGS	RIF/SRIF	
21.	GI FITTINGS	R BRAND/UNIK/KS	

22.	SW PIPES	PERFECT/BURN	
23.	PRESSED STEEL DOORS/WINDOWS FRAME	PERFECT INDL. PRODUCTS/PIL	
24.	GLAZED TILES	SOMANI/ORIENT/JOHNSON & JOHNSON	
	ELECTRICAL ITEMS		
1.	LT SWITCHGEAR	L&T/SIEMENS/ALSTOM/GEC ALSTHOM/GROUP SCHNIEDER	
2.	AMMETERS / VOLTMETER	AE/IMP/MECO/ENERCON	
3.	CURRENT TRANSFORMER	AE/IMP/MECO	
4.	MCB / RCCB	MDS (LEXIC)/SIEMENS/GROUP SCHNIEDER/HPC/INDO/KOPP/HAVELLS	
5.	MCCB	L&T/SIEMENS/MDS (LEGRAND)	
5.	ENERGY METER ELECTRONIC	HPCL/UNIVERSAL/SECURE METER/L&T/ REIL	
6.	POWER / CONTROL CABLES, WIRES	CCI / FORT/GLOSTER/FINOLEX/SKYTONE /ROLEX	
7.	INDICATION LAMPS LED TYPE	BINAY/SIEMENS/L&T	
8.	WEATHER PROOF BOXES FOR ISOLATORS, PUSH BUTTONS	HANSU/HENSEL	
9.	ELECTRIC MOTORS	SIEMENS/BHARAT BIJLEE/CROMPTON/GE ALSTHOM/KIRLOSKAR	
	MECHANICAL EQUIPMENT		
1.	EFFLUENT NON CLOG PUMPS	KIRLOSKAR/STORK/JYOTI/KSB/MAXFLOW	
2.	AGITATOR FOR FLOATING AERATOR	VOLTAS/HE/AMITRON/SACEDE/PARAMOUNT/ENV IRAD/EQUIVALENT	
3.	REDUCTION GEAR BOX	RADICON/POWER BUILD/ESSENPRO	
4.	AERATOR	VOLTAS/AMITRON/PARAMOUNT/HE/SACEDE/ENV IRAD/EQUIVALENT	

NOTE: Following shall be got approved from the Purchaser:

1. Manufacturer of Motor Control Center (MCC).
2. Samples of isolator/ON-OFF boxes near motors.
3. Sample of GI wire / strip for earthing, cable glands and cable lugs etc.

We have noted the above and confirm that our tender is based on these approved makes.

Date : ---------

Signature and seal of Bidder

APPENDIX – II - TO THE FORM OF BID

BIDDING TERMS DEVIATION STATEMENT FORM

2.) The following are the particulars of deviations from the requirements of the bidding conditions/ terms:

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

The terms and conditions prescribed 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.

Dated :- Signature and seal of Bidder

Note :-

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “NO DEVIATIONS”.

APPENDIX – III TO THE FORM OF BID

TECHNICAL DEVIATION STATEMENT FORM

1.) The following are the particulars of deviations from the requirements of the tender specifications :

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

The technical specification 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.

Dated :- Signature and seal of Bidder

Note :-

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “NO DEVIATIONS”.

APPENDIX - IV TO THE FORM OF BID

LIST OF APPROVED MAKES

The following is the list of products and name of the approved manufacturer against each product. The contractor shall quote rates for the various items of works using these products based on maximum two makes out of these approved manufacturers selected & filled up in format given below by the bidder. Any other make of product, not approved below, shall not be allowed for use in this work unless specifically approved in writing separately by the purchaser after establishing its technical suitability, price availability & effect on price quoted by contractor for the item where this item is being used. If no make has been selected by the bidder, the purchaser shall be at liberty to advice the contractor to use any of the approved manufacturer given below for any product of this contract.

SL. No.	ITEM DESCRIPTION	STANDARD MANUFACTURER/MAKES	MAKE SELECTED BY BIDDER (MAX. TWO)
	CIVIL ITEMS		
1.	GREY CEMENT	ACC/JK/LAKSHMI/VIKARM/ LT/ KONARK	
2.	REINFORCEMENT STEEL	SAIL/TISCO/KAMDHENU/RATHI/ VIZAG STEEL	
3.	CONCRETE ADMIXTURES	SIKA/FOSROC/CHEMISTIC/FRC/METCONETE/ CICO	
4.	PAINTS	ASIAN/BERGER/J&N	
	CEMENT PAINT	SUPER SNOCEM/NITCOCEM	
5.	CI PIPES & FITTINGS MANHOLE FRAMES	RIF/SRIF	
6.	GI / MS PIPES	TATA/JINDAL/BST/SURYA ROSHNI	
7.	GI FITTINGS	'R' BRAND/UNIK/KS	
8.	RCC HUME PIPES	INDIAN HUME PIPE CO.	
9.	PRESSED STEEL DOOR/WINDOWS FRAMES	PERFECT INDUSTRIAL PRODUCTS/TIL	
10.	STANDARD ROLLED	AGEW/AHMEDABAD STEEL CRAFT	
11.	GLAZED TILES	SOMANI/ORIENT/JOHSON & JOHNSON	
12.	PVC WATER STOPS	MARUTI	
13.	PP BALL VALVES	DINESH PLASTIC/JYOTI PLASTIC/VISHAL/POLY VALVES	
14.	HDPE PIPES AND FITTINGS	PIL/HASTI/KWH/ORIPLAST HELIPLASTICS/EQUIVALENT	
15.	HDPE PIPES AND FITTINGS	PIL/HASTI/KWH HELIPLASTICS/EQUIVALENT/ ORIPLAST	
16.	FLAME ARRESTOR	HGE/EQUIVALENT	
17.	LEVEL SWITCHES	PREMIER/LEVCON/CHEMTROLS/RICH SYSTEMS/EQUIVALENT	
17.	PRESSURE GAUGE	H.GURU/GLUCK/BELLS/FIEBEG	
18.	CI BUTTERFLY VALVE	AUDCO/KSB/LEADER/BDK	
19.	CI SLUCE/ CHECK VALVE	AUDCO/LEADER/BDK	
20.	CI PIPES AND FITTINGS	RIF/SRIF	
21.	GI FITTINGS	R BRAND/UNIK/KS	
22.	SW PIPES	PERFECT/BURN	

23.	PRESSED STEEL DOORS/WINDOWS FRAME	PERFECT INDL. PRODUCTS/PIL	
24.	GLAZED TILES	SOMANI/ORIENT/JOHNSON & JOHNSON	
	ELECTRICAL ITEMS		
1.	LT SWITCHGEAR	L&T/SIEMENS/ALSTOM/GEC ALSTHOM/GROUP SCHNIEDER	
2.	AMMETERS / VOLTMETER	AE/IMP/MECO/ENERCON	
3.	CURRENT TRANSFORMER	AE/IMP/MECO	
4.	MCB / RCCB	MDS (LEXIC)/SIEMENS/GROUP SCHNIEDER/HPC/INDO/KOPP/HAVELLS	
5.	MCCB	L&T/SIEMENS/MDS (LEGRAND)	
5.	ENERGY METER ELECTRONIC	HPCL/UNIVERSAL/SECURE METER/L&T/ REIL	
6.	POWER / CONTROL CABLES, WIRES	CCI / FORT/GLOSTER/FINOLEX/SKYTONE /ROLEX	
7.	INDICATION LAMPS LED TYPE	BINAY/SIEMENS/L&T	
8.	WEATHER PROOF BOXES FOR ISOLATORS, PUSH BUTTONS	HANSU/HENSEL	
9.	ELECTRIC MOTORS	SIEMENS/BHARAT BIJLEE/CROMPTON/GE ALSTHOM/KIRLOSKAR	
	MECHANICAL EQUIPMENT		
1.	EFFLUENT NON CLOG PUMPS	KIRLOSKAR/STORK/JYOTI/KSB/MAXFLOW	
2.	AGITATOR FOR FLOATING AERATOR	VOLTAS/HE/AMITRON/SACEDE/PARAMOUNT/ ENVIRAD/EQUIVALENT	
3.	REDUCTION GEAR BOX	RADICON/POWER BUILD/ESSENPRO	
4.	AERATOR	VOLTAS/AMITRON/PARAMOUNT/HE/SACEDE/ ENVIRAD/EQUIVALENT	

NOTE: Following shall be got approved from the Purchaser:

4. Manufacturer of Motor Control Center (MCC).
5. Samples of isolator/ON-OFF boxes near motors.
6. Sample of GI wire / strip for earthing, cable glands and cable lugs etc.

We have noted the above and confirm that our tender is based on these approved makes.

Date : --------- Signature and seal of Bidder

SECTION VI

SCHEDULE OF MATERIAL TO BE ISSUED BY THE PURCHASER/PROJECT AUTHORITY

Schedule showing materials to be supplied by the Purchaser/ Project Authority under clause 7 of Section III, the Special Conditions of the Contract for work contracted to be executed and the rate at which they are to be charged for:

Particulars	Unit	Rate at which material will be supplied to the Contractor	Place of Delivery
Cement*	Per bag	NIL	Purchaser/Project Authority's store anywhere within the project site.
Mild steel	Per MT	NIL	
Tor steel	Per MT	NIL	
Structural steel	Per MT	NIL	

*The empty cement bag will become the property of the Contractor.

Note:

1.0 Conditions for issue of materials are given on the following pages which along with relevant clauses in the Section III, the Special Conditions of Contract may be referred to by the contractor.

2.0 The quantity of material issued shall be worked out on the following basis.

a. Each bag of cement as received from supplier/ or as stacked in Owner/ Project Authority's store shall be taken to weigh 50 kg.
b. Weights mentioned in the suppliers invoice/ bills/ vouchers/ RR shall be taken as issue weights for mild steel or tor steel.

3.0 M.S. bars and tor steel bars, shall be issued in weight as available in the Stores.

4.0 Cement shall be stored in separate godowns with pucca floor, weather proof wall & roof. The cement bags shall be stacked horizontally, continuous in each line. These stacks shall be in rows of 12 bags high with a minimum clear space of 600 mm around. The capacity of the godown shall be equal to 25% of the theoretical cement consumption for the whole work.

5.0 **Wastage: (Not Applicable for this contract)**

a) **Cement:**

On completion of work, the theoretical consumption shall be worked out. Over the theoretical consumptions a variation upto +/ - 3% (plus minus three percent) shall be allowed for works estimated cost of which as put in the tender does not exceed Rs. 10.00 lakh and upto +/- 2.5% (plus minus two and half percent) for works the estimated cost of which as put in the tender is more than Rs. 10.00 (ten) lakh. If the actual consumption of cement exceeds the theoretical consumption as per certified measurements of work including wastage by more than the permissible limit, then the excess of cement consumed above the permissible limit shall be recovered at the basic rate or the prevailing market rate (delivered at site) whichever is higher. If the actual consumption is less than the permissible variation of the quantity theoretically as per certified measurements of works including wastage ascertained, the cost of quantity of cement not so used, shall be recovered at the twice the stipulated basic rate.

b) **Mild steel and Tor steel:**

Maximum wastage permitted will be 5% of the theoretical consumption. If the wastage is more than 5% of the steel billed for, then the excess wastage above 5% limit shall be recovered at an enhanced rate of 2 times the Issue rate or double the prevailing market rate if the material is issued free of charge.

c) **Structural steel:**

Maximum wastage permitted will be 5% of the theoretical consumption. If the wastage is more than 5% of the steel billed for, then the excess wastage above 5% limit shall be recovered at an enhanced rate of 2 times the Issue rate or double the prevailing market rate if the material is issued free of charge.

d) All the surplus and serviceable mild, tor steel as well as structural steel, if issued by the Project Authority/ Owner of length more than 2m in case of bars and other sections and of size 1mx1m in case of plates shall be weighed category-wise and returned to the Project Authority/ Owner after the completion of the works. Likewise all surplus and serviceable cement bags in original condition shall be returned to the Project Authority/ Owner after the completion of the works.

e) Pursuant to clause 7.1 of Special Conditions of Contract, an additional quantity of 5% of the billed quantity of mild, tor steel as well as structural steel and theoretical quantity of cement consumed shall be recovered from each interim bill. The actual wastage of the materials issued shall however be derived in the final bill and considered for reconciliation.

6.0 **Rolling Margin: (Not applicable for this contract)**

6.1 Compensation shall be paid to the contractor in case the actual weight of the steel bars is more than the corresponding theoretical weight. For this, the contractor has to raise his claim before utilizing the steel and within 15 days of the receipt of the steel consignment at site.

6.2 Procedure for testing & recording of steel issued

Random samples, minimum 3 samples per consignment of 10 MT or less shall be taken and the average of these tests shall be taken as governing coefficient for a consignment.

6.3 Samples shall be taken jointly & immediately upon the arrival of the consignment and suitably marked and identified. Samples shall be kept in safe custody of the Engineer for future verification if required.

6.4 Records to be maintained clearly, showing consignment date, supplier, quantity of steel received and the area where the steel is used along with the test result.

6.5 Compensation towards the rolling weight difference shall be considered only in case the actual total wastage is more than 5% of the consumption as per the interim bill for the quantity of the round bar and tor steel used. No compensation shall be considered in individual categories of steel bars, where the wastage is 5% or less.

6.6 The permissible wastage of 5% is deemed to take in to account the 2.5% difference on account of rolling difference and 2.5% towards the wastage and therefore no compensation shall be considered up to 2.5% difference in rolling margin.

6.7 The compensation shall be worked out lot wise as under:-

The excess weight on account of the rolling weight difference of more than 2.5% shall be calculated per consignment i.e. if the actual weight per metre length as per the test result is "a", kg/metre, as against the theoretical unit weight "t", kg/m, for a consignment of "W"; then

100 X (a/t)-1)= x% shall be the difference on account of the rolling difference.

W X (x - 2.5)/100 MT shall be deducted from the gross issue for the purpose of recovery of steel issued.

On no account this difference shall be considered for the payment as per item rates for fabrication of reinforcement steel works.

The above calculation shall be done for each individual lot separately, subject to the clauses 6.2 & 6.3 hereof and the total for all such lots, where there is more than 2.5% variation in rolling weight, shall be considered.

However, the total quantity to be considered for the reduction towards the rolling margin from the total quantity issued shall be limited to the gross wastage in excess of 5% of the net consumption of steel.

SECTION - VII

SCHEDULE OF SUPPLEMENTARY INFORMATION

The bidder shall provide the Supplementary Information as Annexed in the form of schedules mentioned hereunder. All these supplementary information shall be considered for the bid evaluation and same in the contract execution. If the requisite information is not supplied by the bidder then the bid may be considered non-responsive and shall be rejected.

a)	Schedule	I	Major items of construction plant to be deployed by the bidder.
b)	Schedule	II	Key Personnel.
c)	Schedule	III	Nominated Sub-Contractors.
d)	Schedule	IV	Major works successfully completed during the last five years.
e)	Schedule	V	Statement of Bonus earned/ Liquidity damages paid in the last five years.
f)	Schedule	VI	Statement of Arbitration & Disputes in the last five years.
g)	Schedule	VII	Financial Business Capability.
h)	Schedule	VIII	Works in hand
i)	Schedule	IX	Details of structural consultants/external laboratory to be appointed
J)	Schedule	X	Manufacturer's authorization form

Signature and seal of Bidder

SECTION – VII

SCHEDULE - I

Major items of Constructional plant to be deployed by the bidder.

Sr. No.	Description of Equipment	Nos. available with the Bidder in working condition.	Nos. Proposed to be deployed at site.
1.	Concrete Mixers		
2.	Vibrators		
	a) Needle type		
	b) Surface type		
3.	Weigh Batcher		
4.	Concrete Cube Testing Equipment		
5.	Steel Scaffolding		
6.	Shuttering Material		
7.	Water Pumps		
8.	Air Compressors		
9.	Welding Equipment		
10.	Elevators		
11.	Vacuum Dewatering Equipment		
12.	Power Trowel & Floater		
13.	D.G. Set		

Signature and seal of Bidder

SECTION - VII

SCHEDULE – II

KEY PERSONNEL

		No. of persons employed with the bidder	No. of persons to be deployed for the project.	
			Office	Site
1.	Technical Personnel			
	a) Senior Engineer			
	b) Site Engineer (Degree holder)			
	c) Junior Engineer (Degree holder)			
2.	Supervisory Personnel			
	a) Supervisor (Diploma holders)			
	b) Foremen			
	c) Technicians			
3.	Other key staff			

Signature and seal of Bidder

SECTION - VII

SCHEDULE – III

Nominated Sub-contractor

(List of works of value more than 10% of the contract value proposed to be sublet)

Sl. No.	Description	Approximate Value Rs.	Name of the Sub-contractor	Place where similar works previously executed.

Signature and seal of Bidder

SECTION - VII

SCHEDULE – IV

Major works successfully completed during the past five years :

Sr. No.	Name of work	Place	Contract Reference	Name of Client	Value of Work	Time of Completion	Date of Completion

Note: Documentary evidence for above information to be attached separately.

Signature and seal of Bidder

SECTION - VII

SCHEDULE – V

Statement of Bonus earned/ Liquidity damages (L.D.) paid in the past five years :

Sl. No.	Name of Work	Place	Contract reference	Name of Owner	Value of Work	Time of Completion		Bonus/ L.D.
						Contract	Actual	

Signature and seal of Bidder

SECTION - VII

SCHEDULE – VI

Statement of Arbitration & disputes in the last five years.

Sl. No.	Name of Work	Place	Contract reference	Name of Client	Value of Work	Nature of Dispute	Award of Arbitration

Signature and seal of Bidder

SECTION - VII

SCHEDULE – VII

Financial and Business Capability.

1.	Audited annual accounts/ Accounts audited under section 44AB of Income Tax Act of past 3 years	:
2.	Where accounts are not required to be audited following information shall be given for last three years duly attested by a Charted Accountant/ Manager of nationalized Bank.	:
a.	Share Capital	:
	Free Reserves	:
	Other Reserves	:
b.	Term loans from financial institutions & banks	:
c.	Current Liabilities	:
	Bank Cash Credits	:
	Others (Including sundry creditors)	:
d.	Provisions	:
e.	Contingent Liabilities including claims not acknowledged	:
f.	Fixed Assets	:
	Gross	:
	Net	:
g.	Cash and Bank Balances	:
h.	Inventories	:

i. Debtors & Advances considered good

More than 6 months :

Less than 6 months :

j. Profit before tax :

k. Loss, if any :

3. Other information

Name of the Bankers :

Bank facilities including credit limits :

4. Projected turn over for the next two years

Year 1 :

Year 2 :

Signature and seal of Bidder

SECTION - VII

SCHEDULE - VIII

WORKS IN HAND

Sl. No.	Name of Work	Contract reference	Name of Client	Place of Contract	Value of Contract	Completion	
						Period	Date

Signature and seal of Bidder

SECTION VII

SCHEDULE - IX

DETAILS OF STRUCTURAL CONSULTANTS/EXTERNAL LABORATORY TO BE APPOINTED FOR THE WORKS

Sr. No.	Name of the Consultant/Firm	Address and Registration No.	Name of the Contact person	Telephone No.
1.	Structural Consultant (Please indicate at least two preferences)			
2.	Environmental Laboratory Approved by State Pollution Control Board (Please indicate at least two preferences)			

SECTION – VII

SCHEDULE - X

(Please see clause 14.3 of Instructions to Bidders')

MANUFACTURERS' AUTHORISATION FORM

No.....

To
THE ORISSA STATE CO-OPERATIVE
MILK PRODUCERS' FEDERATION LTD.,
D - 2, SAHID NAGAR, BHUBANESWAR
PIN – 751 017.

Dear Sir,

Sub: IFB Ref. No. OMFED: BHUB-D: ETP:__

We..... an established and reputable manufacturers of ..... having factories at .....and .....do hereby authorize M/s..... (Name and address of Agents) to bid, negotiate and conclude the contract with you against IFB No. _____for the above goods manufactured by us.

We confirm that we shall be in a position to deliver the above mentioned goods within…..... months.

We hereby extend our full guarantee and, warranty as per clause 15. of the General Conditions of Contract for the goods offered for supply against this invitation for bid by the above firm.

Yours faithfully,

(NAME)
for and on behalf of M/s.
(Name of Manufacturers)

Note: This letter of authority should be on the Letter-Head of the manufacturing concern and should be signed by a person competent and having the power of attorney to bind the manufacturer.

SECTION VIII

FORM OF AGREEMENT FOR EFFLUENT TREATMENT PLANT

(On Non-Judicial Stamp Paper of minimum value of Rs. 100/- or as per Stamp act of local state Govt.)

THIS AGREEMENT is made and executed on the_____day of_____ (Two thousand_____) between THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LIMITETD and having its registered office at BHUBANESWAR – 751 007 (herein after referred to as OMFED which expression shall, unless repugnant to the context or meaning thereof, include the successors and assignees of the OMFED) of the ONE PART and _____

_____

_____

_____ (herein after referred to as the Contractor, which expression, shall, unless repugnant to the context or meaning thereof, include the heirs, successors, assignees, executors and administrators of the Contractor) of the OTHER PART.

WHEREAS the OMFED is desirous that certain Works should be executed, viz _____

_____ and has, by Letter of Acceptance dated _____, accepted a bid by the Contractor for the execution, completion and maintenance of such works, **NOW THIS AGREEMENT WITNESSTH AS FOLLOWS:**

1.0 In this agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2.0 The following documents shall be deemed to form and be read and construed as a part of this agreement, viz

i) this Form of Agreement
ii) the Letter of Acceptance
iii) the said bid and Appendix
iv) the Technical Specifications
v) the Schedule of Quantities
vi) the Drawings
vii) the Schedule of Supplementary information
viii) Special Conditions of Contract
ix) General Conditions of Contract
x) Form of Bank Guarantees

* The Contractor shall not fill up this form.

3.0 The aforesaid documents shall be taken as complementary and mutually explanatory of one another, but in the case of ambiguities and discrepancies shall take precedence in the order set out above.

4.0 In the consideration of the payment to be made by the OMFED to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the OMFED to execute, complete and maintain the works in conformity in all respects with the provisions of the Contract.

5.0 The OMFED hereby covenants to pay the Contractor in consideration of the execution, completion and maintenance of the works the Contract Price at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF the parties hereto have caused their respective Common Seals to be hereunto affixed the day, month and year first above written.

Signed, sealed & delivered for and on behalf of the within named OMFED by the hands of its Authorized Signatory.

Authorized Signatory

The Orrisa Milk Producers' Contractor
Federation Limited (OMFED)
In the presence of:

WITNESS:

1. Signature

   Name

   Address

2. Signature

   Name

   Address

Signed, sealed and delivered for and on behalf of the within named Contractor, the other part.

Authorized Signatory

In the presence of:

WITNESS

1. Signature

   Name

   Address

2. Signature

   Name

   Address

Note: The above value of stamp duty should be minimum Rs.100/- or as per latest notification of Local Government.

SECTION IX

Acceptable Forms of Bank Guarantees

Table of contract

1.0 Form of Bank Guarantee for Performance Security (On Non-Judicial Stamp Paper of Rs.100 minimum or as per the stamp act of local State Govt.)

Bank Guarantee no. Date :

This deed of guarantee made this _____day of _____ (Two thousand _____by (Name and the address of the Bank), hereinafter 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 Orrisa State Co-operative Milk Producers' Federation Limited, Bhubaneswar (hereinafter referred to as the OMFED) which expression shall unless repugnant to the context AND meaning thereof include its legal representative, successors or assignees.

Where as OMFED/its clients has awarded a contract bearing no.____ _____dated_____ on M/s. _____ _____(name and the address of the party), hereinafter referred to as the Contractor, for the execution, completion and the maintenance of _____ And whereas, the Contractor has agreed to submit a performance security in the form of a bank guarantee to the OMFED as per the 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 Period of Maintenance). And whereas, the bank and its duly constituted agent and officer has already read and understood the Contract made between the OMFED and the Contractor.

In consideration of the OMFED having agreed to award the Contract on the Contractor, we _____ (the name of bank), do hereby guarantee, undertake, promise and agree to with the OMFED, its legal representatives, successors and assignees that the within named (the name of the Contractor) their legal representatives and assignees will faithfully perform and fulfil everything within the bidding document and the Contract 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 thereunder and we further undertake and guarantee to make payment to the OMFED a sum of Rs._____ (Rupees_____ _____ only) without any demur, in case the Contractor, their legal representatives and assignees do not faithfully perform and fulfil everything within the bidding document and the Contract 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 Contractor fails to perform or fulfil the Contract as per the terms and conditions agreed upon, the OMFED is entitled to demand an amount equal to Rs. ---------- from the Contractor and the demand made by the OMFED itself will be conclusive evidence and proof that the Contractor has failed to perform or fulfil his obligations under the Contract and neither the Contractor nor the Bank will be entitled to raise any dispute regarding the reasons for the failure of performance or fulfillment on any ground whatsoever.

We, (the name of the Bank), do hereby undertake to pay an amount equal to Rs. ----------, being the amount due and payable under this guarantee, without any demur, merely on a demand from the OMFED which has to be served on us before the expire 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 Contractor or by the reason of the Contractor's failure to perform the said contractual commitments , 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).

We, (the name of bank), further agree that the performance security herein contained shall remain in full force and effect for a period of _____ calendar months from the date of the bank guarantee (the period shall be till the end of Period of Maintenance)and till the OMFED certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said Contractor and accordingly discharge the guarantee, unless a demand or a claim under this guarantee is made on us in writing by the OMFED on or before _____ we shall be discharged from all liabilities under this performance security thereafter.

We, (the name of bank), further agree with the OMFED that the OMFED shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and the conditions of said bidding document and the Contract or to extend the time of performance by the said Contractor from time to time or postpone for any time or from time to time and any of the power exercisable by the OMFED against the Contractor and to forebear or enforce any of the terms and conditions relating to the said bidding document and the Contract and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor, or for any forbearance, act or omission on the part of the OMFED to the said Contractor 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 OMFED may have or hereafter possess in respect of the works executed or intended to be executed and the OMFED shall be under no obligation to marshal in favour of the bank any such securities or funds or asset that the OMFED may be entitled to receive or have a claim upon and the OMFED 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 OMFED 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 effects 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, _____, undertake to renew the Bank Guarantee provided the request for renewal is made by the contractor before the expiry of Bank Guarantee._

We, _____, lastly undertake not to revoke this guarantee during its currency except with the previous consent of the OMFED in writing and the guarantee shall be a continuous and irrevocable guarantee up to a sum of Rs_____ (Rupees _____.) only.

Notwithstanding anything stated herein before : (i) our liability under this guarantee is restricted to Rs_____ (ii) the guarantee shall remain in force till _____ and (iii) the Bank is liable to pay the guarantee amount or any part thereof under this bank guarantee only if the OMFED serves upon the Bank a written claim or demand on or before _____.

SIGNATURE

PLACE

BANK SEAL

DATE

BANK CODE NO.

NOTE:

1: The contractor should ensure that the seal and the 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 Contractors.

3: The value of stamp duty should be minimum Rs.100 or as per the latest stamp act of local State Govt. from where the Bank Guarantee is issued.

2.0 Form of Bank Guarantee for Bid security (On the Non-Judicial Stamp Paper of Rs. 100 minimum or as per the stamp act of local state Govt.)

Bank Guarantee No: Date:

This deed of guarantee made this _____ day of _____ (two thousand and _____) by (Name and the address of the Bank), hereinafter referred to as the Bank, which shall unless repugnant to the context and the meaning thereof includes its legal representatives, successors and assignees and The Orrisa State Co-operative Milk Producers' Federation Limited, Bhubaneswar, (hereinafter referred to as the OMFED) which expression shall unless repugnant to the context and meaning thereof include its legal representative, successors or assignees.

Whereas the OMFED has invited bids for the Construction of the proposed _____ _____ by the Invitation to bid no._____.

AND WHEREAS M/s _____ _____ (Name and the Address of the bidders) who having submitted their bids (hereinafter referred to as the bidder) and have agreed to deposit to the OMFED an amount indicated in the Invitation to bid as per the terms and the conditions of the bidding documents. AND WHEREAS the OMFED is also willing to accept a Bank guarantee in lieu of payment by demand draft of an amount equivalent to the amount of bid security required to be deposited by the bidder to the OMFED and the guarantee shall be kept valid for 120 days after the day of the opening of the bids.

In consideration of the OMFED having agreed to consider the bid proposals having submitted by the bidder without depositing the amount of bid security and against this Bank guarantee, we (name and the address of the Bank) hereby undertake and guarantee to make payment to the OMFED the amount of bid security or any part thereof not deposited by the bidder to the OMFED at any time (time being the essence of the Contract) when the OMFED asks for the same as per the terms and the conditions of the bidding documents within 120 days from the date of opening of the bids.

The Bank further undertakes not to revoke this guarantee during its currency except with the previous consent of the OMFED in writing and the guarantee shall be continuous and irrevocable guarantee upto a sum of Rs. _____ (Rupees _____ only) provided always that any indulgence or forbearance on the part of the OMFED to the said bidder, with or without the consent of the Bank shall not prejudice or restrict remedies against the bank nor shall the same in any event be a ground of defence by the Bank against the OMFED.

In case the OMFED puts forth a demand in writing on the Bank for the payment of the amount in full or in part against this Bank guarantee, the Bank will consider without demur that such demand by itself is a conclusive evidence and proof that the bidder has failed in complying with the terms and conditions stipulated by the OMFED in its bidding document and payment will be made to the without raising any disputes regarding the reasons for such failures on the part of the bidder.

The Bank shall not be discharged or released from this guarantee by any arrangement between the bidder and the OMFED with or without the consent of the Bank or any alterations in the obligations of the parties or by an indulgence, forebearance shown by the OMFED to the bidder.

This guarantee shall be in addition to and without prejudice to any other securities or remedies which the OMFED may have or hereafter possess against the bidder and the OMFED shall be under no obligations to marshal in favour of the Bank any such securities or fund or assets that the OMFED at its absolute discretion may vary, exchange, renew, modify or refuse to complete or enforce or assign any security or instrument.

The Bank agrees that the amount hereby guaranteed shall be due and payable to the OMFED 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 despatch thereof to the Bank by registered post at the address of the said Bank.

In order to give full effect to the provisions of this guarantee the Bank thereby waives all rights inconsistent with the above provisions and which the Bank might otherwise as a guarantor be entitled to claim and enforce.

The guarantee shall remain in force until _____ and the Bank undertakes to renew the Bank Guarantee provided the request is made by the bidder before the expiry of Bank Guarantee.

Notwithstanding anything stated hereinbefore:(i) our liability under this guarantee is restricted to Rs. _____ (Rupees _____ _____ only) (ii) The bank guarantee shall remain in force till_____ ___ and (iii) The bank is liable to pay the guarantee amount or any part thereof under this bank guarantee only if the OMFED serves upon the Bank a written claim or demand on or before_____.

Place
Date:

Signature

Bank Seal

Bank Code no.

Note :

(i) Bidders should ensure that the seal and code no. of signatory is put by the Bankers , before submission of the Bank guarantees.

(ii) Stamp paper is not required in case of Foreign Contractors.

(iii) The value of stamp duty should be minimum Rs 100 or as per latest stamp act of local state govt. from where the bank guarantee is issued.

3.0 Form of Bank Guarantee for Retention Money (on Non-judicial Stamp Paper of Rs. 100 minimum or as per Stamp act of local State Govt.)

Bank Guarantee no. Date:

This deed of guarantee made this _____ day of _____ (two thousand _____) by_____ (Name and the address of the Bank), hereinafter referred to as "the Bank", which express where the context and the meaning so require, include its legal representatives, successors and assignees of the bank and The Orrisa State Co-operative Milk Producers' Federation Limited, Bhubaneswar (hereinafter referred to as the OMFED) which expression shall unless repugnant to the context and the meaning thereof include its legal representative, successors and assignees.
WHEREAS the OMFED has placed its Contract order bearing no. _____ dated _____ on (name and address of the party) hereinafter called the Contractor, for the construction of_____ _____ _____
AND WHEREAS the OMFED has agreed to pay to the Contractor the retention money i.e. 5% of the value of the Contract on submission of a Bank guarantee of equal amount, which will be kept valid upto _____.

In consideration of the OMFED having agreed to pay to the Contractor Rs._____ (Rupees_____ _____ only) being the retention money we (the Bank), hereby undertake and guarantee to make repayment to the OMFED of the said amount without any demur or any part thereof which does not become payable to the Contractor by the OMFED in accordance with and subject to the terms and conditions of the said Contract. The Bank further undertakes not to revoke this guarantee during its currency except with the previous consent of the OMFED in writing and this guarantee shall be a continuous and irrevocable guarantee upto a sum of Rs. _____ (Rupees _____ _____ _____ only).

The Bank shall not be discharged or released from this guarantee by any arrangement between the Contractor and the OMFED with or without the consent of the Bank or any alterations in the obligations of the parties or by an indulgence, forbearance shown by the OMFED to the Contractor and the same shall not prejudice or restrict remedies against the Bank nor shall the same in any event be a ground of defence by the Bank against the OMFED. We (name of bank) do hereby undertake to pay an amount equal to Rs. _____ being the amount due and payable under this guarantee without any demur, merely on a demand from the OMFED stating that the amount claimed is due to the OMFED. In case, the OMFED putforth a demand in writing on the bank for the payment of amount in full or in the part against this bank guarantee, the bank shall consider that such demand by itself is conclusive evidence and proof that the contractor has failed in compliance with the terms and conditions stipulated by OMFED in the contract and payment shall be made to OMFED without raising any such lapse/ failure on the part of the contract.

This guarantee shall be in addition to and without prejudice to any other securities or remedies which the OMFED may have or hereinafter possess in respect of the works executed or intended to be executed and the OMFED shall be under no obligation to marshal in favour of the bank any such securities or funds or assets that the OMFED may be entitled to receive or have a claim upon and the OMFED 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 OMFED on OMFED's 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 despatch thereof to the Bank by registered post at the address of the said Bank.

We, _____, undertake to renew the bank guarantee provided the request for renewal is made by the contractor before the expiry of bank guarantee.

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 guarantor be entitled to claim and enforce.

Notwithstanding anything stated hereinbefore: (i) our liability under this guarantee is restricted to Rs. _____ (Rupees _____ _____ only), (ii) The guarantee shall remain in force till _____ _____and (iii) The Bank is liable to pay the guarantee amount or any part therof under the bank guarantee only if the OMFED serves upon the Bank a written claim or demand on or before_____.

Place

Signature

DATE

Bank Seal

Bank Code no.

Note :

1: **Contractor should ensure that the seal and code no. of signatory is put by the Bankers , before submission of the Bank guarantees.**

2: **Stamp paper is note required in case of Foreign Contractor.**

3: **The value of stamp duty should be minimum Rs.100 or as per latest stamp act of local state Govt. from where the Bank Guarantee is issued.**

SCHEDULE OF QUANTITIES FOR SALAPADA DAIRY

1.0 TOTAL PRICE

S. NO	DESCRIPTION	UNIT	UNIT RATE (IN RS.)	TOTAL RATE (IN RS.)
1	Design, Construction/Fabrication, Supply, Erection, Testing Commissioning, & Guarantee test-run including all necessary Civil, Mechanical, Instrumentation and Electrical works etc. complete including taking statutory approvals on a turnkey basis for the Effluent Treatment Plant as per the schedule of requirement and technical specifications given in the bidding document	1 JOB		
2.	Statuary approval and inspection.	01 Job		
3.	AMC after handed over of effluent treatment plant for three years including supply of labour tools and chemical used for the treatment process.	01 Job (for Three year)		
Total				

_____

(Rupees----------only)

2.0 BROAD BREAK-UP OF PRICES

S.NO	DESCRIPTION	AMOUNT IN RS.
1.	Civil Works and piping	
2.	Mechanical & Instrumentation	
3.	Electrical Works	
4.	Testing, commissioning and Coordination for statutory approvals	
	Total	

(Rupees----------only)

3.0 BREAK-UP PRICES OF CIVIL WORKS, LIGHTING & PIPING

SR. NO.	UNIT	QTY.	UNIT RATE (RS.)	AMOUNT (RS.)
1	Inlet flow meas. channel	**1 No.**		
2	Screen chamber	**1 No.**		
3	Collection Chamber	**1 No.**		
4	Fat removal Unit	**1 No.**		
5	Equalization / Homosoniser tanks	**1 No.**		
6	UASB digester with fill & draw Tank	**1+1 No.**		
7	Splitter box at Aer. tank	**1 No.**		
8	Aeration Tank - I	**1 No.**		
9	Aeration Tank - II	**1 No.**		
10	Primary Clarifier	**1 No.**		
11	Secondary Clarifier & Sludge Thickness Holder Tank	**1+1 No.**		
12	MCC cum operator room	**1 No.**		
13	Filter Press room & filter room.	**1 No.**		
14	V Notch Chamber	**1 No.**		
15	Raw Effluent /Sludge pump pads	**2 Nos.**		
16	Gas Holder Tank with accessories etc.	**1No.**		
17	Treated Effluent Collection Tank	**1 No.**		
18	Treated Water Disposal Pump Pad	**1 No**		
19	Sludge drying bed	**2 Nos.**		
20	Interconnecting path way / steps / stair for the entire plant including lighting.	**01 lot**		
	Total in RS.			

(Rs ---------- ONLY)

4.0 BREAK-UP PRICES OF MECHANICAL EQUIPMENT/INSTRUMENTATION AND ELECTRICAL SUPPLY AND ERECTION COSTS

Mechanical Equipment/ Instrumentation

SR. NO.	UNIT	QTY.	UNIT RATE (RS.)	AMOUNT (RS.)
1	flow measurement and integration instrument	**01 set**		
2	on / off Auto system for all inlet chambers Motor	**02 set**		
3	Bar rack (coarse and fine) for screen chamber	**01**		
4	Diffused air blower & Slow speed floculator with scrapper mechanism for fat , oil removal tank & Homozoniser	**02+01**		
5	Homonised effluent pumps	**02 set**		
6	Settler arrangement for UASB digester	**01+01**		
7	Fixed Aerator for Aeration Tank	**02**		
8	Clarifier / Tube settler	**01+01**		
9	Sludge recirculation pumps	**03**		
10	Filter Press recede type 16 plate manual operated.	**01**		
11	Calibrated V Notch plate for V Notch Chamber	**01**		
12	Final treated water disposal pump	**2 nos.**		
13	Sludge transfer pump with all fitting and accessories as required	**02 nos.**		
14	Air Blower	**02 no.**		
15	Chemical Dosing System	**01 no.**		
16	Valve, pipes & fitting and fixture with all accessories	**01 lot.**		
	Total in Rs.			

(Rs. ---------- **only)**

ELECTRICAL EQUIPMENT:

SR. NO.	UNIT	QTY.	AMOUNT IN RS.
1	Motor control Centre as per design complete with all structure as per Ele. Std.	1 NO	
2	Incoming power cable to MCC (3.5 x 95 sq.mm,AL arm ,pvc)	120 M	
3	Power and control cables. (MCC to Equipment)	1 LOT	
4	Earthing system, isolator /PB station etc.	1 LOT	
5	Power capacitor	1 NO	
6	Lighting DB	1 NO	
	Total		

(Rs. ---------- ONLY)

Note:

1. Though breakup prices has been asked above. This is only to facilitate preparation & payment of bills and this breakup prices shall not be considered for evaluation of bids or additional payments in case there is any variation in quantity, as total price of bid is on turnkey basis FOR site inclusive of all taxes, duties, work contract tax etc. & installation.

2. Unit rate to be indicated for following to take care of variation as mentioned in battery limits.

2.1 Piping from existing last manholes to ETP Plant --Rs/metre.

2.2 Gas piping from ETP for reuse -------Rs/metre.

2.3 Treated Effluent piping from the V notch to the point of disposal /reuse ----Rs/metre

2.4 Incoming cable to MCC ----Rs/metre.

5.0 PERCENTAGE BREAK-UP OF UNIT-WISE PAYMENT FOR CIVIL WORKS

(Ref Clause no 91.2 of section ll)

1. **Inlet chamber /Screen chamber/ Fat removal unit/Equalization Tank/ Splitter box/Aeration tank/Clarifier tank/V Notch chamber/ Pump pads/Treated effluent collection tank/Other units not referred specifically**

a. On completion of earthwork excavation - 08 %
b. On completion of PCC & RCC raft including reinforcement - 40 %
c. On completion of RCC walls upto full height - 27 %
d. On completion of plastering inside and outside - 07 %
e. On completion of flooring - 03 %
f. On completion of water fill test - 08 %
g. On completion of whitewashing/ snowcem/ bitumen painting - 04 %
h. On completion of Miscellaneous items like railing,ladders,plinth protection etc - 03 %

2. MCC, Lab cum Operator Room

a. On completion of earthwork excavation - 06 %
b. On completion of PCC, Footings & RCC columns upto plinth level including reinforcement and Bk. walls upto PL - 30 %
c. On completion of brickwork upto slab stage - 10 %
d. On completion of RCC columns, beams and slabs - 12 %
e. On completion of water proofing - 05 %
f. On completion of flooring - 05 %
g. On completion of fixing of doors, windows and ventilators/rolling shutters - 05 %
h. On completion of internal and external plaster - 08 %
i. On completion of whitewashing/snowcem painting etc. complete - 05 %
j. Internal Electrification including fittings fixtures etc. - 10 %
k. On completion of miscellaneous items like fixtures, plinth protection etc. - 04 %

3. UASB Digestor/ Gas Holder

a. On completion of earthwork excavation - 08 %
b. On completion of PCC & RCC raft including reinforcement - 30 %
c. On completion of RCC walls up to full height - 22 %
d. Providing water proofing plaster - 08 %
e. On completion of plastering outside - 07 %
f. On completion of flooring - 03 %
g. On completion of internal structures such as 'Settler', floating dome, guide frame, interconnecting piping, etc. as applicable - 18 %
h. On completion of whitewashing/snowcem/ bitumen painting, plinth protection etc. - 04 %

4. Flare Stack

a. On completion of earthwork excavation - 07 %

b. On completion of PCC & foundation - 30 %
c. On erection of inner and outer shell - 40 %
d. On completion of burner installation, pipe connections to the stack, ladder - 20 %
e. On completion of painting, finishes etc. - 03 %

5. **Sludge Drying Beds**

a. On completion of earthwork in excavation - 05 %
b. On completion of PCC at the bottom - 10 %
c. On completion of brick masonry up to full height - 40 %
d. On completion of drain channels and fixing of suitable gates - 05 %
e. On completion of filter media laying - 30 %
f. On completion of plastering on both sides and completion of miscellaneous works such as plinth protection etc. - 10 %

6.**Interconnecting Piping, Valves, safety devices, valve chambers etc.**:

a. On the supply of pipes - 50 %
b. On the supply of valves, specials, safety devices. - 30 %
c. On the construction of valve chambers - 10 %
d. On the erection of all pipe lines ,valves etc. - 10 %

7. **Interconnecting pathways/steps/area lighting**:

a. On the excavation for the pathways - 10 %
b. On laying of PCC - 20 %
c. On supply & dressing of rough kotah stones - 30 %
d. On laying of stones & joining - 20 %
e. On construction of steps if required & providing area lighting - 20 %

Important Note:

Bill certification shall be for 80 % of the above amount.

BIDDING TERMS DEVIATION STATEMENT FORM

1.) The following are the particulars of deviations from the requirements of the bidding conditions/ terms:

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

The terms and conditions prescribed 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.

Dated :- Signature and seal of Bidder

Note :-

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “NO DEVIATIONS”.

TECHNICAL DEVIATION STATEMENT FORM

1.) The following are the particulars of deviations from the requirements of the tender specifications :

CLAUSE	DEVIATION	REMARKS (INCLUDING JUSTIFICATION)

The technical specification 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.

Dated :- Signature and seal of Bidder

Note :-

Where there is no deviation, the statement should be returned duly signed with an endorsement indicating “NO DEVIATIONS”.

LIST OF APPROVED MAKES

The following is the list of products and name of the approved manufacturer against each product. The contractor shall quote rates for the various items of works using these products based on maximum two makes out of these approved manufacturers selected & filled up in format given below by the bidder. Any other make of product, not approved below, shall not be allowed for use in this work unless specifically approved in writing separately by the purchaser after establishing its technical suitability, price availability & effect on price quoted by contractor for the item where this item is being used. If no make has been selected by the bidder, the purchaser shall be at liberty to advice the contractor to use any of the approved manufacturer given below for any product of this contract.

SL. No.	ITEM DESCRIPTION	STANDARD MANUFACTURER/MAKES	(MAX. TWO)
	CIVIL ITEMS		
1.	GREY CEMENT	ACC/JK/LAKSHMI/VIKARM/ LT/ KONARK	
2.	REINFORCEMENT STEEL	SAIL/TISCO/KAMDHENU/RATHI/ VIZAG STEEL	
3.	CONCRETE ADMIXTURES	SIKA/FOSROC/CHEMISTIC/FRC/METCONETE/CICO	
4.	PAINTS	ASIAN/BERGER/J&N	
	CEMENT PAINT	SUPER SNOCEM/NITCOCEM	
5.	CI PIPES & FITTINGS MANHOLE FRAMES	RIF/SRIF	
6.	GI / MS PIPES	TATA/JINDAL/BST/SURYA ROSHNI	
7.	GI FITTINGS	'R' BRAND/UNIK/KS	
8.	RCC HUME PIPES	INDIAN HUME PIPE CO.	
9.	PRESSED STEEL DOOR/WINDOWS FRAMES	PERFECT INDUSTRIAL PRODUCTS/TIL	
10.	STANDARD ROLLED	AGEW/AHMEDABAD STEEL CRAFT	
11.	GLAZED TILES	SOMANI/ORIENT/JOHSON & JOHNSON	
12.	PVC WATER STOPS	MARUTI	
13.	PP BALL VALVES	DINESH PLASTIC/JYOTI PLASTIC/VISHAL/POLY VALVES	
14.	HDPE PIPES AND FITTINGS	PIL/HASTI/KWH/ORIPLAST HELIPLASTICS/EQUIVALENT	
15.	HDPE PIPES AND FITTINGS	PIL/HASTI/KWH HELIPLASTICS/EQUIVALENT/ ORIPLAST	
16.	FLAME ARRESTOR	HGE/EQUIVALENT	
17.	LEVEL SWITCHES	PREMIER/LEVCON/CHEMTROLS/RICH SYSTEMS/EQUIVALENT	
17.	PRESSURE GAUGE	H.GURU/GLUCK/BELLS/FIEBEG	
18.	CI BUTTERFLY VALVE	AUDCO/KSB/LEADER/BDK	
19.	CI SLUCE/ CHECK VALVE	AUDCO/LEADER/BDK	
20.	CI PIPES AND FITTINGS	RIF/SRIF	
21.	GI FITTINGS	R BRAND/UNIK/KS	
22.	SW PIPES	PERFECT/BURN	
23.	PRESSED STEEL DOORS/WINDOWS FRAME	PERFECT INDL. PRODUCTS/PIL	
24.	GLAZED TILES	SOMANI/ORIENT/JOHNSON & JOHNSON	
	ELECTRICAL ITEMS		

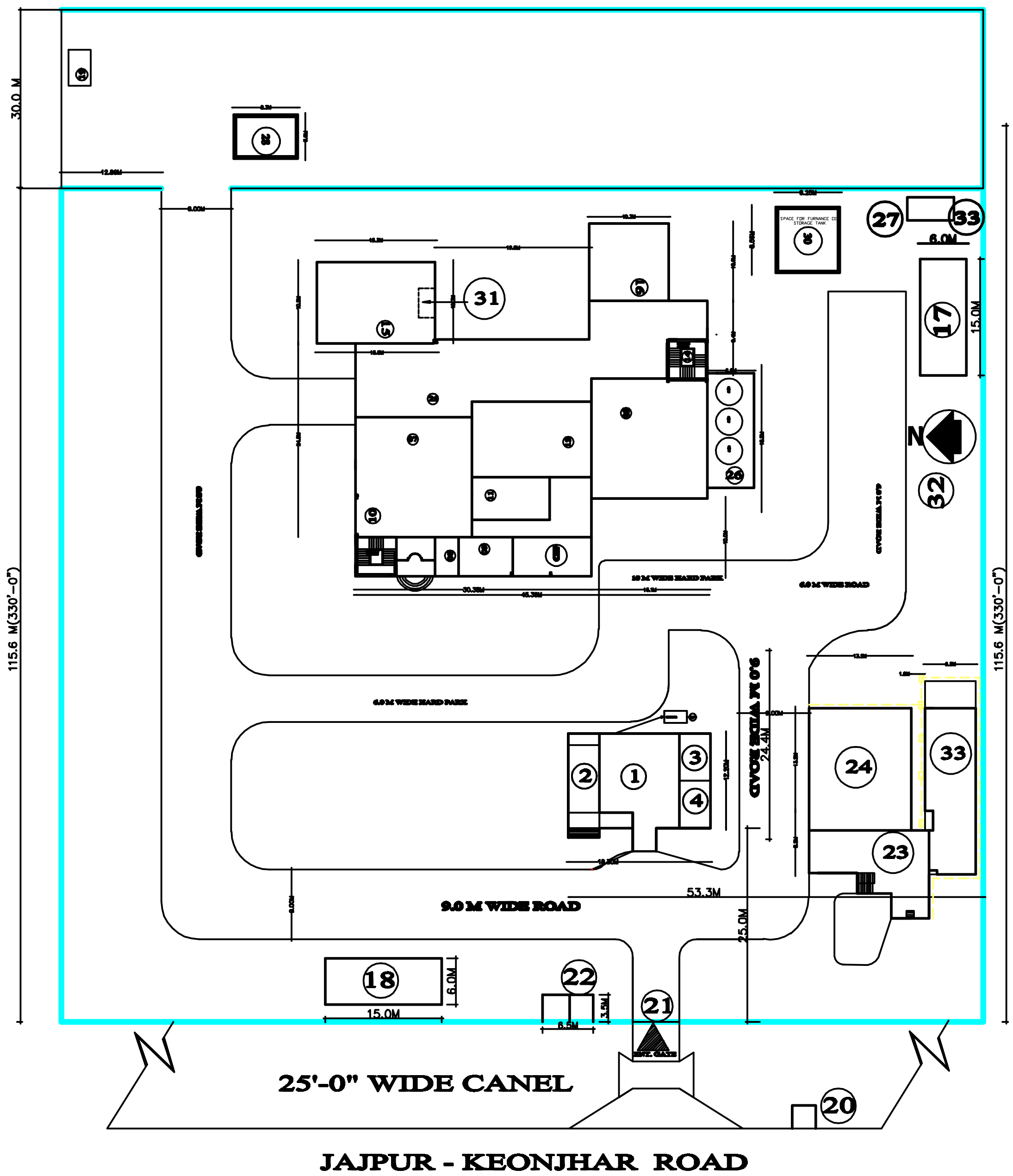
1.	LT SWITCHGEAR	L&T/SIEMENS/ALSTOM/GEC ALSTHOM/GROUP SCHNIEDER	
2.	AMMETERS / VOLTMETER	AE/IMP/MECO/ENERCON	
3.	CURRENT TRANSFORMER	AE/IMP/MECO	
4.	MCB / RCCB	MDS (LEXIC)/SIEMENS/GROUP SCHNIEDER/HPC/INDO/KOPP/HAVELLS	
5.	MCCB	L&T/SIEMENS/MDS (LEGRAND)	
5.	ENERGY METER ELECTRONIC	HPCL/UNIVERSAL/SECURE METER/L&T/ REIL	
6.	POWER / CONTROL CABLES, WIRES	CCI / FORT/GLOSTER/FINOLEX/SKYTONE /ROLEX	
7.	INDICATION LAMPS LED TYPE	BINAY/SIEMENS/L&T	
8.	WEATHER PROOF BOXES FOR ISOLATORS, PUSH BUTTONS	HANSU/HENSEL	
9.	ELECTRIC MOTORS	SIEMENS/BHARAT BIJLEE/CROMPTON/GE ALSTHOM/KIRLOSKAR	
	MECHANICAL EQUIPMENT		
1.	EFFLUENT NON CLOG PUMPS	KIRLOSKAR/STORK/JYOTI/KSB/MAXFLOW	
2.	AGITATOR FOR FLOATING AERATOR	VOLTAS/HE/AMITRON/SACEDE/PARAMOUNT/ENVI RAD/EQUIVALENT	
3.	REDUCTION GEAR BOX	RADICON/POWER BUILD/ESSENPRO	
4.	AERATOR	VOLTAS/AMITRON/PARAMOUNT/HE/SACEDE/ENVI RAD/EQUIVALENT	

NOTE: Following shall be got approved from the Purchaser:

1. Manufacturer of Motor Control Center (MCC).
2. Samples of isolator/ON-OFF boxes near motors.
3. Sample of GI wire / strip for earthing, cable glands and cable lugs etc.

We have noted the above and confirm that our tender is based on these approved makes.

Date : --------- Signature and seal of Bidder



LEGEND

01. STORE FOR CATTLE FEED (EXITING)
02. LABORATORY (EXISTING OFFICE)
3. DG (OLD DG ROOM)
4. LT (OLD PRODUCT)
5. PROCESS
6. LABORATORY
7. POLY PACKING
08. SHIFT OFFICE
9. GHEE MAKING ROOM
10. PRODUCT STORE
11. INCUBATION ROOM & PRODUCT ROOM
12. LABORATORY(1ST FLOOR)
13. COLD STORE
14. PLANT MAINTANCE ROOM
15. SERVICE BLOCK BOILER
16. SERVICE BLOCK REFREGERATION
17. L.T. ROOM(PROPOSED)
18. CYCLE STAND
19. E.T.P.(PROPOSED)
20. MILK PARLOR
21. MAIN ENT.
22. SECURITY CABIN
23. ADMINISTRATIVE BUILDING
24. CATTLE FEED STORE (PROPOSED)
25. CRATE WASHING PLATFORM
26. SILO PLATFORM
27. EXISTING BORE WELL
28. AT. CONDENSER
29. NEW BORE WELL
30. OIL STORAGE TANK
31. OVER HEAD TANK
32. TRANSFORMER YARD
33. LABOUR SHED

TOTAL PLOT AREA=
BUILT UP AREA=
AREA COVRAGE=
PLOT NO =

AREA STATEMENT

1.	PLANT BUILDING	
2.	ADM. BUILDING	
3.	SECURITY CABIN	
4.	BOILER ROOM	
5.	LABOUR IMMUNITY	
6.	STORE	
7.	MILK PARLOUR	

M/s OMFED
D-2, SAHID NAGAR, BHUBANESWAR
PH- (0674) 25461121,254576,2540417,2546030

PROJECT :
PROPOSED DAIRY PLANT, (30000LPD) FOR
AT- SALAPADA,
ANANDAPUR DAIRY ,
DIST- KEONJHAR

DRAWN BY : Er. S.S. PANDA
PREPARED BY : Er. S.S. PANDA
CKD BY : Er. R P CHATRUBEDY
APPROVED BY: Er. J B MAHAPATRA

NORTH : N

TITLE : FACTORIES GENERAL LAYOUT

SCALE : 1:500
DATE : 07/07/2009
WORK DRG NO : omfed/andapur/01