E-BIDDING DOCUMENT

TOWARDS
TURNKEY EXECUTION
(CIVIL / MECHANICAL / ELECTRICAL)
INCLUDING DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENTS, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & TRIAL RUN FOR

RENOVATION OF 10,000 LITER PER DAY CAPACITY TIRTOL DAIRY PLANT

AT - NUAPADA, DIST-JAGATSINGHPUR

THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD. BHUBANESWAR

OCTOBER - 2024

INSTRUCTION TO BIDDERS

NAME OF WORK: TURNKEY EXECUTION (CIVIL, MECHANICAL, ELECTRICAL) INCLUDING DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENTS, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & TRIAL RUN **FOR RENOVATION OF 10,000 LITER PER DAY CAPACITY TIRTOL DAIRY PLANT AT - NUAPADA, DIST-JAGATSINGHPUR, STATE – ODISHA**.

1.	PERIOD OF COMPLETION OF PLANT	:	24 Months from the date of agreement.
2.	Reference of Bid	:	Proj/229/Tirtol Dairy/24
3.	Bid Validity	:	120 days after opening of commercial bid
4.	LAST DATE, TIME AND FOR RECEIPT OF: OFFER DOCUMENT		**11.11.2024 up to 02:00 PM**
5.	TIME, DATE AND PLACE OF TECHNICAL BID OPENING	:	DATE- **11.11.2024 TIME 03.00 PM** at- OMFED, D-2, Sahid Nagar, Bhubaneswar-751 007
6.	DATE, TIME AND FOR **PRE BID MEETING**	:	**24.10.2024 at 11:00 AM**
7.	OFFICER INVITING BIDS	:	MD, OMFED
8.	CONTACT PERSON	:	General Manager (Projects & DO) OMFED, D-2, Sahid Nagar, Bhubaneswar-751 007. Email-dairyoperation@omfed.com /omfed@yahoo.com Mobile No- 7440043849

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www.omfed.com

The Odisha State Cooperative Milk Producers' Federation Ltd.
D-2, Sahid Nagar, Bhubaneswar-751 007.
Ph No- (0674) 2546030/2540273/2540417,
Fax No (0674) 2540974

TENDER NOTICE

OMFED invites sealed techno-commercial offer in separate envelope from experienced bidders for **TURNKEY EXECUTION (CIVIL, MECHANICAL, ELECTRICAL)** including Design, Construction, Supply of dairy equipments, Services & Utilities, Erection, Testing, Commissioning & Trial Run **FOR RENOVATION OF 10,000 LITER PER DAY CAPACITY TIRTOL DAIRY PLANT AT - NUAPADA, DIST-JAGATSINGHPUR, STATE – ODISHA**.

Interested bidders may download the Tender Document from The OMFED web site www.omfed.com only for reference. Bid document will be available in the https://tendersodisha.gov.in from **10.00 AM of 09.10.2024 to 2.00 PM of 11.11.2024** for bidding. Tender cost of **Rs.10000/-+18%-GST** along with **E.M.D.** shall be deposited through online portal at **https://tendersodisha.gov.in** The technical Bid shall be **opened at 03.00 PM on 11.11.2024** at the OMFED Corporate Office in the presence of the interested bidders at Omfed Corporate Office, D/2, Sahid Nagar, Bhubaneswar – 751007 in presence of interested bidders. Bids without requisite EMD shall not be considered.

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.

MANAGING DIRECTOR

SECTION 1

BACK GROUND / INSTRUCTION TO BIDDERS

BACK GROUND / INSTRUCTION TO BIDDERS

The Odisha State Cooperative Milk Producers' Federation Ltd.(OMFED) was established during Operation Flood-II (1980 to 1985) to set up dairy cooperatives in Odisha state based on Anand Pattern. Accordingly, Village level dairy cooperative societies (DCS) are organized at grass root level to procure milk from milk producers and arrange payment based on Fat and SNF content. The procured milk transported to Chilling Centre/Bulk milk coolers owned by District cooperative unions. After chilling, the milk is supplied to nearest dairy owned by OMFED for processing and marketing. There are 12 Milk Unions federated to Odisha State cooperative milk producers' Federation Ltd. (OMFED). It is an apex level dairy cooperative society registered under cooperative society Act-1962. Milk and Milk products are sold under the brand name of "OMFED" by cooperatives.

At present OMFED is procuring on an average 6.0 lakh liters of milk per day from 3760 Dairy Cooperative Societies having 3,00,000 producer members. The average milk marketing including milk products is around 5.0 lakh liters per day, as against the existing processing capacity of 5.5 lakh liter per day. In the recent days, OMFED has taken steps to double its milk procurement in next 5 years. Various Govt. Schemes like RKVY, NDP-1, NPCBB & DD, CMP & IDDP Schemes are under implementation to achieve the projected target of milk procurement to the tune of 10 lakh Ltrs. Per Day. Further, State Govt. is also encouraging the Dairy Farmers by providing health care and breeding supports along with short & long term credit with interest subvention to enhance the milk production. As milk is highly perishable, additional chilling infrastructure needs to be created.

The existing infrastructural facilities at Tirtol Dairy are inadequate to handle existing processing load. Further, some of the machineries are old & obsolete for which the processing expenditure is beyond the standard parameter. The efficiency of the plant needs to be enhanced to cover distant markets. Hence, renovation of existing plant is proposed under the project for assistance.

INSTRUCTION TO BIDDERS

GENERAL

Scope of Bid:

OMFED invites bids for **TURNKEY EXECUTION (CIVIL, MECHANICAL, ELECTRICAL)** INCLUDING DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENTS, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & TRIAL RUN **FOR RENOVATION OF 10,000 LITER PER DAY CAPACITY TIRTOL DAIRY PLANT AT - NUAPADA, DIST-JAGATSINGHPUR, STATE – ODISHA.**

The successful bidder will be expected to complete the works by the intended completion date specified in the General Conditions of Contract.

Source of Funds	**Fund provision for the said project. (in Lakhs)**
Govt. of Odisha	**Rs.400.00**

Eligibility criteria:

1. The bidder should have minimum three years' experience in the related field like turnkey execution of dairy plants comprising of civil / electrical / mechanical works.
2. Annual Sales turn over should not to be less than 5 Crore during the financial year 2021-22, 2022-23 & 2023-24.
3. The bidder should have successfully commissioned new dairy plants or upgradation of dairy plants the recent past. The bidder should furnish relevant documents in this regard. Project Completion report / Performance report are to be submitted along with Purchase Order copy.

BID SECURITY (EARNEST MONEY DEPOSIT)

a. **The bidder shall furnish, as part of its bid, bid security of Rs.8,00,000/-** shall be deposited through online portal at https://tendersodisha.gov.in.

1. The EMD of the technically disqualified Bidders shall be returned after declaration of the list of such technically qualified Bidders in the portal. The EMD of other unsuccessful Bidders shall be refunded after signing of the Agreement with the Successful Bidder. The return of the EMD shall be in the form of bank transfer to the account of the Bidder through the e-procurement portal of the Government of Odisha

2. The bid security is required to protect the purchaser against the risk of bidder's conduct, which would warrant the security's forfeiture.

~~3. The bid security shall be in one of the following forms:~~

~~(a) A bank guarantee issued by a Nationalized/Scheduled bank in India only in the form strictly in accordance to the sample form provided in the bidding documents and valid from the date of bid opening as prescribed in the tender notice till 120 days beyond the validity of the bid.~~

~~Or~~

(b) ~~A demand draft in favour of Orissa State Cooperative Milk Producers Federation Limited, Payable at Bhubaneswar.~~

PREPARATION OF BIDS

DOCUMENTS TO BE SUBMITTED IN THE TECHNICAL BID:

- Audited profit & loss account statement for the year 2021-22, 2022-23 & 2023-24.
- Proof of sales turn over for last three consecutive years- 2021-22, 2022-23 & 2023-24.
- Copy of IT return for the financial year 2021-22, 2022-23 & 2023-24.
- GST Number.
- GSTIN / PAN No.
- Project Completion report / Performance report are to be submitted along with Purchase Order copy towards installation / commissioning of new dairy plants or upgradation of dairy plants during last three years.
- **Cost of tender paper & EMD (as specified at page-7) shall be deposited through online portal at https://tendersodisha.gov.in**
- The original bidding document as downloaded by the bidder should be signed & sealed in each page by the bidder as a token of having read, understood & accepted the contents, therein.

DOCUMENTS TO BE SUBMITTED IN THE COMMERICIAL BID:

- The bidder shall submit their offer as per given **BOQ** format provided at online portal https://tendersodisha.gov.in.
- The rate shall include freight, packing, forwarding **inclusive of GST / all taxes, duties, royalties etc.**

SECTION 2
QUALIFICATION INFORMARION
(To be filled in by Bidder)

SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES

BANK CERTIFICATE

This is to certify that M/s._____ is reputed company with a good financial standing.

If the contract for the work, namely_____is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs._____ to meet their working capital requirements for executing to the above contract during the contract period.

_____

(Signature) Name of Bank

Senior Bank Manager Address of the Bank

AFFIDAVIT

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2. The undersigned also hereby certifies that neither our firm M/s _____ has abandoned any work awarded to us for such works have been rescinded, during last five years prior to the date of this bid.

3. The undersigned hereby author use(s) and request(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.

4. The undersigned understand and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Department Project implementing agency.

_____

(Signed by an Authorised Officer of the Firm)

_____

Title of Officer

_____

Name of Firm

_____

DATE

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s _____ _____ would invest a minimum cash up to 25% of the value of the work during implementation of the Contract.

_____

(Signed by an Authorised Officer of the Firm)

_____

Title of Officer

_____

Name of Firm

_____

DATE

SECTION - 3
CONDITIONS OF CONTRACT

GENERAL CONDITIONS OF CONTRACT
Part – I SCOPE OF BIDDER)

01) Turn Key execution of the project including civil/structural work, mechanical/services, utilities, supply, erection, installation, testing and commissioning and trial run including civil foundation for machineries.
02) Prepare the Architectural drawing, Structural Design and machine foundation drawing prior to the execution as per requirements.
03) Day to day supervision and monitoring for civil/ Mechanical and electrical work to complete the project with in time frame.
04) Main LT Panel with required incoming and outgoing feeders and change over switches and motor control centre as per requirements. MCC panel board for process, Product, Refrigeration, boiler, Internal and street lighting, ETP and spare feeder for bore well.
05) Cables, conduits and earth pit, obtaining permission from local power Distribution Company and work estimate for installation of 11 KVA 4 pole structure substation, statutory inspection of LT, HT & DG set etc.
06) Internal road and Landscaping of the vacant land.
07) Electricity dues and other dues as applicable during the period of execution of the project till handing over.
08) All other items which are not mentioned here but required for Turn Key Execution of the project, commissioning and trial run.
09) Supply of lubricating oil/Refrigerant during commissioning/trial run.
10) Submission of all civil/structural/mechanical/electrical drawings- 4 set with project authority for approval and execution.
11) Watch & ward duty for 24 hours throughout the project period.
12) Temporary storage godown for construction material, plant and machineries, site office, & labour amenities etc. (if required)
13) Deposition of Govt. fees as applicable under the project.
14) The bidder should quote item wise rate and break up in detail.

SCOPE OF OMFED

1) Supply of raw materials, packing materials, fuel and chemicals during commissioning and trial run.
2) Obtaining NOC, consent to establish and consent to operate from OSPCB.
3) Obtaining registration from DIC/MSME for coal license.
4) Statutory approval from Directorate of Factory & Boilers for mechanical installation building and drawings etc.
5) Statutory approval for steam boilers /pipe lines from Directorate of Factories & Boilers.
6) Statutory approval relating to legal meteorology.

GENERAL CONDITIONS OF CONTRACT

Part - II

1. The contract means the document forming the tender and acceptances thereof and the formal agreement executed between the competent authority on behalf of the Odisha State Cooperative Milk Producers' Federation Ltd., Bhubaneswar (referred hereinafter as 'OMFED') and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time form one contract and shall be complementary to one another.

2. In the contract, the following expressions shall, unless the context otherwise requires have the meanings, hereby respectively assigned to them:-

i) The expression works or work shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.

ii) The **site** shall mean the land/or other places on. into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

iii) The **Contractor** shall mean the individual, firm or company, whether incorporate or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm of company.

iv) The Engineer -In-Charge means the Engineer/ officer who shall supervise and be in-charge of the work.

v) **OMFED shall** mean The Odisha State Cooperative Milk Producers' Federation Ltd.

vi) **Competent Person to sign agreement**: - Managing Director or the person authorized by Managing Director shall be competent authority to sign.

vii) **Excepted Risk** are risks due to riots (other than those on account of contractor employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of **OMFED**, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the **Accepting Authority** or causes solely due to use or occupation by OMFED of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to OMFED's faulty design of works.

Provided that the Contractor is to take all necessary measures to prevent such adverse impact and damage and he would also show that he has taken all due precaution to prevent /minimize any adverse effect/ damage from the above.

viii) **The Defect liability certificate** is the certificate issued by General Manager (Proj) after defect liability period has ended and upon correction of defects by the contractor.

ix) **The defect liability period** is will be decided by OMFED for different nature of works from date of completion of the work and must be mentioned in the Agreement.

It would be decided by the OMFED for different nature of work from time to time as mentioned in Contract data. The Defect liability period is **12 months** from the date of handing over the plant. The equipment supplied by the bidder found defective within the defect liability period shall be rectified/replace by the bidder.

x) **The intended completion** is the time intended to complete the work by the contractor.

xi) **The start date** is given in the contract data. It is the date when the contractor shall commence execution of the works. It does not necessarily coincide with any of the site possession date.

xii) **A sub contractor** is a person or corporate body who has a contract with the contractor to carry out a part of the construction work in the contract, which includes work on the site.

xiii) **Temporary works** are works designed, constructed, installed and removed by the contractor that are needed for construction or installation of the works.

xiv) **Authority** means Managing Director, Odisha State Cooperative Milk Producers' Federation Ltd., Odisha who invites tenders on behalf of The **OMFED** as specified in tender document.

xv) **Specifications** mean the specifications followed by relevant Authority of the Government of India or State Government in the area where the work is to be executed and/or as specified by OMFED.

xx) **Tender value/Agreement value** means the value of the entire work as stipulated in the letter award;

3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.

4. Heading and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken in to consideration in the interpretation or construction thereof or of the contract.

5. The contractor must furnish, free of cost one certified copy of the contract documents with standard specifications and such other printed and published documents, together with all drawings in three sets & in CD as may be forming part of the tender papers. None of these documents shall be used for any purpose other than that of this contract.

6. The work to be carried out under the Contract shall, except as otherwise provided these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works.

7. The contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Financial Bid, which rates and prices shall, except as otherwise provided cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

8. The several documents forming the contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.

i) In the case of discrepancy between the schedule of Quantities, the Specifications and/or the Drawings, the following order of preference shall be observed:-

ii) Description of Schedule of Quantities.

iii) Particular Specification and Special Condition, if any

iv) Drawings.

v) Indian Standard Specifications of B.I.S.

If there are varying or conflicting provisions made in any one document forming part of the contract, Managing Director shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.

Any error in description, quantity or rate in Schedule of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.

9. The successful tenderer /contractor, after submitting the performance guarantee i.e. within 15 days of receipt of letter of acceptance shall attend OMFED for authentication, signing and completion of the contractor document and execute the agreement consisting of:-

i) The notice inviting tender, all the documents including drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

ii) Standard Form as mentioned in tender format consisting of:

Various standard clauses with corrections up to the date stipulated in tender norms along with annexure thereto.

10. APPLICATION

These general conditions shall apply to the extent that they are not superseded by provisions in other parts of the contract.

11. Use of Contract and Information

The contractor shall not, without the OMFED'S prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample or information furnished by or on behalf of the OMFED in connection therewith, to any person other than a person employed by the contractor in the performance of the contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance.

The contractor shall not, without the OMFED'S prior written consent, make use of any document or information enumerated in para.4.1 except for purposes of performing the contract.

Any document, other than the contract itself, enumerated in Para. 4.1 shall remain the property of the OMFED and shall be returned (in all copies) to the OMFED on completion of the contractor's performance under the contract if so required by the OMFED.

12. PATENT RIGHTS

The contractor shall indemnify the OMFED against all third-party claims of infringement of patent, trademark or industrial design rights arising from use of the goods/services or any part thereof in India.

13. Inspection and Tests

The OMFED or its representative shall have the right to inspect and/or test the goods to confirm their conformity to the contract. The Technical Specifications shall specify what inspections and tests the OMFED shall notify the contractor in writing of the identity of any representatives, if retained for these purposes.

The inspection of the goods shall be carried out to check whether the goods are in conformity with the technical specifications and shall be in line with the inspection/test procedures laid down in the schedule of specifications and the contract conditions.

The inspections and tests may be conducted on the premises of the contractor or its subcontractor(s) / at point of delivery and/or at the good's final destination. Where conducted on the premises of the contractor or its subcontractor(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. In case of any defects or deficiency notified by the OMFED'S inspection authority, the contractor will rectify and make good the same without delay and not proceed further processing of such items(s) of goods without obtaining approval from the inspection authority.

Should any inspected or tested goods fail to conform to the specifications/ the OMFED 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.

The OMFED'S right to inspect, test and, where necessary, reject the goods after the goods' arrival at destination shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the OMFED or its representative.

Nothing in clause 7 shall in any way release the contractor from any warranty or other obligations under this contract.

14. Packing and Marking

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 handing 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 handing facilities at all points in transit & destination.

The packing, marking and documents within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the contract, required by law, and, subject to clause 18, in any subsequent instructions ordered by the OMFED.

Each package shall be marked to indicate:

a) Name of the contractor
b) Details of items in the package
c) Name of the consignee
d) Order number
e) Gross/net and tare weights of the item
f) Destination

15. Delivery and documents

Delivery of the goods shall be made by the contractor for destination, by road.

The following documents shall be provided by the contractor / contractor:

Original and three copies of:

(I) The contractor's invoice showing order no. Goods description, quantity, unit price, total amount;

(ii) Delivery note/packing list/lorry receipt;
(iii) Manufacturer's/contractor's guarantee certificate;
(iv) Inspection certificate issued by the nominated inspection agency, and the contractor's factory inspection report;
(v) Insurance policy;
(vi) GST invoice /octroi receipts, wherever applicable, duly sealed indicating payments made; and
(vii) Any other document evidencing payment of statutory levies.

Note: The nomenclature used for the item description in the invoice/s, packing list/s and delivery note/s etc. should be identical to that used in the order. The dispatch particulars including name of transporter, LR no. and date should also be mentioned in the invoice/s.

16. Insurance:

For supply of equipments:

The manufacturer shall have to arrange **all transit risk insurance warehouse to warehouse basis**, including strike clauses, for an amount equal to 110 % of the FOR destination value of the Goods, valid for a period of not less than 3 months after the expected date of arrival of Goods at destination.

In the event of any damage to/loss of consignment in transit, it will be your responsibility to lodge necessary claims with the carriers/ underwriters and pursue them till settlement. Since the insurance policy will be in our name, if required, we shall give you necessary authorisation letter authorizing you to lodge and pursue claims on our behalf with the carriers/ underwriters. Also you shall have to make good the losses/ damages occurred in transit by making replacement /payment to us in the first instance and if claims are settled by the underwriters and any amounts are realized by us, the amounts thus realized in settlement of claims shall be reimbursed to you. In other words, the prima facie responsibility rests on you for getting compensation of the damage/losses incurred if any, due to all transit hazards.

During storage at site:

The contractor shall arrange for insurance of all items stored/ received at the site including the items of supply covered under this contract & the contractor shall furnish necessary details of such insurance to the OMFED, on demand. Any default on the part of the contractor due to which any item does not get covered under insurance; the consequential losses shall be charged to the contractor.

The contractor shall 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.

17.Transportation

The contractor is required to deliver the Goods FOR Destination, by road. Transport of the goods to the destination shall be arranged through a reputed and Bank approved transporter having local offices at destination and Bhubaneswar, and shall be paid for by the contractor.

18.Incidental services

18.1 The contractor is required to provide the following services:

a) Performance of on-site assembly, installation, hooking-up to existing system, Start-up, testing, commissioning, performance trial run for a period of 30 days and handing over of the supplied goods;
b) Furnishing of tools & tackles required for assembly and maintenance of the supplied goods;
c) Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied goods;
d) Operation, maintenance and repair of the supplied goods for a period of 30 days, provided that this service shall not relieve the contractor of any warranty obligations under this contract; and

e) Conduct of training of the OMFED'S personnel, on-site, in assembly, start-up operation, maintenance and repair of the supplied goods, if required.

18.2 Prices charged by the contractor for the preceding incidental services are to be included in the price of the contract.

19. Spare parts

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 may elect to purchase from the contractor, provided that this election 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 of the pending termination, in sufficient time to permit the OMFED to procure its needed requirements; and
(ii) Following such termination, furnishing at no cost to the OMFED, the blueprints, drawings and specifications of the spare parts, if and when requested.

Contractors 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 six months of placement of order.
The obligation of contractor stated in Para 13.1 shall continue even after expiry of the contract.

20. Warranty / guarantee

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 under this contract shall have no defect arising from design, material of workmanship or from any act or omission of the contractor that may develop under normal use of the supplied goods in the conditions. The contractor also guarantees that the goods supplied shall perform satisfactorily as per the designed/rated/ installed capacity as provided for in the contract.

This warranty / guarantee shall remain valid for 12 months after the goods, or any portion thereof as the case may be, have been delivered, commissioned & handed over to the OMFED after the performance of 30 days trial run period.

The OMFED shall promptly notify the contractor in writing of any claims arising under this warranty.

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.

If the contractor, having been notified, fails to remedy the defects(s) within a period of 30 days, the OMFED 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 may have against the contractor under the contract.

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

The Defect liability period is 12 months from the date of handing over the plant. The equipment supplied by the bidder found defective within the defect liability period shall be rectified/replace by the bidder.

21. Fixed prices

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 its bid.

22. Change orders

The OMFED may, at any time, by a written order given to the contractor, make changes within the general scope of the contract in any one or more of the following:

(a) Drawings, designs or specifications, where goods to be furnished under the contract are to be specifically manufactured for the OMFED;
(b) The method of shipment or packing;
(c) The place of delivery; or
(d) The services to be provided by the contractor.

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 contract, whether changed or not changed by the order, an equitable adjustment shall be made in the contract price or delivery schedule, provided that such claims by contractor are reasonable & to the satisfaction of the OMFED. 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 change order.

23. Contract Amendment

Subject to clause 22, no variation in or modification of the terms of the contract shall be made except by written amendment signed by the OMFED.

24. Assignment

The contractor shall not assign, in whole or in part, its obligations to perform under the contract, except with the OMFED'S prior written consent.

25. Subcontracts

The contractor shall notify the OMFED in writing of all subcontracts awarded under the contract if not already specified in his bid, such notification, in his original bid or later, shall not relived the contractor from any liability or obligation under the contract.

26.0 Delays in the contractor's performance

26.1 Deliveries in the goods and performance of services shall be made by the contractor in accordance with the time schedule specified by the OMFED, in Section –I of the bidding documents.

26.2 An unexcused delay by the contractor in the performance of its delivery obligations shall render the contractor liable to any or all of the following sanctions: - forfeiture of its performance security, imposition of liquidated damages, and/ or termination of the contract for default.

26.3 If at any time during performance of the contract, the contractor or its subcontractor(s) should encounter conditions impending timely delivery of the goods and performance of services. The contractor shall promptly notify the OMFED in writing of the fact of the delay, its likely duration and its cause (s). As soon as practicable after receipt of the contractor's notice, the OMFED shall evaluate the situation and may at its discretion extend the contractor's time for performance, in which case the extension shall be notified to the contractor by amendment of the contract.

27.0 Time for completion

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, within the time stated in section–I of the bidding documents or such extended time as may be allowed.

28.0 Extension of Time of Completion

Should the amount of extra or additional work of any kind or any cause of delay referred to in these conditions, or exceptional adverse climatic conditions, or other special circumstances of any kind whatsoever which may occur, other than through a default of the contractor, be such

as fairly to entitle the contractor to an extension of time for the completion of the works. OMFED shall determine the amount of such extension and shall notify the contractor accordingly. Provided that the OMFED is not bound to take in account any extra or additional works 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.

29.0 Penalty for Delay

If the contractor shall fail to achieve completion of the works within the specified time, then the contractor shall pay to the OMFED the sum at the rate of 0.5 % (half percent) of the total value of work done under the contract, as a penalty, for every week or part of the week which shall elapse, between the time prescribed & the date of certified completion of the work. The OMFED may without prejudice to any other method of recovery, deduct the amount of such penalty from any payment in its hands, due or which may become due to the contractor. The payment or deduction of such penalty shall not relieve the contractor from obligations to complete the works, or from any other of his obligations and liabilities under the contract.

The aggregate maximum of the penalty for delay payable to the OMFED under this clause shall be subject to a maximum of 10 % of the total value of work.

The criteria for deriving the penalty for delay shall be the actual value of works executed and the amended time of completion.

Any incremental taxes and levies due to the delay in the performance of the contract by the contractor shall be to the contractor's account.

30.0 Termination for default

30.1 The OMFED 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 in part,

(a) If the contractor fails to delivery an or all the goods within the time period (s) specified in the contract, or any extension thereof granted by the OMFED;

Or

(b) If the contractor fails to perform any other obligation(s) under the contract.

30.2 In the event the OMFED terminates the contract in whole or in part, the OMFED 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 for any excess costs for such similar goods. However, the contractor shall continue performance of the contract to the extent not terminated.

30.3 Consequent to such termination of contract, the OMFED 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.

32.0 Force Majeure

32.1 Notwithstanding the provisions of clauses hereof, the contractor shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extend that, its delay in performance or other failure to perform its obligations under the contract is the result of an event of force majeure.

32.2 For 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 either in its sovereign or

contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.

32.3 If a force majeure situation arises, the contractor shall notify the OMFED in writing of such condition and the cause thereof, within 7 days. Unless otherwise directed by the OMFED in writing, the contractor shall continue to perform its obligations under the contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the force majeure event.

33.0 Termination for Insolvency

The OMFED may at any time terminate the contract by giving written notice to the contractor, without compensation to the contractor, if:

(a) The contractor becomes bankrupt or otherwise insolvent,

(b) The contractor being a company is wound up voluntarily by the order of a court receiver, liquidator or manager appointed on behalf of the debenture holders or circumstances shall have arisen which entitle the court or debenture holders to appoint a receiver, liquidator or a manager,

Provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the OMFED.

34.0 Termination for Convenience

34.1 The OMFED, may by written notice sent to the contractor, terminate the contractor, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is of the OMFED'S convenience, the extent to which performance of work under the contract is terminated, and the date upon which such termination becomes effective.

34.2 The goods that are complete and ready for shipment within 30 days after the contractor's receipt of notice of termination shall be purchased by the OMFED at the contract terms and prices. For the remaining goods, the OMFED may elect:

(a) To have any portion completed and delivered at the contract terms and prices; and /or

(b) To cancel the remainder and pay to the contractor an agreed amount for partially completed goods and for material and parts previously procured by the contractor.

35.0 Settlements of Disputes

35.1 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 written instructions or decision. There upon the engineer shall give his written instructions or decision within a period of fifteen days of such request.

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

35.3 If the engineer fails to give his instructions or decisions in writing within a period of fifteen days after being requested, or if the contractor is dissatisfied with the instructions and decisions, he shall appeal to the OMFED, which shall afford an opportunity to the contractor to be heard and to offer an evidence in support of his appeal. The OMFED shall give a decision within a period of thirty days after the contractor has given the said evidence in support of his appeal.

35.4 If the contractor is dissatisfied with this decision, the contractor within a period of thirty days from the receipt of the decisions shall indicate his intension to refer the dispute to arbitration, failing which the said decision shall be final and conclusive.

36.0 Arbitration

All disputes or differences in respect of which the decision is not final and conclusive shall, on the initiative of either party, be referred for adjudication as per the Arbitration And Conciliation

Act 1996

37.0 Applicable law

The contract shall be interpreted in accordance with the laws of the union of India.

38.0 Notices

38.1 Any notice given by one party to the other pursuant to the contract shall be sent in writing or by telegram/ fax/ cable and confirmed in writing to the address specified for that purpose in the special conditions of contract.

38.2 A notice shall be effective when delivered or on the notice's effective date, which ever is later.

39. 0 Taxes and Duties

The contractor shall be entirely responsible for all taxes, duties, license fees etc. incurred until handing over of the contractor goods and services to the OMFED. All Government fees paid for inspections and approvals by statutory authorities shall be reimbursed by the OMFED on production of copy of treasury Challan for same. Service charges for depositing the govt. fees or submission of requisite forms with the statutory authorities shall be not being admissible.

40.0 Right of use defective equipment

If after handing over of the equipments and within the guarantee and warranty period, the operation or use of the equipment(s) proves to be unsatisfactory, the OMFED shall have the right to continue to operate or use such equipment

Until rectifications of defects errors or omissions by repair or partial or complete replacement is made, without interfering with the OMFED'S operation.

41.0 Jurisdiction

For the settlement of any dispute arising out of the contract against this bid, only the courts at Bhubaneswar shall have jurisdiction.

42. 0 AWARD OF CONTRACT

Award Criteria

The OMFED will award the Contract to the Bidder whose Bid has been determined

(i) to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price; and

(ii) to be within the available bid capacity adjusted to account for his bid price which is evaluated the lowest any of the packages opened earlier than the one under consideration.

In no case, the contract shall be awarded to any bidder whose available bid capacity is less than the evaluated bid price, even if the said bid is the lowest evaluated bid. The contract will in such cases be awarded to the next lowest bidder at his evaluated bid price.

OMFED's Right to accept any Bid and to reject any or all Bids

The OMFED reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby in incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the ground for the OMFED's action.

Notification of Award and Signing of Agreement

The Bidder whose Bid has been accepted will be notified of the award by the OMFED prior to expiration of the Bid validity period by email, fax or by hand with acceptance letter from the bidder, confirmed by registered letter. This letter (hereinafter and in the *General Conditions of Contract* called the "Letter of Acceptance") will state the sum that the OMFED will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract

Price").

The notification of award will constitute the formation of the Contract, subject only to the furnishing of the performance security in accordance with the provisions of tender clause.

The Agreement will incorporate all agreements between the OMFED and the successful Bidder. It will be signed by the OMFED and the successful Bidder, after the performance security is furnished.

Performance Security

Within 15 (Fifteen) days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the OMFED a Performance Security in any of the forms given below for an amount equivalent 10% of the Contract price.

If the performance security is provided by the successful Bidder in the form of an Bank Guarantee, it shall be issued either (a) at the Bidder's option, by a Nationalized / Scheduled Indian bank within state or (b) acceptable to the OMFED.

Failure of the successful Bidder to comply with the requirements of tender clause shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.

Advance Payment and Security

The OMFED will provide an Advance Payment on the Contract Price as stipulated in the terms of payment of tender, subject to maximum amount, as stated in the tender document.

Corrupt or Fraudulent Practices

The OMFED will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract with PWD and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for the contractor, or in execution.

Furthermore, Bidders shall be aware of the provision stated in Tender Clause of the General Condition of contract.

APPENDIX to STANDARD BIDDING DOCUMENT

ANNEXURE – I

Major items of constructional plant to be deployed by the bidder.

Sl.no	description of Equipment	No's available with the bidder In working Condition.	no's proposed to be deployed At site.
1.	Concrete mixers		
2.	Vibrators a) Needle type		
	b) Surface type		
3.	Weight batcher		
4.	Concrete cube Testing equipment		
5.	Steel scaffolding		
6.	Shuttering material		
7.	Water pumps		
8.	Air compressors		
9.	Welding equipments		
10.	Elevators		

ANNEXURE – II

List of Key Personnel to be deployed on Contract Work

Sl. No.	**Personnel**	**Qualification**	
1.	Project Manager	B.E. Civil + 15 Years Exp. (5 years as Manager)	1 No.
2.	Site Engineer	B.E. Civil + 10 Years (5 years Exp. in Building Construction)	1 No.
3.	Plant Engineer	B.E. Civil + 10 Years Exp. or B.E. Mech + 15 Years Exp.	1 No. Each

CLAUSE OF CONTRACT

CLAUSE 1 (Performance Guarantee)

The contractor shall submit an irrevocable PERFORMANCE GUARANTEE of 10% (Ten percent) of the contract amount in the shape as

- Demand Draft of a nationalised / scheduled Bank issued in favour OMFED,

Or

- A bank guarantee issued by a Nationalized/Scheduled bank in India.

The security shall be repaid to the bidder after 15 (Fifteen) month of successful installation / trial run & successful commissioning / handing over of entire project.

(i) The performance Guarantee shall be initially valid up to Twenty Months beyond the defect liability period. In case the time for completion of work gets enlarged, the contractor shall get the validity of performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor without any interest.

(ii) The authority shall not make a claim under the Performance guarantee except for amounts to which the OMFED is entitled under the contract (notwithstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

(a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the OMFED may claim the full amount of the Performance guarantee.

(b) Failure by the contractor to pay OMFED any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by General Manger Project..

(c) Failure by the Agency to rectify any defects as defined in the defect liability clause in the tender of contract data to the satisfaction of the Engineer in charge the contractor has to pay OMFED, any amount due, either as agreed by the Contractor or determined under any of the Clauses/ Conditions of the Agreement, within 30 days of the service of notice to this effect by Engineer in Charge.

(iii) In the event of the contract being determined or rescinded under provisions of any of the clause/condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the **OMFED**.

CLAUSE 2 (Contractor failed to maintain the required progress)

If the contractor fails to maintain the required progress as per tender clause or to complete the work and clear the site on or before the contract or extended date of completion, he shall, without prejudice to any other right or remedy available under the law to the **OMFED** on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the Managing Director (whose decision in writing shall be final and binding) may decide on the amount of tendered value of the work for every completed day/month (as applicable) that the progress remains below that or that the work remains incomplete.

This will also apply to items or group of items for which a separate period of completion has been specified.
Compensation @ 0.5 % per week of delay to for delay of work be computed on per Day basis

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed **10% of the Tendered Value** of work or to the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the OMFED. In case, the contractor does not achieve a particular milestone mentioned in tender clause, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of extension of time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

CLAUSE 3 (Remedy against the contractor for inferior workmanship)

Subject to the other provisions contained in this clause, the Engineer In Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

i) If the contractor having been given by the Engineer In Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.

ii) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

iii) if the contractor has, without reasonable cause, suspended progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer In Charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continues to do so after a notice in writing of seven days.

iv) If the contractor fails to complete the work within the stipulated date or items of work with individual date of completion, if any stipulated, on or before such date(s) of completion and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer In Charge.

v) If the contractor persistently neglects to carry out his obligations under the contract and/or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer In Charge.

vi) If the contractor commits any acts mentioned in tender clause hereof:

vii) If the work not started by the contractor within One month of the stipulated time subject to maximum of 45 days.

When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer In Charge on behalf of OMFED shall have powers:

a) To determine or rescind the contract as aforesaid (of which termination or rescission notice in writing to the contractor under the hand of Engineer In Charge shall be conclusive evidence). Upon such determination or rescission the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the OMFED.

b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined or rescinded as above, shall not be allowed to participate in the tendering process for the balance work.

In the event of above course(s) being adopted by the Engineer In Charge the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer In Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

CLAUSE 3A (Delay due unforeseen situation)

In case, the work cannot be started due to reasons not within the control of the contractor within One month of the stipulated time for completion of work, either party may close the contract. In such eventuality, the Earnest Money deposit and the Performance Guarantee of the contractor shall be refunded, but no payment on account of interest, loss of profit or damages etc. shall be payable at all.

CLAUSE 4 (Extra liabilities to contractor)

In any case in which any of the powers conferred upon the Engineer in charge by Clause- 3 thereof, shall have become exercisable and the same are not exercised the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall not withstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer in charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Engineer in charge which shall be final and binding on the contractor) use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work. or any part thereof, paying or allowing for the same in account at the contract rates or, in the case of these not being applicable, at current market rates to be certified by the Consultant-In-Charge, whose certificate thereof shall be final, and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) in the event of the contractor failing to comply with any such requisition, the Engineer in charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Engineer in charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

CLAUSE 5 (Time and Extension for Delay)

The time allowed for execution of the Works as specified in the tender or the extended time in accordance with these conditions shall be the **essence of the Contract**. The execution of the works shall commence from such time period as mentioned in letter of acceptance or from the date of handing over of the site whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, **OMFED** shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the earnest money and performance guarantee absolutely.

As soon as possible, after the contract is concluded, the Contractor shall submit a Time & Progress Chart for each milestone and get it approved by OMFED. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the work. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer in charge and Contractor within the limitations of time imposed in the contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate Programme has been agreed upon) complete the work as per milestone given in tender.

If the work(s) be delayed by.

i) Force majeure, or
ii) Abnormally bad weather, or
iii) Serious loss or damage by fire, of

iv) Civil commotion, local/commotion of workmen, strike or lockout] affecting any of the trades employed on the work, or

v) Delay on the part of other contractors or tradesmen engaged by Engineer in charge in executing work not forming part of the Contract, or

vi) Any other cause which, in the absolute discretion of the authority or beyond the Contractor's control, then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer in charge but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer in charge to proceed with the works.

Request for the rescheduling of Milestones and extension of time, to be eligible for consideration, shall be made by the contractor in writing within fourteen days of the happening of the event causing delay on the prescribed form. The Contractor may also, if practicable, indicate in such a request, the period for which extension is desired.

In any such case the OMFED give a fair and reasonable extension of time and reschedule the milestones for completion of work. Such extension shall be communicated to the Contractor by the Engineer in charge in writing, within 3 months of the date of receipt of such request. Non application by the contractor for extension of time shall not be a bar for giving a fair and reasonable extension by the Engineer in charge and this shall be binding on the contractor.

CLAUSE 6 (Measurement of Work Done)

Engineer in Charge shall, except as otherwise provided, ascertain and determine measurement and the value in accordance with the contract of work done.

All measurement of all items having financial value shall be entered in Measurement Book and/or level field book; so that a complete record is obtained of all works performed under the contract. All measurements and levels shall be taken jointly by the Engineer in Charge or his authorized representative and by the contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer in Charge and the contractor or their representatives in token of their acceptance. If the contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties.

If for any reason, the contractor or his authorized representative is not available and the work of recording measurements is suspended by the Engineer in Charge or his

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

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

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

The contractor shall give not less than seven days notice to the General Manager (Proj)or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimension thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-In-Charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Consultant-In-Charge's consent being obtained in writing, the same shall be uncovered at the contractor's expense, or in default thereof, no payment or allowance shall be made for such work or the materials with which the same was executed.

General Manager (Proj) or his authorized representative may cause either themselves or through another officer of the OMFED to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

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

CLAUSE 7 (Payment on Intermediate Certificate to be regarded as Advances)

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstruct of such payment may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the General Manager (Proj) under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion interim payments shall continue to be made as herein provided, without prejudice to the right of the OMFED to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

CLAUSE 8 (Completion notice)

Within ten days of the completion of the work, the contractor shall give notice of such completion to the General Manager (Project) and within thirty days of the receipt of such notice, the General Manager (Project)shall inspect the work and if there is no defect in the work shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of execution thereof, If the contractor shall fail to comply with the requirements of this clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the General Manager (Proj) may at the expense of the contractor remove such scaffolding surplus materials and rubbish etc. and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8 A (Contractor to Keep Site Clean)

When the annual repairs and maintenance of works are carried out, the splashes and droppings from white washing, color washing, painting etc. on walls, floor, windows etc. shall be removed and the surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done without waiting for the actual completion of all the other items of work in the contract. In case the contractor fails to comply with the requirements of this clause, the

Engineer in charge shall have the right to get this work done at the cost of the contractor either ideally or through any other agency. Before taking such action, the Engineer in charge shall give ten days notice in writing to the contractor.

CLAUSE 8 B (Completion Plans to be submitted by the Contractor)

The contractor shall submit completion plan as required vide General Specifications within thirty days of the completion of the work.

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay a sum equivalent to 1.5% of the value of the work.

CLAUSE 9 (Payment of Final Bill)

The final bill shall be submitted by the contractor in the same manner as specified in payment terms details within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer in charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer in charge, will, as far as possible be made within the period specified herein under, the period being reckoned from the date of receipt of the bill by the Engineer in charge.

CLAUSE 10 Deleted

CLAUSE 11(Work to be executed in Accordance with Specifications, Drawings, Orders etc)

The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Engineer in Charge and the contractor shall be furnished free of charge one copy of the contract documents together with specification, designs, drawings and instruction as are not included in the standard specifications of Public Works Department specified in tender document or in any Bureau of Indian Standard or any other, published standard or code or, Schedule of Rates or any other printed publication referred to elsewhere in the contract.

The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

CLAUSE 12 (Deviations/ Excess item Variations Extent and Pricing) , Deviation, Extra items and Pricing, Deviation, Substituted Items, Pricing, Deviation, Deviated Quantities, Pricing

The Engineer in Charge shall have power (i) to make alternation in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer in Charge after approval from competent authority and such alterations omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extend, if requested by the contractor, as follows :

i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus.

ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer in Charge after approval from competent authority

In the case of extra item(s) the contractor may within fifteen days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, for the work and the Engineer in Charge after approval from competent authority shall within one month of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates as per power delegated in PWD Code/ OMFED regulation and on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

In the case of substituted items, the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the aforesaid para.

If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted) the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted) the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

In the case of contract items, substituted items, contract cum substituted items, which exceed the limits laid down in Schedule F, the contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis, for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities the Engineer in Charge shall within one month of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determined the rates as per power delegated in PWD Code/ OMFED regulation and on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

The contractor shall send to the Engineer in Charge once every three months an up to date account giving complete details of all claims for additional payments to which the contractor may consider himself entitled and of all additional work ordered by the Engineer in Charge after approval from competent authority which he has executed during the preceding quarter failing which the contractor shall be deemed to have waived his right. However, the Managing Director is authorized for consideration of such claims on merits.

For the purpose of operation of tender clause the following works shall be treated as works relating to foundation:

i) For buildings, compound walls, plinth level or 1.2 meters (4 feet) above ground level whichever is lower excluding items of flooring and D.P.G. but including base concrete below the floors.
ii) For abutments, piers, retaining walls of culverts and bridges, walls of water reservoirs the bed of floor level.
iii) For retaining walls where floor level is not determinate 1.2 meters above the average ground level or bed level.
iv) For Roads all items of excavation and filling including treatment of sub-base.

Foreclosure of Contract due to Abandonment or Reduction in Scope of Work Any operation incidental to or necessarily has to be in contemplation of tenderer while filing tender, or necessary for proper execution of the item included in the Schedule of quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations.

CLAUSE 13 (OMFED can abandon or reduce the scope of work)

If at any time after acceptance of the tender OMFED shall decide to abandon or reduce the scope of the works for any reason whatsoever and hence not require the whole or any part of the works to be carried out, the Engineer in Charge shall give notice in writing to that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The contractor shall be paid at contract rates full amount for works executed at site and in addition, a reasonable amount as certified by the Engineer in Charge for the items hereunder mentioned which could not be utilized on the work to the full extent in view of the foreclosure.

i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labour huts, staff quarters and site office, storage accommodation and water storage tanks.

ii) **OMFED** shall have the option to take over contractor's materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided, however, **OMFED** shall be bound to take over the materials or such portions thereof as the contractor does not desire to retain. For materials taken over or to be taken over by **OMFED,** cost of such materials as detailed by Engineer in Charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration of damage which may have been caused to materials whilst in the custody of the contractor.

iii) If any materials supplied by **OMFED** are rendered surplus, the same except normal wastage shall be returned by the contractor to **OMFED** at rates not exceeding those at which these were originally issued less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to Government stores, if so required by **OMFED**, shall be paid.

iv) Reasonable compensation for transfer of T & P from site to contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.

v) Reasonable compensation for repatriation of contractor's site staff and imported labour to the extent necessary.

The contractor shall, if required by the Engineer in Charge furnish to him books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.
The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor's materials at site taken over by OMFED as per item (ii) above. Provided always that against any payments due to the contractor on this account or otherwise, the Engineer in Charge shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by OMFED from the contractor under the terms of the contract.

CLAUSE 14(Cancellation of contract in full or part)

i) At any time makes default in proceeding with the works or any part of the work with the due diligence and continues to do so after a notice in writing of 7 days from the Engineer-In-Charge; or

ii) commits default to comply with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him.

iii) fails to complete the works or items of work with individual dates of completion, on or before the date(s) of completion, and does not complete then within the period specified in a notice given in writing .

iv) shall offer or give or agree to give to any person working at OMFED on contract/deputation or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any action relation to the obtaining or execution of this or any other contract for OMFED; or

v) shall enter into a contract with **OMFED** in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Competent Authority; or

vi) shall obtain a contract with OMFED as a result of wrong tendering or other non-bonafide methods of competitive tendering; or

vii) being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors; or

viii) being a company, shall pass a resolution or the Court shall make an order for the winding up of the company, or a receiver or manager on behalf of the debenture holders or otherwise shall be appointed or circumstances shall arise which entitle the Court or debenture holders to appoint a receiver or manager; or

ix) shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days; or

x) assigns, transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Competent Authority;

The Competent Authority may, without prejudice to any other right or remedy which shall have accrued or shall accrue hereafter to OMFED by a notice in writing to cancel the contract as a whole or only such item of work in default from the Contract.

The Engineer in Charge shall on such cancellation by the Competent Authority have powers to:

(a) take possession of the site and any materials, constructional plant, implements stores, etc.,
thereon; and/or

(b) carry out the incomplete work by any means at the risk and cost of the contractor.

On cancellation of the contract in full or in part, the Engineer in Charge shall determine what amount, if any, is recoverable from the contractor for completion of the works or part of the works or in case the works or part of the works is not to be completed, the loss of damage suffered by OMFED. In determining the amount, credit shall be given to the contractor for the value of the work executed by him up to the time of cancellation, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor.
Any excess expenditure incurred or to be incurred by **OMFED** in completing the works or part of the works or the excess loss or damages suffered or may be suffered by **OMFED** as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to OMFED in law be recovered from any moneys due to the contractor on any account, and if such moneys are not sufficient the contractor shall be called upon in writing and shall be liable to pay the same within 30 days.

If the contractor shall fails to pay the required sum within the aforesaid period of 30 days the Engineer in Charge shall have the right to sell any or all of the contractors unused materials, constructional plant, implements, temporary buildings, etc. and apply the proceeds of sale thereof towards the satisfaction of any sums due from the contractor under the contract and if thereafter there be any balance outstanding from the contractor, it shall be recovered in accordance with the provisions of the contract.

Any sums in excess of the amounts due to OMFED and unsold materials, constructional plant, etc., shall be returned to the contractor, provided always that if cost or anticipated cost of completion by Government of the works or part of the works is less than the amount which the contractor would have been paid had he completed the works or part of the works, such benefit shall not accrue to the contractor.

CLAUSE 15 (Suspension of Work)

i) The contractor shall, on receipt of the order in writing of the Engineer in Charge (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer in Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

a) on account of any default on the part of the contractor or;

b) for proper execution of the works or part thereof for reasons other than the default of the contractor; or

c) for safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Consultant- In-Charge.

ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above.

a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Engineer in Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor. Provided the contractor submits his claim supported by details to the Engineer in Charge within fifteen days of the expiry of the period of 30 days.

(iii) If the works or part thereof is suspended on the orders of the Engineer in Charge for more than three months at a time, except when suspension is ordered for reason (a) in sub- Para (i) above, the contractor may after receipt of such order serve a written notice on the Engineer in Charge requiring permission within fifteen days from receipt by the Engineer in Charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of

the works as an omission of such part by **OMFED** or where it affects whole of the works, as an abandonment of the works by **OMFED**, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Consultant-In-Charge. In the event of the contractor treating the suspension as an abandonment of the contract by **OMFED**, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer in Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer in Charge within 30 days of the expiry of the period of 3 months.

CLAUSE 16 (Action in case Work not done as per Specifications)

All works under or in course of execution or executed in pursuance of the contract shall at all times be open and accessible to the inspection and supervision of the Consultant-In-Charge/ Engineer in charge / Managing Director or his authorized subordinates in charge of the work and all the superior officers, officer of the Organization of the OMFED and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions of have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

It shall appear to the Engineer in Charge or his authorized subordinates in charge of or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or article provides by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract the contractor shall, on demand in writing which shall be made within six months of the completion of the work from the Engineer in Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing do so within a period specified by the Engineer in Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause of the contract (for non-completion of the work in time) for this default.

In such case the Engineer in Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the competent authority may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure and incidental items rectified, or removed and re-executed at the

risk and cost or contractor. Decision of the Engineer in Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

CLAUSE 17 (Contractor Liable for Damages, defects during maintenance period)
If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road curb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wired, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within defect liability period after a certificate final or otherwise of its completion shall have been given by the Engineer in Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a

notice in writing on that behalf make the same good at his own expense or in default the Engineer in Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit except for the portion pertaining to asphaltic work which is governed by sub-para(iii) of clause 35 or the proceeds of sale thereof or of a sufficient option thereof. The security deposit of the contractor shall not be refunded before the expiry of defect liability period after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later.

In case of Maintenance and Operation works of E & M services, the security deposit deducted from contractors shall be refunded within one month from the date of final payment or within one month from the date of completion of the maintenance contract whichever is earlier.

CLAUSE 18 (Contractor to Supply Tools & Plants etc.)
The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Consultant-In-Charge's stores), plant, tools, appliances, implements, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specification or other document forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer in Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing the same may be provided by the Engineer in Charge at to the contractor, under this contract or otherwise

and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

CLAUSE 18 A (Recovery of Compensation paid to Workman)

In every cash in which by virtue of the provisions sub-section (1) of Section 12, of the Workmen's Compensations Act, 1923, OMFED is obliged to pay compensation to a workman employed by the contractor, in execution of the works, Government will recover from the contractor the amount of the compensation so paid; and without prejudice to the right of the OMFED under sub-section (2) of section 12, of the said Act, OMFED shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by OMFED to the contractor whether under this contract or otherwise. OMFED shall not be bound to contest any claim made against it under sub-section (1) Section 12, of the said Act, except on the written request of the contractor and upon his giving to Government full security for all costs for which Government might become liable in consequence of contesting such claim.

CLUASE 18 B (Ensuring Payment and Amenities to Workers if Contractor fails)

In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, **OMFED** is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the rules under Clause 19H or under the State Labour Regulations, or under the Rules framed by **OMFED** from time to time for the protection of health and sanitary arrangements for workers employed by contractors working for OMFED, **OMFED** will recover from the contractor the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the **OMFED** under sub-section (2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, **OMFED** shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by **OMFED** to the contractor whether under this contract or otherwise **OMFED** shall not be bound to contest any claim made against it under sub-section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the contractor and upon his giving to the OMFED full security for all costs for which Government might become liable in contesting such claim.

CLAUSE 19(Labour Laws to be complied by the Contractor)

The contractor shall obtain a valid license under the State Labour Act, and the Contract Labour (Regulation and Abolition) Central rules 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfill these requirements shall attract the penal provisions of the contract arising out of the resultant non-execution of the work.

CLAUSE 19 A (labour below the age of fourteen years)

No labour below the age of fourteen years shall be employed on the work.

CLAUSE 19 B (Payment of Wages)

i) The contractor shall pay to labour employed by him either directly or through sub- contractors, wages not less than fair wages as defined in State Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970 and the contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

iii) In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the state Labour Regulations made by Government from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and the Contract Labour (Regulation And Abolition) Central Rules, 1971, wherever applicable.

iv)

a) The Engineer in Charge concerned shall have the right to deduct from the moneys due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of nonfulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.

b) Under the provision of Minimum Wages (Central) Rules 1950, the contractor is bound to allow to the labours directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at same rate as for duty. In the event of default, the Engineer in Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer in Charge concerned.

v) The contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's

Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Act, 1970, or the modifications thereof or any other laws relating thereto and the rules made thereunder from time to time.

vi) The contractor shall indemnify and keep indemnified OMFED again payments to be made under and for the observance of the laws aforesaid and the State Labour Regulations without prejudice to his right to claim indemnity from his sub-contractors.

vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

viii) Whatever is the minimum wage for the time being, or if the wage payable higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

CLAUSE 19 C (Safety code for labour)

In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per P.W.D. Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid he shall be liable to pay a penalty of Rs. 200/- for each default and in addition the Engineer in Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19 D (Information on labour engaged)

The contractor shall submit by the 4th and 19th of every month, to the Engineer in Charge a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively :-

(1) the number of labourers employed by him on the work,
(2) their working hours,
(3) the wages paid to them,
(4) the accidents that occurred during the said fortnight showing the circumstance under which they happened and the extent of damage and injury caused by them, and
(5) the number of female workers who have been allowed maternity benefit according to Clause 19F and the amount paid to them.

Failing which the contractor shall be liable to pay to Government a sum not exceeding Rs. 200/- for each default or materially incorrect statement. The decision of the Chief Consultant shall be final in deducting from any bill due to the contractor the amount levied as fine and be binding on the contractor.

CLAUSE 19 E (Health and sanitation for labours)

In respect of all labour directly, or indirectly employed in the works for the performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by the **OMFED** and contractors.

CLAUSE 19 H (Accomodation for labours)

The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Consultant-In-Charge.

i) a) The minimum height of each hut at the eaves level shall be 2.10m (7ft.) and the floor area to be provided will be at the rate of 2.7 sq. m. (30 sq. ft.) for each member of the worker's family staying with the labourer.

b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m X 1.50m (6' X 5') adjacent to the hut for each family.

c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.

d) The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

ii) a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Consultant-In-Charge.

In case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer in Chargeand the contractor shall ensure that throughout the period of their occupation the roofs remain water-tight.

b) The contractor(s) shall provide each hut with proper ventilation.

c) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.

d) There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the

approval of the Consultant-In-Charge. Back to back construction will be allowed.

iii) **Water supply -** The contractor(s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The contractor(s) shall also at his/their own cost make arrangements for laying pipe lines of water supply to his/their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.

iv) The site selected for the camp shall be high ground, removed from jungle.

v) **Disposal of Excreta -** The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

vi) **Drainage -** The contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

vii) The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

viii) **Sanitation -** The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

CLAUSE 19 I (Removal of labour with misconduct)

The Engineer in Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractor's employment upon the work who may be incompetent or who misconducts himself and the contractor shall forthwith comply with such requirements.

CLAUSE 19 J (Illegal occupation of constructed building)

It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorized during construction, and is handed over to the Engineer in Charge with vacant possession of complete building. If such building though

completed is occupied illegally, then the Engineer in Charge shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay a levy up to 5% of tendered value of work may be imposed by the Engineer in Charge upon approval of Managing Director whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However, the Engineer in Charge, through a notice, may require the contractor to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 20 (Comply to the minimum wage act)

The Contractor shall at least pay and comply with all the provisions of the Minimum Wages Acts and Rules framed there under other labour laws related to contract labour.

CLAUSE 21 (Work not to be sublet. Action in case of In solvency)

The contract shall not be assigned or sublet without the written approval of the Engineer in Charge with approval of Managing Director. And if the contractor shall assign or sublet his contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public officer or person in the employ of Government in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer in Charge on behalf of the **OMFED** shall have power to adopt the courses specified in Clause 3 hereof in the interest of Government and in the event of such course being adopted the consequences specified in the said Clause 3 shall ensue.

CLAUSE 22 (Paymant of compensation)

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of OMFED without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

CLUASE 23 (Changes in firm's Constitution to be intimated)

Where the contractor is a partnership firm, the previous approval in writing of the Managing Director shall be obtained before any change is made in the constitution of the firm where the contractor is an individual or a Hindu undivided family business concern such approval as

aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If previous approval as aforesaid is not obtained,

the contract shall be deemed to have been assigned in contravention of Clause 21 thereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

CLAUSE 24 (Work to be executed as per direction of OMFED)

All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Engineer in Chargewho shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

CLAUSE 25 (Settlement of Disputes and Arbitration)

- All disputes or differences in respect of which the decision is not final and conclusive shall, on the initiative of either party, be referred to the adjudication of a sole Arbitrator, to be appointed by OMFED. The appointment of sole Arbitrator so made shall be final and conclusive.
- 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.
- 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.
- The Arbitrator from time to time, with the consent of the parties enlarges the time for making and publishing the award.

- The venue of the Arbitration shall be in **Bhubaneswar** only and jurisdiction for any matter/dispute arising out of or concerning or connected with such Arbitration shall be of such courts as exercising jurisdiction over Bhubaneswar.

- 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 .
- The award of the Arbitrator shall be final and binding on both the parties.
- The Arbitration proceedings shall be governed by Arbitration and 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 OMFED shall not be withheld, unless they are the subjects of the Arbitration proceedings.

- Neither party is entitled to bring a claim or dispute to Arbitration after thirty days of expiration of the maintenance period.

  Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in-before mentioned and as to the quality of workmanship or materials used on the work or as

to any other question, claim right matter or thing whatsoever in any way arising out of or relating to contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter.

if the contractor considered any work demanded of him to be outside the requirements of the contract, or dispute any drawings, record or decision given in writing by the Engineer-in-Charge on any matter in connection with or arising out of the contract or carrying out of the contract or carrying out of the work, to be unacceptable, he shall promptly within 7 days request the Engineer in Charge in writing for written instruction or decision. Thereupon, the Engineer in Charge shall give his written instructions or decision within a period of fifteen days from the receipt of the Contractor's letter.

If the Engineer in Charge fails to give his instruction of decision in writing within the aforesaid period or if the contractor is dissatisfied with the instructions or decision of the Engineer in Charge, the contractor may, within 15 days of the receipt of Engineer in Charge decision, appeal to the General Manager (OMFED) who shall afford an opportunity to the contractor to be heard, if the latter so desires, and to offer evidence in support of his appeal. The General Manager (OMFED) shall give his decision within 30 days of receipt of contractor's appeal. If the contractor is dissatisfied with this decision, the contractor shall within a period of 30 days from receipt of the decision, give notice to the General Manager (OMFED) for appointment of arbitrator failing which the said decision shall be final binding and conclusive and not referable to adjudication by the arbitrator.

Expert where the decision has become final, binding and conclusive in terms of sub para (i) above disputes or difference shall be referred for adjudication through arbitrator appointed by Managing Director (OMFED). If the arbitrator so appointed is unable or unwilling to act or resign his appointment or vacates his office due to any reason whatsoever another sole arbitrator shall be appointed in the manner aforesaid. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

It is a tern of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each such dispute along with the notice for appointment of arbitrator and giving reference to the rejection by the General Manager (OMFED) of the appeal.

It is also a term of the contract that the arbitrator shall be deemed to have entered on the reference on the date he issued notice to both the parties calling them to submit their statement of claims and counter statement of claims. The decision of arbitrator will be final & binding to the parties.

All arbitration shall be held at Bhubaneswar and at no other place.

CLAUSE 26 (Contractor to indemnity Govt. against Patent Rights)
The contractor shall fully indemnify and deep indemnified the **OMFED** against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under the action brought against **OMFED** in respect of any such matter as aforesaid the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the **OMFED** if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer in Charge in this behalf.

CLAUSE 27 (Lumpsum Provisions in Tender)

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

CLAUSE 28 (Action where no Specifications are specified)
In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications, Indian Road Congress for road works and Indian Building Congress for building works or any central government agency. In case there is no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturers specifications. If not available then as per District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Consultant-In-Charge.

CLAUSE 29 (With-holding and lien in)
Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer in Charge or the **OMFED** shall be entitled to without and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer in Charge or the **OMFED** shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken

from the contractor, the Engineer in Charge or the **OMFED** shall be entitled to withhold and have a lien to retain to the extent of payable or which may at any time thereafter become payable to the contractor under the same contract or any other contract with the Engineer in Charge of the **OMFED** or any contracting person through the Engineer in Charge of the **OMFED** or any person through the Engineer in Charge pending finalization of adjudication of any such claim.

- **respect of sums due from contractor**

  It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer in Charge or **OMFED** will be kept, withheld or retained as such by the Engineer in Charge or **OMFED** till the claim arising out of or under the contract is determined by the arbitrator (if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a Partnership firm or a limited company, the Engineer in Charge or the **OMFED** shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.
- **Lien in respect of claims in other Contracts**

  i) **OMFED** shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract etc., to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of over-payment and it shall be lawful for **OMFED** to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by OMFED to the contractor, without any interest thereon whatsoever.

CLAUSE 29 A (withhold of payment)

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer in Charge or the **OMFED** or any other contracting person or persons through Engineer in Charge against any claim of the Engineer in Charge or **OMFED** or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer in Charge or the **OMFED** or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer in Charge or the **OMFED** will be kept withheld or retained as such by the Engineer in Charge or the **OMFED** or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 30 (Unfiltered water supply)

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

a) That the water used by the contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer in Charge.

b) The Engineer in Charge shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Engineer in Charge, unsatisfactory.

CLAUSE 33(Employment of Technical Staff and employees)

Contractors Superintendence, Supervision, Technical Staff & Employees

The contractor shall provide all necessary superintendence during execution of the work and as along thereafter as may be necessary for proper fulfillment of the obligations under the contract.

The contractor along with bidding of the tender, intimate in writing to the Engineer in Charge the name, qualifications, experience, age, address and other particulars along with certificates, of the principal technical representative to be in charge of the work. Such qualifications and experience shall not be lower than specified in Qualification Criteria. The Engineer in Charge shall within 15 days of issue of letter of acceptance intimate in writing his approval or otherwise of such a representative to the contractor, intimate in writing his approval or otherwise of such a representative to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal the contractor shall appoint another such representative according to the provisions of this clause. Decision of the tender Managing Director shall be final and binding on the contractor in this respect. Such a principal technical representative shall be appointed by the contractor soon after receipt of the approval from Managing Director or any other person so authorized by him. Technical staff shall be available at site within fifteen days of start of work.

If the contractor (or any partner in case of firm/company) who himself has such qualifications, it will not be necessary for the said contractor to appoint such a principal

technical representative but the contractor shall designate and appoint a responsible agent to represent him and to be present at the work whenever the contractor is not in a position to be so present. All the provisions applicable to the principal technical representative under the Clause will also be applicable in such a case to contractor or his responsible agent. The principal technical representative and/or the contractor or his responsible authorized agent shall be actually available at site also during recording of measurement of works and whenever so required by the Engineer in Charge by a notice as aforesaid and shall also note down instructions conveyed by the Engineer in Charge or his designated down the instructions and in token of acceptance of measurements.

If the Engineer in Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative or agent is effectively appointed or is effectively attending or fulfilling the provision of this clause, a recovery shall be effected from the contractor as specified in tender cluse and the decision of the Engineer in Charge as recorded in the site order book and measurement recorded in Measurement Books shall be final and binding on the contractor. Further if the contractor fails to appoint a suitable technical representative or responsible agent and if such appointed persons are not effectively present or do not discharge their responsibilities satisfactorily, the Engineer in Charge shall have full powers to suspend the execution of the work until such date as a suitable agent is appointed and the contractor shall submit a certificate of employment of the technical representative/responsible agent along with every on account bill/fixed bill and shall produce evidence if at any time so required by the Engineer in Charge.

i) The Contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.
The contractor shall provide and employ skilled, semi- skilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer in Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer in Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer in Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 34 (Levy/Taxes payable by Contractor)

- Conditions for reimbursement of levy/taxes if levied if levied after receipt of tenders

i) GST, any other tax on materials or Labour Welfare Tax (if applicable) in respect of this contract shall be payable by the contractor and **OMFED** shall not entertain any claim whatsoever in this respect.

ii) The contractor shall deposit royalty and obtain necessary permit for supply of the

red bajri, earth, moorum, sand, stone chips, kankar, etc. from local authorities.

If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable to the Government of India and does not at any time become payable by the contractor to the Government. Local authorities in respect of any material used by the contractor in the works then in such a case, it shall be lawful to the Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

CLAUSE 35(All tendered rates shall be inclusive of all taxes and levies)

The rate quoted by bidders shall be inclusive of GST. The bidder shall raise invoice in the name of OMFED and submit hard copy of bill in duplicate.

All tendered rates shall be inclusive of all taxes and levies payable under respective statutes. However, pursuant to the Constitution (46th Amendment) Act, 1982, if any further tax or levy is imposed by Statute, after the last stipu7lated date for the receipt of Tender offer including extensions if any and the Contractor thereupon necessarily and properly pays such taxes / levies,

the Contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the Engineer in Charge/ Chief Engineer(whose decision shall be final and binding on the Contractor) attributable to delay in execution of work within the control of Contractor.

(ii) The Contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the OMFED and /or the Engineer In Charge and further shall furnish such other information/ document as the Engineer in Charge may require from time to time.

The contractor shall, within a period of 30 days of the imposition of any such further tax or levy, pursuant to the Constitution (46th Amendment) Act, 1982, give a written notice thereof to the Engineer in Charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 36 (Termination of contract in case of imprisonment)

If the contractor is imprisoned, becomes insolvent compound with his creditors, has a receiving order made against him or carries on business under a receiver for the benefit of the creditors or any of them, or being a partnership firm becomes dissolved, or being a company or corporations goes into liquidation or commences to be wound up not being a voluntary winding up for the purpose only of amalgamation or reconstitution the Nigam shall be at liberty.

To give such liquidator, receiver, or other person in whom the contract may become vested, the option of carrying out the contract or a position there of to be determined by the Nigam, subject to his providing an appropriate guarantee for the performance of such contractor.

To terminate the contract, forthwith by notice in writing to the Agency, the liquidator, the receiver or person in whom the contract may become vested and take further action as provided in the relevant clauses of the contract.

CLAUSE 37 (Termination of Contract on death of contractor)
Without prejudice to any of the rights or remedies under this contract if the contractor dies, the Managing Director on behalf of the **OMFED** shall have the option of terminating the contract without compensation to the contractor after the affidavit of his/their legal heir/heirs that they are not going to be in this profession in future.

CLAUSE 38(If relation working In OMFED then the Agency not allowed to tender)

The Agency shall not be permitted to Rate Offer for works in the concerned division (responsible for award and execution of contracts) in which his near relative is posted as officer or as an officer in any capacity between the grades of the **officer** He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by the OMFED. Any breach of this condition by the Agency's of this Nigam shall lead to blacklisting. If however the Agency's is registered in any other State / Central Govt. / State Milk Federation, he shall be debarred from tendering in OMFED for any breach of this condition.

NOTE: By the term "near relatives" is meant wife, husband, parents and grand parents, children and grand children, brothers and sisters, uncles, aunts and cousins and their corresponding in law.

CLAUSE 39 (No-Gezetted- Engineer to work as Agency within two years of retirement)

No engineer of gazetted rank or other gazetted officer employed in engineering or administrative duties in an engineering OMFED shall work as a Agency or employee of a Agency for a period of two years after his retirement from OMFED service without the previous permission of OMFED in writing. This contract is liable to be cancelled if either the Agency or any of his employees is found at any time to be such a person who had not obtained said permission prior to engagement in the Agency's service, as the case may be.

CLAUSE 41 (Repaid of the Performance Security Deposit Amount)

The security shall be repaid to the bidder after 15 (Fifteen) month of successful installation / trial run & successful commissioning / handing over of entire.

Clause 42 (Responsibility of technical staff and employees)
Technical officers/staff deployed by the Contractor at any construction site will also be responsible for inferior quality/poor performance of any work; and his name will be circulated to all division of the department, to debar from any other site, if his name is being proposed by other contractor.

CLAUSE 43 (Contractor's Risks)

All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

CLAUSE 44

- Insurance
- Cash flow estimate to be submitted

The Contractor shall provide, in the joint names of the OMFED and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract Data for the following events which are due to the Contractor's risks: loss of or damage to the Works, Plant and Materials ;

loss of or damage to Equipment;

loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract; and Personal injury or death.

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

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

If the Contractor does not provide any of the policies and certificates required, the OMFED may affect the insurance which the Contractor should have provided and recover the premiums the OMFED has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

Alteration to the terms of insurance shall not be made without the approval of the Managing Director.

Both parties shall comply with any conditions of the insurance policies.

CLAUSE 45 (Safety, Security and Protection of the Environment)

The Contractor shall, within the time stated in special Conditions of contract after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Agency will be entitled under the Contract and the Agency shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer in charge.

CLAUSE 47 (Cost of Samples)

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.

CLAUSE 48 (Cost of Tests)

The cost of making any test shall be borne by the Contractor if such test is :
clearly intended by or provided for in the Contract, or particularised in the Contract (in case only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfill) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

CLAUSE 49 (Cost of Tests not provided for)

If any test required by the Engineer which is : not so intended by or provided for,
(in the cases above mentioned) not so particularized, or (though so intended or provided for) required by the Engineer to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the materials or Plant tested, shows the materials, Plant or workmanship not to be in accordance with the provisions of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor, but in any other case Sub-Clause shall apply.

CLAUSE 50 (Commencement of Works)

The contract shall commence the Works as soon as is reasonably possible after the receipt by him of a notice to this effect from the Consultant-In-Charge, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

CLAUSE 51 (Substantial Completion Parts)

If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Test on Completion prescribed by the Contract, the Engineer may issue a Taking-of Over Certificate in respect of that part of the Permanent Works before completion of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defects Liability Period.

CLAUSE 52 (Force Majeure)

Neither party shall be liable to the other for any loss or damage occasioned by nor raisin out of acts of GOD such has unprecedented flood, volcanic eruption, Earthquake or other convulsion of nature and other acts such as the general partial strikes by a section of OMFED employees, invasion, the act of foreign countries hostilities or war like operation before or after declaration of war, rebellion military or usurped power which prevent performance of the contract and which could not have been foreseen or avoided by a prudent person.

CLAUSE 53 (Recovery)

Any amount found recoverable from the Agency shall be recovered as public demand under the rule without prejudice to any other mode of recovery.

TERMS OF PAYMENT

Part – III PAYMENT TERMS

PAYMENT TERMS FOR CIVIL/STRUCTURAL WORK

1. **10% Advance** Payment against civil work order value (after deposit of 10% PSD & execution of agreement by bidder) against **13% Bank Guarantee** from any Nationalized/Scheduled Bank valid till successful completion of project and shall be recovered from subsequent running bills. The 13 % Bank guarantee against 10% advance shall be adjusted from subsequent running bills and after adjustment of advance the 13% Bank Guarantee shall be refunded to the Bidder.

- **75%** of the civil work payment shall be released in **5(five) number running bills** on actual execution basis.
- Balance 15% of the billed value shall be released on **successful completion** of the civil work.

PAYMENT TERMS FOR MECHANICAL/ELECTRICAL WORK

- **10% Advance** Payment of Mechanical & Electrical total work order value (after deposit of PSD & execution of agreement by bidder) against **13% Bank Guarantee** from any Nationalized/Scheduled Bank valid till successful completion of project.

- **PAYMENT BREAK UP**

  All payment shall be released against detailed break up cost to be furnished by the bidder in advance and accepted by the payment authority of OMFED.

  a) On Progress of work:

     50% of the mechanical and electrical equipment price components shall be paid on safe delivery of the Goods at the destination.

  b) On Progressive Erection:

     20% of the mechanical and electrical price components shall be paid on the value of the progressive erection work completed for individual components.

  c) On Commissioning:

     10% of the mechanical and electrical price components shall be paid after successful commissioning of the entire plant after obtaining necessary statutory approvals.

  d) On final acceptance:

     The balance 10% of the contract price of the Mechanical & Electrical shall be paid on continuous satisfactory running of the complete plant for one month, on completion of other contracted services and accepted by the OMFED representative, within the scope of this contract.

TAXATION & PATENT RIGHTS AND ROYALTIES

1. The Contractor shall be entirely responsible for all taxes including GST, duties, royalties, license fees, levied by Government etc.

2. The Contractor shall be liable to pay all corporate taxes, income tax, GST 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 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 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. The Contractor's staff, personnel and labour will be liable to pay personal income taxes in India in respect of such 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.
3. It is responsibility of the contractor to pay and finalize the GST in respect to the contract extra claim regarding GST shall not be paid by OMFED.
4. The Contractor shall keep harmless and indemnify the OMFED from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or 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 taxes and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the works or any of them.

BID SECURITY (EARNEST MONEY DEPOSIT)

1. **The bidder shall furnish, as part of its bid, bid security for a value of Rs.8,00,000/-.**
2. The bid security is required to protect the purchaser against the risk of bidder's conduct, which would warrant the security's forfeiture.
3. The bid security shall be in one of the following forms:

(c) A bank guarantee issued by a Nationalized/Scheduled bank in India only in the form strictly in accordance to the sample form provided in the bidding documents and valid from the date of bid opening as prescribed in the tender notice till 120 days beyond the validity of the bid.

Or

(d) A demand draft or pay order in favour of Orissa State Cooperative Milk Producers Federation Limited, Payable at Bhubaneswar.

4. Any bid not secured in accordance with clause 1 in General Condition of Contract, will be rejected by OMFED as non-responsive and the 2nd cover (price bid) shall not be opened at all.

5. Unsuccessful bidders bid security will be discharged/ returned as promptly as possible but not later than 120 days after the expiration of the period of bid validity prescribed in the bidding document.
6. The successful bidders bid security will be discharged upon the bidders executing the agreement furnishing the performance security deposit.
7. No interest shall be paid by OMFED on the bid security furnished by the bidder.
8. The bid security may be forfeited:

(a) If a bidder withdraws or modifies his bid during the period of bid validity;

Or

(e) In the case of these successful bidder, if the bidder fails:

i) To sign the agreement in accordance with tender norms;

Or

ii) To furnish the required performance security deposit as per tender norms.

Performance Security

The contractor shall submit an irrevocable PERFORMANCE GUARANTEE of 10% (Ten percent) of the tendered amount in the shape as

- Demand Draft of a scheduled Bank issued in favour OMFED, payable at Bhubaneswar.

Or

- A bank guarantee issued by a Nationalized/Scheduled bank in India.

iii) The security shall be repaid to the bidder after 15 (fifteen) months of successful installation / trial run & successful commissioning / handing over of entire plant.

iv) Within 15 (Fifteen) days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the OMFED a **Performance Security** for an amount equivalent **10%** of the Contract price. The 10% Performance Security shall be release to the bidder after 15 (fifteen) months of successful installation / trial run & successful commissioning / handing over of entire plant.

(i) The performance Guarantee shall be initially valid up to Twenty Months beyond the defect liability period. In case the time for completion of work gets enlarged, the contractor shall get the validity of performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor without any interest.

(ii) The General Manager (Projects) shall not make a claim under the Performance guarantee except for amounts to which the OMFED is entitled under the contract (notwithstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

(d) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the General Manager (Projects) may claim the full amount of the Performance guarantee.

(e) Failure by the contractor to pay OMFED any amount due, either as agreed by the

contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by General Manger Project.

(f) Failure by the Agency to rectify any defects as defined in the defect liability clause in the tender of contract data to the satisfaction of the Engineer in charge the contractor has to pay OMFED, any amount due, either as agreed by the Contractor or determined under any of the Clauses/ Conditions of the Agreement, within 30 days of the service of notice to this effect by Engineer in Charge.

(iii) In the event of the contract being determined or rescinded under provisions of any of the clause/condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the **OMFED**.

PAYMENT IN THE EVENT OF FRUSTRATION

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 to the Contractor in respect of the work executed shall be the same as that which would have been payable under clause36 hereof if the Contract had been terminated under the provisions of clause 36 hereof .

SETTLEMENT OF DISPUTES

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 the decision. Thereupon the Engineer shall give his written instructions or decision within a period of 30 days of such requests.

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

3. If the Engineer fails to give his instructions or decisions in writing within a period of 30 days after being requested, or if the Contractor is dissatisfied by the instructions and decision he shall appeal to the OMFED which shall afford an opportunity to the Contractor heard and to offer an evidence in support of his appeal. The OMFED shall give a decision within a period of thirty days after the Contractor has given the said evidence in support of his appeal.

4. If the Contractor is dissatisfied with this decision, the Contractor within the 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.

SECTION - 4

SPECIAL CONDITION OF CONTRACT

SPECIAL CONDITION OF CONTRACT

The drawings designs submitted by the bidder shall be verified by the Consultant engaged by OMFED which is binding for execution by the bidder.

Part – I For Civil Works

1.0 EARTHWORK

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 leveling, 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 establish 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 burnt or disposed off as directed by Engineer. Where earth fill 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/OMFED and from time to time deliver the same to such person or persons as Owner/OMFED may from time to time authorize 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, slit, moorum 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 meter in any dimension and not more than 200mm 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 masonry 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 earthwork in excavation shall be done as per the Architect and structural consultant's 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 cone by the Contractor. Roots or trees met with during the excavation shall be cut and smeared with coal tar. Excavated earth shall be stacked at least 3m 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 leveled watered, consolidated and ready for termite treatment. The maximum lead for stacking the earth shall be 100m, unless otherwise categorically specified in the item description.

C) In firm soil if the excavation is deeper than 2m the sides of the trenches shall be made bigger by allowing steps of 50 cm on either side so as 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 leveled 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 and 10 coarse aggregate of nominal size 40mm) 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 neighbor's property caused by his negligence during the constructional operations.

J) To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, soleplates, 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 murum or earth to fill up the voids and the mixture used for filling.

K) As soon as the work in foundation 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.

i) **Lead**

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. If the lead is not specified in the respective item, a basic lead of 100 m shall be considered for quoting rates. Only leads beyond 100m shall be considered as extra lead and the Contractor shall be compensated for the same. For the purpose of measurement of lead the area to be excavated or filled or area on which excavated material is to be deposited/disposed off shall be divided into suitable blocks and for each of the blocks, the distance between centerlines shall be taken as the lead which shall be measured, as far as practically possible, by the shortest straight line route on the plan and not the actual route taken by Contractor. No extra compensation is admissible on the grounds that the lead including that for borrowed materials had to be transported over marshy or katcha land/route.

ii) All excavation shall be measured net. Dimensions for purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other foundations structure to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. Excavation inside slopes shall not be paid for. Contractor may make such allowances in his rates to provide for excavation in side slopes keeping in mind the nature of the soil

and safety of excavation. In soft/slushy soil or in firm soil if the excavation is deeper than 2m the sides of the trenches shall be made bigger by allowing steps of 50cm on either side so as to keep slope 0.25:1. This shall be paid as per original tender rate. However, if concreting is proposed against the additional/extra excavation made by the Contractor shall be made good by the Contractor with concrete of the same class as in the foundations at his own cost.

iii) Backfilling as per specification the side of foundations of columns, footings, structures, walls, tanks rafts, trenches etc. with excavated materials will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation/ stacking of selected stacked material, conveying it to the place of final backfill, compaction etc. as specified. As a rule material to be back filled shall be stacked temporarily within the basic lead of 100 meters unless otherwise specified in the item.

iv) The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, riprap with regular slopes as directed by Engineer within the lead specified and leveling the same so as to provide natural drainage. Rock/soil excavated shall be stacked properly as directed by Engineer. As a rule, softer material shall be laid along the center of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Excavated soft rock or hard rock shall be stacked separately.

v) The bailing out of water shall also be executed by the Contractor at his own cost.

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

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

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

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

1.04 Earth work in excavation in rocks upto 1.50 M 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 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 satisfactions of Engineer at his cost. As excavation approaches its final lines and levels, the depth of 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 license 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 shall include the cost of all these operations.

(C) Contractor shall obtain necessary license for storage of explosive 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 explosive 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 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 ensuring safety.

iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within200M 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 chiseling prior to the 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 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 filed 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 gelatin with detonator and fuse 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.

xiv) The rate quoted for excavation shall include the following jobs:

a) Refilling of the trenches and consolidating and spreading as per the Engineer's directions.

b) Shoring and strutting as demanded by the site conditions and as instructed by the Engineer.

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 description given in the Schedule of Quantities that the compaction of the plinth fill shall be carried out by means of 10/12 tonne 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 100 M but not exceeding 300M

The general specification is same as item no. 1.06

1.08 Filling excavated earth in ground for land development

(A) No earthfill 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 leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 600 mm and leveled 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 should 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 materials 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 material 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 roads do not exist ,at his cost.

(B) If any material is rejected by Engineer, Contractor shall remove the same for with 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 plinth 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 the 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.Constructionof 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 100mm-150mm unless, otherwise specified in the item description in the Schedule of quantities and the quality has to be got approved by the Engineer.

(B) Rubble shall be laid closely in position on the subgrade.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 morrum, 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 herringbone. 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 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 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 and mortar of proportion as specified in the item description in the Schedule of Quantities.

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.

2.0 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) IS1489 : 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) IS 2386 : Methods of test for aggregates for concrete.
(Parts I to VIII)

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.

11) IS 3025 : Methods of sampling and test (physical and chemical water used in industry).

12) IS 432 : Specification for mild steel and medium tensile steel bars and hard drawn steel wire for
concrete reinforcement.
(Part I &II)

13) IS 1139 : Specification for hot rolled mild steel and medium tensile steel deformed bars for

concrete reinforcement.

14) IS 1566 : Specification for plain hard drawn steel wire Febric for concrete reinforcement.

15) IS 1785 : Specification for plain hard drawn (Part I) steel Wire for pre stressed concrete.

16) IS 1786 : Specification for cold twisted steel bars for Concrete reinforcement.

17) IS 2090 : Specification for high tensile steel bars used in Prestressed concrete.

18) IS 4990 : Specification for plywood for concrete shuttering Work.

19) IS 2645 : Specification for integral cement water proofing Compounds.

(b) **Equipment**

1) IS 1791 : Specification for batch type concrete mixers.

2) IS 2438 : Specification for roller pan mixture.

3) IS 2505 : Specification for concrete vibrators immersion type.

4) IS 2514 : Specifications for concrete vibrating tables.

5) IS 3366 : Specification for pan vibrators.

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

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

8) IS 2750 : Specification for steel scaffoldings.

(c) **Codes of practice**

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

2) IS 1343 :33de of practice for prestressed concrete.

3) IS 457 : Code of practice for general construction of Plain and reinforced concrete for dams and Other massive structures.

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

5) IS 3935 : Code of practice for composite construction.

6) IS 3201 : Criteria for design and construction of precast 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 (Part I& II) : Code of practice for steel tubular 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.

II <u>General</u>

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 <u>Materials</u>

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 mixtures.

(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 50kg bags. The use of bulk cement will be permitted only with the approval of the engineer.

ii) A certified report attesting to the conformance of the cement to IS specification 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 OMFED

i) Contractor will have to make his own arrangements for the storage of minimum 25 MT of cement. If supplies are arranged by OMFED, 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 the 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) Aggregates in general designate both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75mm 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 the 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 cost 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 stockpiles in the material yard near the work site in bins properly constructed to avoid intermixing 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 the bins or stock

piles. Coarse aggregate shall be piled in layers not exceeding 1.20metres in height to prevent coning or segregation. Each layer shall cover the entire area of the stock pile 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 percentage of determine 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:

IS Sieve Designation	Percentage passing for Grading Zone I	Grading Zone II	Grading Zone III	Zone IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600micron	15-34	35-59	60-79	80-100
300micron	5-20	8-30	12-40	15-50
150micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of the sieves other than 600micron 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 600micron 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,2.36mm,1.18mm,600micron,300micron,and 150micron and dividing the sum by 100.

(D) **Coarse Aggregate**

a) Coarse aggregate for concrete, except for 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 piece 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	--	--	--	95	100	--	--
20mm	0-20	85-100	--	--		30-95		100	--
16mm	--	--	85-100	--		--	--	90	--
12.5mm	--	--	85-100	--		--	--	--	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 should have granular or crystalline surfaces, Friable, flaky and laminated prices, mica and shale, if present, shall only be in such quantities that will not is the opinion of the Engineer affect adversely the strength and/or durability of concrete. The maximum size of coarse aggregate shall be 75mm for class a concrete, 40mm for class B concrete, and 20mm for class C concrete. The maximum size of coarse aggregate shall be 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 of maximum limit of 20% of the volume of concrete when specifically approved by Engineer. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5mm 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 particles occurring 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 Material 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
i) Coal and Lignite	1.00	1.00
iii) Clay Lumps	1.00	1.00
I V) 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. Portable 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 clean container previously rinsed out with similar water.

c) Average 28 days compressive strength of at least three 15cm 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 the 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 30seconds from the initial setting time of the control test block prepared with 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 2ml of 0.1 normal Noah. The details of the tests shall be as given in IS 3025.

ii) To neutralize 900ml sample of water using methyl orange as an indicator, it should not require more than 10ml of 0.1 normal HCl. The details of the tests 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		
Sulphate (as SO4)	0.30	11(Ignited residue)
Alkali chlorides (as Cl)	0.05	20
	0.10	24

(F) **Brick aggregates**

The brickbats shall be of new bricks well burnt, hard, durable and broken into 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 IS432

(PartI) 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 the engineer.

b) Plain round mild steel bars grade II as per IS 432 (part I) may be issued with prior approval if the 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, 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 37 mm and down).

The brick bats, 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 concrete1:4:8 (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 specified in item no. 2.01

2.04 Providing and laying plain cement concrete 1:3:6(1 cement: 3 coarse sand, 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 M 15 for structures of 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 specifications 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	Minimum cement content per mm
	At 7 days	at 18 days	at 7 days	at 28 days		
M 42	35.0	54.0	27.0	46.0	20	550 kg
M 35	31.0	45.0	23.5	39.0	20	470 kg
M 30	28.0	42.0	20.0	33.0	20	420 kg
M 25	23.5	35.0	17.0	28.0	20	370 kg
M 20	19.4	29.0	13.5	22.0	20	320 kg
M 15	14.0	17.0	10	16.0	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 proportion due to the 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 tests

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 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 not less than 3 minutes until the resulting concrete is uniform in appearance. Each mix of concrete shall be of such quantity as to leave about 10% excess concrete after molding 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 material 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 mixing shall be as short as possible yet sufficient to produce a homogenous mass.

e) Compression tests of concrete cubes shall be made as per IS 516 on 15cm 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 0.2 mm. 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. temp 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 tests specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to the Engineer. The test result shall be accepted by the Engineer if the average compressive strengths of the specimens are tested subject to the condition that

only one out of the five consecutive tests 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 right proportions. The different sizes shall be stocked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible as determined by the 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 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 aggregate 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 work for the job 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 dur-ing mixing to produce a mix of sufficient workability to enable it to be well consolidated, to be worked into 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 75 mm thick.	25mm to 40mm	75mm to100mm
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 to150mm

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 15cm machine suitable for 15cm cubes of 100 tones capacity with proving calibration ring.

ii) Twelve cast iron cube moulds of 15cm size.

iii) One Lab. balance to weigh up to 5kg 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 5 litre to 0.1 litre.

vii) One electric oven with thermostat up to 120 Deg.Cent.

viii) One flakiness gauge.

ix) One elongation index gauge.

x) One sedimentation pipette

xi) One pyconometer

xii) Two calibrated glass jars of 1 litre 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 at 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 7^{th} and 28^{th} day from the day of casting 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 a 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 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 .Test 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 coarse 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) pictographic examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value. Any or all these tests would normally be ordered to 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 an approved test laboratory. If the tests are successful, OMFED 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 contactor to dismantle such portions of the work, which in his opinion are unacceptable and redo the work to the standard stipulated at contactor’s cost.

c) Load test on members or any other tests

i) In the event of any work being suspected as 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 tests, 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% 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 testify the recovery after the second test is not at least 75% 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 part of the structure as directed by the 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/OMFED. The contractor shall bear the cost of so doing, unless the failure of 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 aluminates 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 meter 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 far 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 after concrete placement begins, proposed surfaces except framework, which will come in contract 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 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 rehandled 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 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 rehandled 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 location where direct placement is not possible and 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 1m 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 1m. 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 form by wheelbarrows, 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 wastewater shall be kept clear of forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1m.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 specifically 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 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 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.

o) Compact on

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 and 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 is 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 under layer 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 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 vibrators 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 through bonding, as directed by Engineer.

p) 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.

q) Special provision in placing

When placing concrete in walls with openings and in floors of integral slabs 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.

r) Placing concrete with 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.

s) 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 ten 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 judgment 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 the edges and corners of the slabs to ensure proper protection to this 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 equipments 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 2.36mm 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 out 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 in 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 under 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 of 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, otherwise 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 sub floors to be covered either concrete topping, terrazzo or quarry tile and similar surfaces shall be smooth screened 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, sidewalk floors and slabs shall be consolidated, screened 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. Joint 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.

iii) 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 surfaces 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.

iv) 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 carborundum 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 20 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 of 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 15 concrete in super structure up to 12 M height from plinth level

The general specification is same as per item no. 2.0

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 super structure 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 15 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 up to 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 up to 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:

viii) 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.

ix) 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 atleast twice the stress to which the concrete may be subjected to at the time of lifting.

x) 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.

xi) 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.

xii) Slots, openings or holes, pockets etc. shall be provided in the concrete work 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 upto plinth level

a) The formwork shall consist of shores, bracing, sides of beams and columns, bottom of slabs etc. including ties anchors, hangers inters 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 formwork as well as its construction shall be the responsibility of the contractor. If so 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, wormholes, 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.

i) 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.

ii) Formwork, during any stage of construction showing signs of distortions 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.

iii) Excessive construction camber to compensate for shrinkage, settlement may impair the structural strength of members and shall not be permitted.

iv) 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.

v) 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 form 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 hair face finish of concrete surface without any rendering or plastering, form work shall be carried out by using wood planks, ply wood 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, sills, 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 tong and grooved joints if required to prevent grout loss with tie rods positions and directions 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 horizontally 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 joints, unless the use of groove strips is specified in drawings. Such forms shall be removed and reset from lift to lift. Sheeting of reset forms shall be tightened against the concrete so that the forms will not be spread and permit abrupting 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 on the corner of forms for exposed exterior corners so as to produce 20 mm beveled edges except where otherwise shown in the drawings. Interior corners and edges at formed joints shall not be beveled 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.

vi) No exposed concrete surfaces shall be rendered or painted with cement or otherwise. Plastering of defective concrete as 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 the 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 complete work until the building is handed over.

h) Bracing struts and props

i) Shuttering shall be braced, strutted, propped and so supported that it shall not deform underweight 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 are to be reinstated to take care of construction loads anticipated to be 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 work coming in contact with concrete are perfectly cleaned 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 concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concrete 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 corner and angles exposed in the finished structure shall be formed with moulding to form chamfers or fillets on the finished concrete. The standard dimension for chamfers and fillets, unless otherwise specified shall be 20 mm* 20 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 are 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 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 therefore. The contractor shall remove the shuttering after obtaining the approval of the Engineer.

ii) In no circumstances shall forms be struck until the concrete reaches strength of atleast 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 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 and arches:

i)	Spanning upto 6 m	14 days	8 days
ii)	Spanning over 6 m	21 days	12 days

iv) Striking shall be done with utmost care to avoid damage to arises and projections and without shock or vibration, by gently easing the wedges. If after removing the formwork, 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 neither 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 measure 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 and Erecting shuttering for exposed RCC work

The specification of 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 specification. The top surface of the masonry shall be leveled 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 waterproofing compound

The water proofing compound may be Foss, Sika, Cico or of any equivalent 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 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 approved means. Reinforcing bars shall not be straightened and rebent 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 32 mm 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 unhealed 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 in 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 which ever is less.

ii) For a longitudinal reinforcing bar in a column, not less than 40 mm, 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 of 25 mm nor less than the diameter of the bar.

iv) For tensile, compressive, shear, or other reinforcement in slab or wall not less than 12 mm 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 cover 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 40 mm or the diameter of the main bars, whichever is greater. In the presence of seawater and soils and waters of a corrosive character the covers 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 porter 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 fibers

The bitumen impregnated fiber 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 quality. 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.

3.0 MASONRY WORKS

Applicable codes and specifications

a) 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 1).

3.01 Providing and constructing brick masonry in CM in foundation and up to 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, and 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 paralleled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles and which absorb water more than $1/5^{th}$ of their weight when soaked in water for twenty-four hours shall be rejected. Overheated 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 brickwork to the Engineer for approval. Bricks supplied shall conform to these approved samples. Brick samples 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 matter and of sound, hard, clean and durable particles. 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, through mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 30 minutes of 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 retempering 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 230 mm thick and over shall be laid in English bond unless otherwise specified. While laying bricks shall be pressed in to 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 brickwork shall be plumb, 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 courses shall be kept uniform. For walls of thickness greater than 230 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 for scaffolding shall be closed before plastering. All interconnected brickwork 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 10 mm. 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 or pointing to be done. Where plastering or pointing is not required to be done the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork 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 12 mm before another course is laid.

iv) All brickwork 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 bricks 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, tiles, anchors, conduits, structural sheet, steel lintel 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, chasses, 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 brickwork in accordance with the drawings and specifications.

Providing and brick work in CM in super structure at all levels

The general specification is same as per item no.3.02.

3.03 providing and constructing 115 mm brick masonry in partition for superstructure 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 bricks 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 1.2 mm deep iron band kept at every fourth course of 115mm thick brickwork. 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 hone comb brick work

The specification for the material and the workmanship shall be as specified in the items 3.10 or 3.03 depending on the thickness of the brick work. The proportion of the CM shall be as specified in the item description in the schedule of quantities.

3.06 Providing and constructing Facing brickwork

a) Facing bricks of the type specified shall be laid in the positions indicated on the drawings and all facing brickwork shall be well bonded to the backing bricks. No facing brickwork snail at anytime be more than 600 mm above the backing brickwork.

b) Facing work shall be pointed as the work proceeds and internal faces of the brickwork shall be pointed with neat joint to give a fair face.

c) Faced work shall be kept clean and free from damage, discoloration etc. at all times. The Contractor shall carefully plug all holes with bricks similar to the surrounding.

d) For facing brickwork double scaffolding shall be used and no holes in brickwork for scaffolding shall be permitted.

3.06 Providing and constructing Concrete block masonry

Concrete blocks (hollow or Solid) shall generally conform to IS:2135. 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 brickwork as given 3.3 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 Iess than 6mm and not more than 8 mm. The face joints shall be raked to a minimum depth of 10 mm 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.

Precast concrete screen blocks or Jali work be may used for decorative purposes. The contractor shall furnish samples for approval.

3.08 Providing and constructing Random rubble masonry uncoursed in foundation and up to 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 IS:1597 (Part I). The stores shall be laid in mortar proportions specified or 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 in to 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 12 mm.

e) Spauls and spinning 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 600 mm thick and under, in walls thicker than 600 mm 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 150 mm 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 the quoins shall be of selected stones, neatly dressed with chisel 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 the 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 or masonry shall continue for a minimum of ten days.

3.09 Providing and constructing Random rubble masonry uncoursed in superstructure

The specification shall be same item 3.08.

3.10 Providing and constructing coursed rubble masonry in foundation and up to 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 1). Height of each course in the masonry shall not be 150 mm. The stones in each course shall be of equal height. All courses shall of the same height unless otherwise specified. All stones shall be set in full cement mortar of proportion specified for the respective items of work. Stone shall be got approved by the Engineer.

b) The face stone shall be squared in all joints and beds. The beds being hammer dressed or chisel dressed type and square for at least 75 mm from the face and the joint for at least 40 mm. The face of the stone shall be hammer dressed so that bushings shall not project more than 40 mm

c) No spauls or pinning shall be allowed on the face. All bed joints shall be horizontal and side joints vertical and no joints shall be more than 10 mm 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 600 mm in thickness 3 times their height.

e) Through stones shall be inserted every 1.5 meters to1.8 meters apart in every case and shall run right through when the wall is not more than 600 mm thick when the wall is more than 600 mm thick a line of two or more headers shall be laid from the face to face which shall overlap each other by at least 150 mm. 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 100 mm. The corner shall be chisel dressed for a width of 25 mm.

g) The Walk 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 stone 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 leveled lip 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.

4.0 WOOD WORK

Applicable codes

IS: 4021- Timber door, window and ventilator frames
IS: 2202- wooden flush door shutters (solid core type) part I
IS: 1003- Timber paneled and glazed shutter (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 paneled or glazed or partly paneled & 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 those come in contact.

c) All joining shall be wrought on all faces and finish off by hand with sand paper with slightly rounded arises.

d) The joints shall be pinned with hard wood pins and put together with white lead. Joining shall be by means of mortise and ten on or dovetailed joints as approved. 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.

e) 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.

f) Door frames shall be riveted. All dimensions shall be as per drawings. The verticals of door frames shall project about 50 mm 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 masonry or concrete work with concrete block of mix 1:2:4 and size 230x300x250. The work shall conform to IS: 4021.

g) The door shall be paneled or solid flush doors as described in the item of work. All doors shall be supplied with approved fittings such as hinges, mortise 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 waterproof plywood as per item description in the schedule of Quantities.

h) The workmanship of all doors and window shutters shall conform to the requirements of IS: 1003 (Parts I & II) and IS: 2202 (Part I). Flush door panels shall be got tested as per IS: 4020 in standard laboratories.

i) 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.

j) **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 up to 900 sqcm area.

3mm thick glass for panes from 900-5500 sqcm area.

4mm thick glass for panes from 5500-8400 sqcm area.

5.5mm thick glass or plate glass for panes above 8400 sqcm.

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 holdfasts on each side, respectively. These hold fasts shall be embedded in Masonry 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 open able 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 open able 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 mosquito/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, galvanized 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) , .71mm wire dia and 1.40mm average distance between the wire shall be used.

4.09 **Providing & fixing fixed glass louvers 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 2Smm thick block board or particleboard 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 handrail 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 handrail shall be fixed on HS 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 lipped. The glass shall be braced with beading and putty. The !ipping and the architrave shall be painted with 2 coats of approved paint or polished as directed. Opening upto 0.259 sqmn 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.

5.0 FINISHING WORK

Applicable Codes

IS: 2394 -Code of practice for application of lime plasters finish.

IS: 1477 -Code of practice for painting of ferrous metals in buildings and allied finishes (part -I &II)

IS: 427 -Distemper, dry colours as required.

IS: 2395 -Code of practice for painting concrete, masonry and plaster surfaces.

IS: 428 -Distemper, oil emulsion, and 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 recommenced. Concrete surfaces to be plastered will how ever 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 brickwork and RCC should be fixed with chicken wire mesh/PVC strip as directed before plaster.

The proportion of the mortar should be as specified under the respective items of work. Cement shall be mixed thoroughly in dry conditions and then just enough water added to obtain a workable consistency. The quality of water, send and cement shall be as mentioned in the specification for concrete and 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 crewel and finished smooth by toweling. The plastered surface shall be rubbed with iron plate till the surface shows cement paste. The work shall be in the line and level. Curing of plaster shall be started as soon as the applied plaster has hardened 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 directed by the engineer.

5.02 **Providing & Applying Cement plaster 19 mm thick**

The general specification is same as item 5.0l but for the thickness of the plaster. The plasterwork shall be carried out in 2 layers, the first layer being 12-14mm thick and the second layer being 6 -7mm thick. The proportions of the mortar for both the layers shall be as specified in the item specification. The first layer shall be splashed against the prepared surface with a trowel to obtain an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise directed by the engineer. The plastered surface shall be rubbed with the iron plate till the cement paste comes on the surface.

5.03 **Providing & Applying lime punning to the plastered surface**

The plastered surface shall be finished smooth by trowel ling 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, window 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 at least for 7 days.

5.06 Providing & Applying waterproof 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 plasterwork. 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.

a) 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 trowels. 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 up to 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 stroke from 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 viz. British, Asian, Jenson & Nicholson, ICI or Shalimar. 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 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 "SNOWCEM" or of equivalent 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 at least 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 waterproof. This shall be applied with brushes. The paint shall be of approved quality.

5.13 Providing & fixing chicken mesh

The wire mesh shall be of 24 gauges and it shall be fixed with nails at the junction of brick masonry and RCC elements. The chicken wire mesh shall not sag in between the nails. This shall be done before the application of plaster.

5.4 **Providing & Applying dry distemper**

Distemper shall be or 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 De got approved by the Engineer. Water bound and oil bound distemper shall conform to the requirements of IS:427 and IS :428 respectively.

5.4 Providing & Applying Colour Wash

Colour wash shall be applied the same way as white wash. Necessary and approved colouring chemicals 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 powdery 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.

6.0 FLOORING

Applicable codes.

IS: l443 -Code of practice for laying and finishing of cement concrete flooring tiles.

IS: 2ll4 -Code of practice for laying in site 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 at least 14 days. About a. week after laying the tiles each and every tile shill 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 title 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 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 12 mm 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 of projects 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 levelled. 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 underbed 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 levelled 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 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 joint should be struck smooth. If specified terrazzo 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 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 at least 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 (l cement;4 coarse sand .The joints are filled with ordinary cement and 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 windowsills 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 up to 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 masonry 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 8mm wide and 8mm 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 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 protected properly. Glass/PVC /aluminium strips 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 provided on lean concrete no slurry is required.
The flooring shall be finished with 12mm 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 t 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.l2 P & L IPS flooring of 50 thick

-Do- same as item 6.11 but for 50mm thick.

6.13 Providing and laying l5-20 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 l2mm thick RCC 1:2:4(l 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 grace iron particles, free from non-ferrous metal particles oil, grease, sand and soluble alkaline compounds. This shall be mixed with cement in proportion of 4 cement and 1. compound by weight. The laying procedure is same as per the specification for IPS flooring.

6.17 Providing & Laying Industrial tile in floorings skirting and dado.

The sizes of the tiles shall be 600mm x 600 mm or as directed, and the thickness shall be 19mm 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 *(2* cement: 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 10 mm joints all around.

The joints shall be raked to 12-19mm deep and filled with epoxy based resin. The resin is mixed with quick dried and acid alkali proof powder. As the resin is an atmospheric hardening agent, it does not required curing. The work place shall be kept dry for the joint filling operation. The stone shall be either hand polished or machine polished cleaned with oxalic acid and wax combined.

6.13 **P&L 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 with out warp and with straight edges, true and even in shape and size and of uniform colour. The tile surface shall be of fine grain texture, dense and homogenous. The thickness of the tile shall be as per the item specification. The tiles shall be submerge in the water till the bubbles cease.

They should be laid on a base of l2mm thick mortar bed (cement or lime 1:3 sand) and cement (3 kg/sqm) 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 joint shall be cleaned with wire brush and then the joint shall be floated with white or gray 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 6.19.

6.25 **Providing & Applying 115mm thick water proofing treatment**

First layer of about 20mm thick in CM 1:3 (1 cement, coarse sand) mixed with waterproofing compound of M/S.lndia Water Proofing Co., Bombay or equivalent shall be laid as instructed by the Engineer. Then brickbats shall be laid over this 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 lay of waterproof plaster and the gaps between the brickbats shall also be filled with CM mixed with waterproof plaster. Finally the surface is finished smooth and desired pattern are formed on the surface with thread. All opening sleeves, drains, pipes, etc. shall be specially treated and made sure that they are water tight.

6.27 **Providing & Laying Cast iron tile flooring**

The tiles shall be laid over a bed of 37 mm thick 1:2:4*;* 1 cement; 2 coarse sand; and 4 graded stone aggregate of nominal thickness 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 and 1 sand. Curing shall be done at least for15 days. 7he tiles shall be hand/machine polished and the entire surface shall be smooth and all joints shall be filled properly.

7.0 STEEL 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 such as “Perfect Industrial Products", TIL or of equivalent make. They shall be single/double riveted as per the architect’s drawing. It shall be made of CR sheet of size 65x125x1mm 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 a hold fast size 150x20x3 mm for each size and the same shall be embedded in brick work with CC 1:2:4 blocks of size 300x23x230 mm. The hollow portion of the frame shall be fitted 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 tower bolts, 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 100x6x1mm thick and it shall be of perfect industrial Products. TIL Senharvic, Agew, or of any approved make. The frames shall be double riveted. The frame shall be provide with 3 holdfasts of 100x15x3 mm.
Long and the same shall be grouted with cc 1:2:4 in the brick work or to RCC member. Shutters shall be made of standard steel sections style f7d, sash bsr of t6 and locking ba4r 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 aluminum or GI hollow square pipe of 10 sq mm and wall thickness 1.25mm.

The section shall be provided with arrangement for fixing the ms or aluminum oxidized handless 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 party open able and partly fixed windows

-Do- same as item 7.01

7.04 -do- same as item 7.01.for fixed windows

-Do- same as per item 7.01

7.05 -do- same as item 7.01 but for louvered 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 wire netting shall be 22 to 23 SWG and galvanized. 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 tower bolts 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 fabrics**

This shall have a GI rectangular or square shape 75, 50, 25 mm size as per requirement. The gauge of the wire shall be 8X10. The gap size shall be 75X25 mm in general unless be 8X10. The gap size shall be 75X25 mm in general unless specified otherwise. This shall be welded/bolted to the MS Frame made of angle iron 40x 40 x 6 and tee 40 x 40 x 40 x 6 mm with an ms beading of 30 x 3 or 12 x 6 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 19 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 arrangement and deep channel guides. In case galvanized rolling shutters are specified the rolling shutter shall be made of hot dip galvanized slats hood, deep channel guides all preferably in one louse. 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).

Incase of hand operated pull and push type rolling shutters and very large than 10 sq m in area, they shall be provided with ball bearing for smooth and efficient operation in case of large rolling Sutherlands 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 wind pressures in the area.

7.09 providing &fixing mechanical operated rolling shutters
-Do- same item 7.08.

7.10 providing & fixing partly grilled rolling shutters
-Do- same as items 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 brick work. It shall be painted with one coat of prime

and 2 coats of approved synthetic enamel paint.

7.12 **Providing and fixing MS inserts in RCC and brick work**

a) 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 contractor the inserts bolts fixtures and fitting etc are out of alignment the contractor shall make arrangements to have the inserts and bolts removed and reaffixed in their proper position as directed by the engineer at no 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. 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 b 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 an Rcc member, the pipe shall be welding to the steel plate by embedding it in the Rcc member.

7.14 (B) Providing & fixing SS pipe railing

It shall be done with the specified class of SS pipe as per the item in the schedule of quantities. 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 b 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 an RCC member, the pipe shall be welding 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 fabrication 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 holding 1: 2: 4 (1 cement , 2sand, 4 graded coarse aggregate of nominal size 12 mm 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 architect, s 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 WIFE FENCING.

This fencing shall be either be made with RCC posts and struts or with MS 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 paints.

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 and other defects and uniformly galvanized. The type, length and standard weight of the GI wire shall be as specified below.

Nominal dia Of wire Line wire		Point wire between two barbs	Nominal distance Length in Nominal	Min.	Max.	M/100kg
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 shall be well stretched in number of rows as specified with two diagonals. The spacing 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 the every 28m. The length of the strut shall be 1.5 times the length of the post.

8.0 ROOFING

8.01 Providing, Fabricating & Erecting MS Structural steel work for trusses, purling, grinders columns, rafters, struts, wind ties, bracings etc.

All structural steel materials such as angles, RS joists flats, tees plants, channels etc. shall conform to the latest edition of IS 226. All structural steel shall be free from twist before fabrication. Cutting of members shall be cone by shearing, cropping sawing or gas cutting contact surfaces of plants and butt joints shall be accurately machined over the whole area so that the parts consecrate shall butt over the entire surface of contact. Welding of pieces shall be done with the approval of the Engineer.

The components parts shall be assembled in such a manner that they are not damaged in any way and specific cambers as snow in the drawing or as directed by the Engineer, shall be provided.

For polted connection, where necessary washers shall be tapered or otherwise suitability to give satisfactory bearing the treated portion of the bolt shall project beyond the nut by at leaser 1.5 threads.

Welding shall be done in accordance with the latest edition of 18 813 and 814, Code of Practice for use of Electric Arc welding for general Construction in mild steel. In welding it must be ensured that the base metal is in fused state when filler metal makes contact with it ; filler metal does not overflow upon any unfused base metal base metal is not cut along the weld edges. Flowing metal floats the slag, oxide and gas bubbles at the surface behind advance pole. For this current shall be adjusted or the electrode size is changes welding shall be free from cracks, discontinuity, under or over size welding thickness.

Surface to be welded shall be free from loose mill scale, rut grease, paints and the any other foreign materials. As far as possible avoid the welding at heights and at difficult positions. Generally fillet welding is preferred. The parts to be welded are brought in as close contact as practicable and rigidly clamped together.

Before erection, steel work shall be thoroughly cleaned of rust, loose scale, dust welding of approved make and one coat of synthetic enamel paint of approved make as specified in the item before erection and final coat of painting after the erection as directed

Steel members shall be hoisted and put in position carefully without any damage to the member and to the building and labour. The trusses shall be lifted at such points that they do not buckle or deform or be unduly stressed. The end of the truss which faces the steel members shall be hoisted and put in position carefully without any damage to the member and to the building and labour. The trusses prevailing wind shall be fixed and the other end may be kept free to move. the steel work shall be securely fastened wherever necessary, temporarily braced ,to provide for all load to be carried by the member during erection for all loads to be carried by the member during erection including the loads due to the

erection equipment and its operation . No permanent bolting or welding is done until proper alignment has been obtained. The holes for the rivets shall be determined with the help of templates and drilled. Erection clearance of the cleared ends shall not be more than 1.5mm and without clearing end clearance shall not be more than 3mm. grouting or embedding of structural steel members done after the approval of the alignment level & position of the members by the engineer.

Important points

Before the actual execution of the job, the contractor shall prepare fabrication drawing for all structural steel work from the structural drawing s supplied to him and determine the exact cutting b marking out on a level platform to full scale.
Welding plant, electrodes and other equipments sufficient number of spare parts and staff shall be maintained by the contractor at site at his cost.

8.02 **-**do- as per item 8.01 but with ms b class pipes

-Do- same as item 8.01 but with ms b class pipes as per item description given in the schedule of quantities.

8.03 **Providing & fixing ms chequered plates**

The chequered plates shall be cut to the required shape with arc gas cutting machine. The cut edges shall be ground and finished properly. The plates shall be given a coat of primer and two coats of approved synthetic enamel paint.

8.04 **PROVIDING & FIXING MS HOLDING DOWN BOLTS**

The MS holding down bolts of specified dia. Length and shape shall be provided as per the drawings in line & level. These shall be fixed to RCC work of brickwork by grouting it with concrete. The bolt shall be provided with nuts and washers. The grease shall be applied to the thread portion with the help of templates. If the bolts need some adjustment it shall be provided with a wooden piece 75x75mm of 50mm dia GI pipe bolt shall be provided at the time of concreting and shall be removed after initial set.

8.05 **PROVIDING & FIXING GI/AC CORRUGATED SHEETS.**

AC/GI sheet and accessories shall be free from cracks, chipped edges and corners. The fixing shall be done as per the latest edition of IS 459. The spacing of the purlins shall not be more than 1.4m for 6mm sheets. The light shall not visible from the joints of the AC/GI sheets. The AC/GI sheets to be kept on ceiling shall be placed with smooth side upward and the AC/GI sheets to be put in cladding shall be placed with smooth side to side. The AC sheets shall have at sides a lap of half corrugation and an end lap of 150mm minimum. The free over hangs at ends shall not be more than 300mm.
Hole for 8mm dia L or J bolts shall be drilled and not to be punched in the ridge of the corrugation. The diameter of the hole shall not be galvanized J or L hooks with nuts and

two nos. of bitumen washers. All AC sheets accessories shall be painted or white washed as specified in the item or directed by the Engineer.

8.06 **PROVIDING & FIXING AC ACCESSORIES.**

-Do- same as above but for North lighjt curve, AC ridges Curves, Corner pieces, Bargeboards, Eaves board etc.

8.07 **P & F ALIMINIUM FALSHING**

This shall be fixed between the RCC facia and the AC sheets with bitumen to prevent leakage. The work shall be carried out as per the item specification.

9.0 MISCLLANEOUS WORKS

9.01 Providing and fixing night latch of approved make such as godrej or equivalent as directed.

This shall be measured in no. The rate shall be quoted for providing night latch of approved quality and make fixing the same in the door shutters and finishing as per item schedule properly in case of damage.

9.02 providing & Fixing approved make 6 levers Mort ice lock with pair of brass oxidized/chromium plated handles.

This shall be measured is nos. The rate quoted shall be for providing mort ice lock with handles in doors and finishing as per item schedule.

9.03 Providing and fixing hydraulic door closer or approved size and make such as EVERITE/HYPER/GARNISH or equivalent as directed.

This shall be measured is no. This shall be fixed at places as directed by the Engineer.

9.04 Providing and Fixing PVC hand rail 50mm wide of approved colour to and make such as Caliplast or equivalent, including matching the joints as directed by Engineer.

This shall be measured in RM.

9.05 Filling the electrical zaris 250mm to 150mm wide and 50mm to 100mm deep with cement mortar 1:3 and finishing the same to match with the surrounding white wash or any other finish, etc. complete as directed.

This shall be measured in RM. No patch shall be seen after the zarries are filled up.

9.06 Dismantling brick masonry walls and partitions, paltered or unflustered as per instructions including finishing the broken surface to match with the surrounding. Removing the debris as directed within site cutting the reinforcements if any etc. complete as directed.

The work shall be measured in cum.

9.07 Dismantling the RCC beams, slabs lintel, columns, padre, walls platform etc. including finishing the broken surface to match the surrounding , removing the debris within site, including cutting the reinforcement if any etc. complete as directed.

This shall be measured in cum.

9.08 The zaris 25mm to 150 mm de and 50 to 100mm deep with PCC (1:2:4) and Finishing with plaster to match with surrounding including chiseling, scafolding, curing etc. complete as directed.

9.09 Making holes upto 30cms, in dia or 30 x 30 cms. In size in RCC works and filling the same with PCC (1:2:4) and finishing the same as per surrounding including Scaffolding. Curing etc. complete as directed scaffolding, cutting the reinforcement bars, curing etc. complete as directed.

This shall be measured in nos.

9.10 Providing and fixing approved quality and make such as everite or equivalent aluminum hydraulic floor door spring as directed.

This shall be fixed in floor. The floor shall be cut properly for the placing of the spring if necessary. The flooring near the spring location shall be redone matching the existing flooring. Nothing extra shall be paid for this.

This shall be measured no.

9.11 Providing and fixing 24 gauge aluminum kick plates including cutting to size as per details and fixing with aluminum screw etc. all complete as directed.

This shall be measured in sq.m.

9.12 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300mm long with outside flanges/threaded end for connecting the inlet, outlet, washout and overflow pipes for 75 mm dia.

The specification of that GI pipe shall be as per the specification given in Section 11.00 of this Technical specification. It shall be placed during concreting the walls of the sump.

It shall be measured in nos. the rate quoted shall be for the providing and placing of the pipe with flange or threaded in line and level.

9.13 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300mm long with outside flanges/treaded overflow pipes for 50mm dia.

-Do- same as item 9-15

9.14 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300 mm long with outside flanges / threaded end for connecting the inlet, outlet, washout and overflow pipes for 38 mm dia pipe.

-DO- same as item 9.15.

9.15 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300 mm long with outside flanges / treaded end for connecting the inlet, outlet, washout and overflow pipes for 25 mm dia. Pipe.

-Do- same as item 9.15

9.16 Taking the delivery of COLD STORE doors of maximum size 3m x 2.5m. from the project Authority site store and fixing the same in line and level, cutting the brick work, RCC and fixing with holdfast in cc 1:2:4 blocks including finishing the surface smooth , currying etc, all complete as directed.

This shall be measured in on.

9.20 Providing and fixing removable CI gratings of approved quality for rain water pipes including painting the same with two coats of approved enamel paint as directed for 1000mm dia.

This shall be measured in on.

9.21 Providing and fixing removable CI gratings of approved quality for rain water pipes including painting the same with two coats of approved enamel paint as directed for 150mm dia.

-Do- same as item 9.20

9.22 Fixing special CI drain in flooring

The taps shall be supplied by the Project Authority. It shall be fixed in position as shown in the drawing as directed. It shall be placed in brick chamber of size 300 x 300mm and 230mm thickness. The chamber shall be finished inside with 12mm thick plaster in CM 1:4 (1 cement, 4 coares sand). The base of the thick PCC 1:4:8 bed. The trap shall be

fixed in the chamber and shall fibre as directed. The flooring at the 1:1 and jute fibre as directed. The flooring at the junction of the trap shall be finished properly so that it matches with the existing flooring.

9.23 **Providing and fixing vent Cowl**

The vent cowl shall be of CI or PVC as specification in the item description. It shall be of approved quality .

10.0 ROAD WORK

Materials

Murrum

It shall be got from approved quarries. It shall be granular and gritty. It shall be free from dust, all rubbish and any organic materials as well as clods of black cotton soils. The materials shall be got approved prior to its use in road construction.

The materials shall be stacked on a level ground. If the item is only for supplying of murrum, then it shall conveying with the lead and lift and stacking the same at site as directed by the Engineer. The rate shall also include all tools, duties, fees, royalties etc.

SAND

The sand shall be from a river or nala or sea. It shall be clear, sound properly grated, free from organic materials slit; clay etc. and it shall be well grated.

METAL

The stone metal be hard, sound, durable, stone of close texture as is locally available and reasonably free from decay and weathering. It shall be angular or cubical, and round elongated or flaky metals shall be rejected. No round or oblong pebbles or angular chips shall be allowed. The size of the metal shall be 40mm to 63mm. All disintegrated stone shall be rejected. The metals shall be tested for Abrasion value, Aggregate Impact value and Flakiness Index in standard laboratories before the materials is put to use and they shall conform to relevant is codes as given in page 4, 16 of this section. Metal shall be stacked at site on fairly level ground.

ROLLING

A power roller shall, as a rule, be not less than 10 tones but if at any time still heavier rollers are required on the works the contractor shall have to bring them as my be directed by the Engineer. A hand roller should not be less than a ton. Rolling shall progress from edges to the center of the road in strips parallel to the centerline of the road. Rolling shall be done by lapping uniformly each preceding near wheel track by at least one half width of the track.

On super elevations. Rolling shall be started at inner edge and shall progress towards outer edge. During and after rolling, the surface shall be checked for grade and camber,

with camber plate. The roller shall be started, worked or stopped without jerks. Rolling shall not normally be done length less than 100 M.

10.01 SURFACE DRESSING INCLUDING PREPARATION OF SUBGRADE

The high portion of ground shall be cut down and/or hollows and depression shall be filled upto 500 mm. The gradient and camber / slope should be maintained as per requirement so as to give an even, neat and tidy look to the work. The measurement will be in sq.m. The area requiring cutting or filling more than 300 mm shall be paid separately under relevant items of earth work and surface dressing item will not be applicable. Earth from cutting will be used for filling. The rate for the item shall also include jungle clearing viz plants, shrubs, grass etc. excluding trees.

Preparation of Subgrade

The subgrade shall be leveled approximately to the proper level and camber by filling depressions with excavated material and cutting of protuberances. The subgrade shall be made to have as nearly as practicable, a uniform bearing layer and all hard spots therefore be properly excavated and refilled. All soft and spongy parts of the subgrade shall be excavated and refilled with approved materials of 15 cm layers for the same reason. The cost of this excavation will be paid under the item for excavation. The Subgrade shall be watered as directed at least 12 hours before a 10 MI roller is put on it.

Proper accesses should be prepared for the roller to get to the subgrade and all manholes frames and covers should be removed and replaced by plates of adequate strength free of cost whenever they interfere with the free rolling of the subgrade.

After rolling the camber, super elevation and longitudinal slope etc. of the subgrade shall conform in shape to those of the finished road surface. This should be checked with the help of level strings and camber board, if necessary. When subgrade consists of black cotton soil, a thin layer of murrum or coarse sand shall be provided below any base course, watered and rammed and rolled tightly.

10.01 **Providing & Laying base course**

65 mm, nominal size or as specified, metal shall be spread over the prepared base to a thickness 0f 130mm in one or two layers as specified, the metal layer dry and wet shall then be rolled and consolidated by a 10 tone power roller. The thickness of the consolidated layer after completing all the operation described below shall be less than 100mm than blinding material like murrum or red bajri shall be laid and watered and rolled. Rolling shall start from edge of road and proceed towards the crown in longitudinal strips overlapping on successive strips by at least one half the width of the rear wheel of the roller. The operation shall continue till no visible settlement of the metal or movement under the roller is observed. The gradient and camber shall be checked from time to time by means of level, stackes, strings camber board etc. any

depression or hump shall be corrected by removing completely the metal layer there at the spot and rolling the same satisfactorily.

After the dry rolling is completed, gift, stones, dust, sand etc. shall be spread. Moderate sprinkling of water and rolling shall be continued and stone dust shall again be spread if required till all the voids are completely filled and the movement of metal under the wheel ceases. If there is excess powder the same shall be removed lightly by brooms.

The surface shall be checked for camber etc. the unevenness or undulations shall be rectified as required. The whole surface shall be then watered, extra powder added if required, brushed and rolled to obtain a mosaic surface. This type of surfaces shall be maintained till upper layer is laid.

10.02 Providing & laying wearing course

50 mm metal shall be spread, in one or two layers, over the prepared base to a thickness of 100mm consolidated and the prepared base to a thickness of 100mm consolidated and the rate of spreading grit shall not be less than 10 to 15 sq.ft/ 100 sq.ft. the other operations such as rolling watering etc. as item 10.02.

10.04 Providing and laying 20 mm thick layer of hot asphalt & aggregate over the wearing course.

The surface shall then be brushed free of any loose blinding material out of the voids into which it has set. The surface then shall be tested for depression, which shall be made up by remettaling and blinding with aggregate of a size equivalent to the depth of the depression.

Bitumen 80/100 of approved brand, heated to a temperature of 350 deg.F. shall then be applied evenly to the road surfaced by means of a pressure distributor at the rate of 25 kg per 10 sqm.

While the bitumen 80/100 is still hot the surface shall be laid evenly with premix aggregate of 20mm size well mixed with bitumen. The stone aggregate shall be hot and dry and contain not more than 2% moisture before use. It shall be first screened of dust, measured and heated. The rate of application of stone chips shall be 0.20 cum per 10 sqm or as specified in the Schedule of Quantities.

After spreading of the premix carpet the road shall be given a final rolling with 10 tonne power roller. Any soft spot or depression detected at a later date shall be made up as directed by the engineer.

10.05 **Providing and Laying Seal coat with hot bitumen**

Seal coat is applied to water proof road, to seal the surface, to prevent oxidation due to air circulation to strengthen bitumen surface or to improve texture, reduce porosity and tendency to disintegration.

Seal coat with hot bitumen: Treatment consists of applying a coat of hot bitumen 2.5 kg/sqm. On prepared surface, binding with stone grit 0.30 cu.m/10m. and consolidating with road roller of 10 tonne.

10.06 Providing & laying seal coat with bitumen emulsion

Seal coat with bitumen emulsion. Other details same as 10.05

10.07 Providing & laying seal coat with pre-mixed sand

Seal coat with pre-mixed sand: The type of treatment consists of laying sand coated with bituminous binder on a prepared surface and consolidating with road roller. Bitumen 96 kgs per 0.75 cu.m of coarse sand for 100 sq.m. road area shall be used.

10.08 Providing & laying RCC kerb

Road kerbing shall be cast-in-situ/precast cement concrete stone as per the item description in the Schedule of Quantities. In case of pre-cast kerb it shall be laid over Brick bat concrete 1:4:8 150 mm thick or as specified in the ground and the joint between the tow stone shall be filled up with cement mortar (1:6). The stones shall be cast with cement concrete of 1:2:4 proportion within the project premises. The stone shall be cured for at least days. Contractor shall have to make one tank at his own cost for curing the stones.

The whole work shall include excavation, cutting roads if necessary, laying of bed concrete, shuttering, excluding reinforcement, casting, exposed concrete finishing and curing the kerb stones. The item shall be measured in RM.

10.09 Providing & laying RCC pavements

The cement concrete pavement consists of cement concrete(1:2:4) 1 cement, 2 coarse sand, 4 graded stone aggregates, 20 mm nominal size or richer mix as specified laid on the prepared base, compacting and curing. Reinforcement shall be provided in the slabs as per drawings/directed.The surface shall be examined for existing of soft patches and suitably treated to have uniform bearing capacity. The prepared surface shall confirm to the line, cross section shown. The Mixing and placing of concrete and compaction and curing shall be as per RCC specifications. The top surface of the road slab shall be either floated finish or striped finish or brush finish or broom finish as directed.

10.10 **Providing & laying RCC roads**

Mixing and placing of concrete, compacting and curing shall be as per RCC specification. Before concreting the form work should be placed to exact alignment, line and level. The width of the panel shall not be more than 6M. Alternative panels should be cast to avoid cracking and cured. The top surface of the road slab shall be either floated finish or striped finish or brush finish or broom finish as directed. The entire work shall be cured for minimum 15 days.

11.0 WATER SUPPLY

11.01 Providing & laying underground GI pipeline for 75 mm dia.

The pipes shall be galvanized mild steel welded pipes and screwed and socketed tubes conforming to the requirements of IS: 1239, for medium grade. They shall be of the diameter (normal bore) specified in the description of the item. The sockets shall be designated by the respective nominal bores of the pipes for which they are intended. The pipes and sockets shall be cleanly finished well galvanized in and out and free from cracks surface flaws, laminations and other defects. All screws threads shall be clean and well cut. The ends shall be cut cleanly and square with the axis of the tube.

All screwed tubes and sockets shall have pipe threads conforming to the requirements of IS: 554 screwed tubes shall have taper threads while the sockets shall have parallel threads.

The fittings shall be of malleable cast iron or mild steel tubes complying with all the appropriate requirements as specified for pipes. The fittings shall be designated by the respective nominal bores of the pipes for which they are intended. The fittings shall have screw threads at the ends conforming to the requirements of IS: 554. Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be taper.

The pipes and fittings shall be inspected at site before use to ascertain that they conform to the specification. The defective pipes shall be rejected. Where the pipes have to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 554 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pipes are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the latter procedure may not result in a water tight joint.

The screw threads of pipes and fittings shall be protected from damage until they are fitted.

The pipes shall be cleaned of all foreign matter before being laid in joining the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with

white lead and a few turns of spun yarn wrapped round the screwed end of the pipes. The end shall then be screwed in the socket, tee etc. with the pipe wrench. Care Should be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Purr from the joint shall be removed after screwing. After laying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter. Any threads exposed after jointing shall be painted or in the case of underground piping thickly coated with approved anticorrosive paint to prevent corrosion.

If the galvanized iron pipes and fittings are laid in trenches, the widths and depths of the trenches for different diameters of the pipes shall be as in the table given below: -

TABLE

Dia of pipe	Width of trench	Dept of trench
15mm to 50mm	30cm	60cm
65mmto100mm	45cm	75cm

At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for each work in trenches. The pipes shall be painted with two coats of anticorrosive bituminastic paint of approved quality. The pipes shall be laid on a layer of 7.5cm sand and filled up to 15cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed when excavation is done in rock the bottom shall be cut deep enough to permit the pipes to be laid on a cushion of sand 7.5cm minimum. In case of bigger diameter pipes where the pressure is very high thrust blocks of cement concrete 1:2:4(1 cement: 2 coarse sand: 4 graded stone aggregate of 20mm nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground sand spreading it over a sufficient area.

TEST

After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6kg/cm^2 (60 MWC) the pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off takes and stop cocks shall then be closed and Specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped the test pressure should maintain without loss for at least half an hour. The pipes and fittings

shall be tested in the sections as the work of laying proceeds, keeping the joints exposed for inspection during the testing.

11.02 providing and laying underground GI pipeline 50mm dia

-Do- same as item 11.01

11.03 providing and laying underground GI pipeline 38mm dia

-Do- same as item 11.01

11.04 providing and laying underground GI pipeline 25mm dia

-Do- same as item 11.01

11.05 providing and laying underground GI pipeline 20mm dia

-Do- same as item 11.01

11.06 providing and laying underground GI pipeline 12mm dia

-Do- same as item 11.01

11.07 providing and laying GI pipe line 75mm dia for open line work the galvanized iron pipes and fittings shall run on the surface of the walls or ceiling (not in chase) unless otherwise specified. The fixing shall be done by means of standard pattern holder bat clamps. Keeping the pipes about 1.5cm clear of the walls ceiling pipes may be fixed in the ducts or recesses etc. provided there is sufficient space to work on the pipes with the usual tools.

All the pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable the pipes shall be fixed to walls with standard pattern holders bat clamps of required shape and size so as to fit tightly on the pipes when tightened with screwed bolts. The clamps shall be fixed at short length and near the fittings as directed by the Engineer. The pipeline shall be tested as specified in the item 11.01

11.08 providing and laying open GI pipeline 50mm dia

-Do- same as item 11.07

11.09 providing and laying open GI pipeline 38mm dia

-Do- same as item 11.07

11.10 providing and laying open GI pipeline 25mm dia

-Do- same as item 11.07

11.11 providing and laying open GI pipeline 20mm dia

-Do- same as item 11.07

11.12 providing and laying open GI pipeline 12mm dia

-Do- same as item 11.07

11.13 providing and laying concealed in structure GI line 75mm dia.

For internal work the pipes shall be concealed in the brick masonry. Chasses or zarries shall be cut in the walls and the pipes shall be laid. The pipes shall not ordinarily be buried in the solid floors. Where unavoidable pipes may be buried for short distances provided adequate protection is given against damage, but the joints in the pipes shall not be buried. Where directed by the Engineer MS sleeve shall be fixed at a place where a pipe is passing through a wall or floor for inspection of the pipe and to follow freedom for expansion movements and contraction and other. In case the pipe is embedded walls or floors it should be painted with anticorrosive bituminastic paint of approved quality. The pipe should not come in contact with line mortar or Lime concrete as the pipe shall be laid in layer of sand filling done under concrete floors or as directed by the engineer. The floor and wall shall be finished same as the surrounding surface after the completion of the work. The line shall be measurement.

GI pipes with fittings laid properly shall be measured along the centre line lengths. The rate shall include making zarries in the wall, cutting floor, making holes, painting the pipe line with anticorrosive bituminastic paint all complete.

11.14 providing & laying concealed in structure GI pipe line 50 mm dia

-Do- same as item 11.13.

11.15 providing & laying concealed in structure GI pipe line 38 mm dia.

-Do- same item 11.13

11.16 providing & laying concealed in structure GI pipeline 25 mm dia.

-Do- same as item 11.13.

11.17 providing & laying concealed in structure GI pipeline 20 mm dia

-Do- same as item 11.13.

11.18 providing & laying concealed in structure GI pipeline 12 mm dia

-Do- same as item 11.13.

11.19 providing and fixing sluice valve for 75 mm dia pipeline

It shall be of approved quality. It shall be measured in nos.

11.20 providing and fixing sluice valve for 50 mm dia pipeline

-Do- same as item 11.19.

11.21 providing and fixing sluice valve for 38 mm dia pipeline

-Do- same as item 11.19.

11.22 providing and fixing sluice valve for 25 mm dia pipeline

-Do- same as item 11.19.

11.23 providing and fixing sluice valve for 20 mm dia pipeline

-Do- same as item 11.19

11.24 providing and fixing sluice valve for 12 mm dia pipeline

-Do- same as item 11.19.

11.25 providing and fixing of wheel valve of approved quality for 75 mm dia pipe line

It shall be of approved ISI make. It shall be fixed in the pipe line at the place as directed by the engineer.

11.26 providing and fixing of wheel valve of approved quality for 50 mm dia pipe line

-Do- same as item 11.25.

11.27 providing and fixing of wheel valve of approved quality for 38 mm dia pipe line

-Do- same as item 11.25.

11.28 providing and fixing of wheel valve of approved quality for 25 mm dia pipe line

-Do- same as item 11.25.

11.29 providing and fixing of wheel valve of approved quality for 20 mm dia pipe line

-Do- same as item 11.25.

11.30 providing and fixing of wheel valve of approved quality for 15 mm dia pipe line

-Do- same as item 11.25

11.31 providing & fixing bib cock for 15 mm dia pipeline

A bibcock (biptap) is a draw off tap with horizontal inlet and free outlet. It shall be of specified size and shall be of the screw down type. The closing device should work by means of a disc carrying a renewable non-metal- seating at right angle to the axis of the threaded spindle, which operates it. The handle shall be either catch of butterfly type security fixed to the spindle. The cocks shall be open in anti- clockwise direction. When the bid cocks are required to be chromium plated the chromium plating shall be of grade b type conforming to IS: 1068. In finish and appearance, the plated articles shall be free from plating defects such as blister, pits, and roughness and shall not be stained or discolored.

11.32 providing & fixing long body bib cock

-Do- same as item 11.19. The bib cock long body is generally provided for the kitchen sink.

11.33 P & F stop cock for 12 mm dia pipe line

A stopcock (stop tap) is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. It shall be specified size and shall be of the screw down type. The closing device should work by means of a disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angle to the axis of the threaded spindle which operates it. The handle shall be either catch or butterfly type securely fixed to the spindle. Valve shall be of the loose letter seated pattern. The cocks shall open in anti-clockwise direction. When the stop cocks are required to be chromium plated the chromium plating shall be of grade B type plated articles shall be roughness and shall not be stained or discolored.

11.34 providing & fixing stop cock for 19 mm dia pipe line

-Do- same as item 11.21.

11.35 providing & fixing angle valve

The brass fittings shall be of heavy quality, CP and approved manufacture and pattern with screwed or flanged ends as specified. The fittings shall in all respects comply with

the requirements of is: 781. The standard size of brass fittings shall be designated by the normal bore of the pipe to which the fittings are attached. a sample of each kind of fittings shall be got approved from the engineer and all supplies made according to the approved samples. All cast fittings both internal and external surfaces shall be clean, smooth and free from sand etc. Burring, plugging stopping or patching of the casting shall not be permitted. The or that when assembled the points shall be axial, parallel and cylindrical with surfaces smoothly finished. The area of the water way of the fittings shall not be less than the area of the normal bore. The fittings shall be fully examined and cleared of all foreign matter before being fixed. The fittings shall be fitted in the pipe line in the work man like manner. The joints between fittings and shall be made leak proof. The joints sure kg/sq .cm and the defective fittings and joints shall be replaced or redone.

11.36 providing & fixing shower rose

This shall be of approved make. This shall be properly as directed by the engineer

11.37 providing & fixing 25 mm dia GI hydrant for gardening

The work shall be carried out as per the drawing and as directed. It shall be provided with a wheel valve and a vertical piece of GI pipe to keep the hydrant level above the existing GL at a height as directed by the engineer. The hydrant shall be fixed in the brick chamber of size 450 x 450 mm and depth 230 to 500 mm to suit the site conditions. The bottom of the chamber shall be finished with PCC 1:4:8 100 mm thick and the walls shall be finished with 12 mm thick plaster in CM 1:4. An MS cover shall be provided for the chamber.

11.38 providing & fixing 6 mm thick asbestos string for 25 mm dia line

This shall be wound closely over the GI pipe concealed in structure.

11.39 providing & fixing 6 mm thick asbestos string for 12 mm dia line

-Do- same as item 11.26

11.40 providing & fixing towel rail

This shall be brass chromium plated or as specified and of approved make. The length shall be between 500 and 800 mm and the rod shall be of 20 mm dia. It shall be fixed as directed by the engineer.

11.41 providing & fixing CI manhole cover of 40 kg

This shall be of approved make. The cover shall be provided on a CI frame. The frame shall be properly fixed in the brick work/ RCC cover slab of the chambers.

11.42 providing & fixing ball cock for 38 mm dia pipe

This shall be of approved class and make. This may be of brass or PVC as specified in the item. It shall be fixed as directed y the engineer.

11.43 providing & fixing ball cock for 25 mm dia pipe

-Do- same as item 11.30.

11.44 providing & fixing ball cock for 12 mm dia pipe

-Do- same as item 11. 30.

11.45 providing & fixing cp brass water spout 12 mm dia

This shall be provided and fixed at places as directed by the engineer. The part of brickwork around the spout shall be finished to match the external finish. No patch shall be seen. The spout shall be of approved quality.

11.46 providing & fixing GI water spout of 75 mm dia

The spout shall be 200 to 450 mm in length as directed by the engineer. One end of the pipe shall be cut diagonally and tack welded at te bottom to facilitate the flow of water. It shall be fixed at places as directed by the engineer. The brickwork after the placement of the spout shall be finished properly to match the external finish. The spout shall e painted with paint of approved shade and make.

11.47 P & F GI water spout of 50 mm dia

-Do- same as item 11.34

11.48 P & F GI water spout of 38 mm dia

-Do- same as item 11.34

11.49 P & F GI water spout of 25 mm dia

-Do- same as item 11. 34

11.50 Fixing of geyser

The geyser shall be shifted from the site stores to the required place. Then necessary anchor bolts with nuts. CP brass pipes and cp brass angle valves for inlet and outlet.

11. 51 fixing of water coolers

The water cooler shall be shifted from the site stores to the required place. Then necessary coach / anchor. Bolts with nuts, CP brass pipes and CP brass angle valves for inlet and GI outlet pipe of 25 mm dia up to drain point shall be provided and fixed.

11. 52 Fixing PVC water tanks

The tanks shall be shifted from the site stores to the place as shall be fitted to the tanks and the tank shall be properly fixed. Pedestals for the tanks shall be constructed as directed by the engineer.

12.0 SANITARY WORKS

SCOPE OF WORK

The scope of work includes providing and fixing sanitary fixtures, providing and laying drainage lines and all items of work described in the schedule of quantities.

DRAWINGS

Checked and approved drawings showing location of sanitary and water supply fixtures will be furnished to the Contractor and all drawing so furnished shall form a part of this specification. The Contractor shall refer these drawings for all information contained thereon which pertains to and required for this work.

In the case of variations between the drawings and the specifications, or discrepancies in the information furnished by the Engineer, the Contractor shall refer such discrepancies to the Engineer before proceeding with such work.

All connected works will be measured and paid under respective items of work unless specifically mentioned otherwise.

12.01 Providing & laying 300 mm dia non-pressure Hume pipe

The pipe shall be with or without reinforcement as required and of the class as specified. These shall conform to IS: 458. The reinformeced cement concrete pipes shall be manufactured by centrifugal (or spun) process while unreinforced cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws, the external and internal surface of the pipes shall be smooth and bard. The pipes shall be free form defects resulting from imperfect grading of the aggregate mixing or moulding. The unreinforced pipes (non pressure pipes) shall withstand a test pressure equivalent to 0.7 Kg/Sq. com (7m head) of water.

Concrete used for the manufacture of unreinformced and reinforce3d concrete pipes and collars shall not be leaner than 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate). The max size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight. The minimum cover for reinforcement of spun pipes and for all other pipes shall be as given below:

spun pipes thickness	pipes other than	Spun pipe	Pipes
		Mm	Mm
Less than 30 mm		9	12
30 mm to 75 mm		12	18
75 mm and over		18	18

Where the pipe shall be bedded directly on soil, the bed shall be suitable rounded to fit the lower part of the pipe. The cost of this Operation being included in the rate for ling the pipe.

Loading, transporting, and unloading of concrete pipes shall be done with care handling shall be as to avoid impact. Gradual unloading b inclined plane or b chain block is recommened. all pipe section and connection shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used pipes shall be lowered in to the trenches carefully. mechanical appliance ma be used. Pipes shall be laid true to the line and grade, as specified. lying of pipe shall proceed upgrade of a slope.

if the pipe have spigot and socket joints, the socket ends shall face up-streem,in the case of pipes with joints to be made with loose collar ,the collar shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directly in case where the foundation condition are unusual such as in the proximity of trees or holes under existing or proposed tracks manholes etc. the pipe shall be encased all round in 15cm thick cement concrete 1:5:10 (1 cement :5 coarse sand 10 grades stone aggregate 40 mm nominal size) or compacted sand or graval.

In cases where the natural foundation is inadequate the pipes shall be laid either in concrete or cradle supported be laid either in concrete or cradle supported on proper foundation or on any other suitably designed structure. If a concrete cradle bedding is used the depth of concrete below the bottom of the pipe shall be at least 1/4th of the internal dia of the pipe subject to a minimum of 10 cm and a max of 30 cm. The concrete shall extend up the sides of the pipes at least to a distance of 1/4th of the outside diameter for pipes 300 cm and over in diameter. The pipe shall be laid in this concrete bedding before the concrete has set pipes laid in trenches in earth stall be bedded evenly and firmly and as far up the haunches of the pipes as to safely transit the load expected from, the backfill through the pipe to the bed. This shall be done either by excavating the bottom of the trench to fit the curve of the pipe or by compacting the earth under the curve of the pipe to form an even bed. Necessary provision shall be made for joint wherever required. When the pipe is laid in a trench in rock, hard clay, shale or other hard material the space below the pipe shall be excavated and replaced with an equalizing bed of concrete sand or compacted earth. In no case shall pipe be laid directly on such hard material. When the pipes are laid completely above the ground the foundations shall be made even and sufficiently compacted to support the pipeline without any material settlement. Alternatively the pipeline shall be supported on rigid foundations at intervals. Suitable arrangements shall be made to retain the pipeline in the proper alignment such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall in no case exceed the length of the pipe. The pole shall be supported as far as possible close to the joints. In no case shall the joint come in the center of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted. Suitably designed anchor blocks at change of directions and grades for pressure lines shall be provided where required.

Jointing of the pipes shall be done as described below:

a) Collar shall be space symmetrically over the two pipes and the space between collar and pipe filled with cement mortar 1:1 thoroughly rammed with caulking tools. The joint shall be finished with a fillet sloping at 45. Joints shall be protected and cured for about 10 days. If specified in the item specification wedge shaped groove in the end of the pipe shall be filled with a special bituminous plastic compound for bitumen soaked spunyarn. The collar shall then be slipped over the end of pipe and next pipe butters well against tee plastic compound by suitable appliances so as to compress the plastic compound in the grooves, care being taken not to disturb concentricity and level of the pipes.

12.02 Providing &laying 230 mm dia non pressure Hume pipe

-DO- same as item 12.01.

12.03 Providing &laying 150 mm dia non pressure Hume pipe

-DO- same as item 12.01.

12.04 Providing & laying stoneware pipe of 300 mm dia

All pipes with spigot and socket ends shall conform to IS 651 and shall be of grade 'A' as specified. These shall be sound free from visible defects such as fire cracks or hair cracks. The glaze of the pipe shall be free from crazing. The pipes shall give a sharp clear sound when struck with a light hammer. There shall be no broken blisters.

The approximate thickness of 60 cm long pipes shall be as given in the table:

Internal diameter of the pipe mm	Thickness of the barrel and socket mm	Weight of pipe per M Kg
100	12	14
150	16	22
200	17	33
230	19	44
250	20	52
300	25	79
350	30	100
400	35	128
450	38	147

The length of pipes shall be 60 cm exclusive of the internal depth of the socket. The pipe shall be handled with sufficient care to avoid damage to them.

All pipes shall be laid on a bed of 15 cm cement or lime concrete as specified, projecting on each side of the pipe to the width of the trench which shall be nominal dia of pipe + 400 mm. The pipes with their crown level at 1.20 m depth and less from ground shall be covered with 15 cm thick concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm around the pipe. Pipes laid at a depth greater than 1.25 m at crown shall be concreted at the side upto the level of the centre of the pipe and sloped off from the edges to meet the pipe tangentially. The concreting shall be done as per specifications for concrete. The pipes shall be carefully laid to the alignment levels and gradients show on the plans and sections great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in a straight the without vertical or horizontal undulation. The pipe shall be laid with socket up the gradient. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be formed in the concrete to receive the socket of the pipe.

Where pipes are not bedded on concrete the trench floor shall be left slightly high and carefully bottomed up as pipe laying proceeds, so that the pipe parrels rest on firm and undisturbed ground. If the excavation has been carried to low the desired levels shall be made up with concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded brick bat of 40 mm nominal size for which no extra payment shall be made.

If the floor of the trench consists of nock very hard ground that cannot easily be excavated to a smooth surface the pipe shall be laid on a leveling course of concrete as desired. When SW pipes are used for strom water drainage, no concreting will normally be necessary. The cement mortar for jointing will be 1:3 (1 cement 3 fine sand) testing of joints will also not be done.

Tarred gasket of hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be slipped home well: into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more a 1/4th of the total depth of the socket.

The remainder of the socket shall be filled with stiff mixture of cement mortar in the proportion of 1:1 cement 1 line sand when the socket is filled, a fillet shall be formed round the joint with a trowel forming any angle of 45 with the barrel of the pipe. After a day's work any extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured.

Water test

a) Stoneware pipes used for sewers shall be subjected to a test pressure of 1.5m head of water at the highest point of the section under test. The test shall be carried out by suitably plugging the low end of the Drain and the ends of the connection if any and filling the system with water. A buckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head. Or the top may be plugged with a connection to a hose ending in funnel, which could be raised or lowered till the required head is obtained and fixed suitably for observation. Where leakage will be visible the defective part of the work shall be removed and made good.

In cases where sides are not bedded on concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe, and rammed with a shovel and light tamper. The method of filling will be continued up to the top of pipe. The refilling shall rise evenly on both sides of the pipe continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe. The remainder of the backfill shall not be done until 7 days have elapsed for brick sewers and 14 days of concrete sewers, unless local conditions or materials are suitable for the

earlier placing of load on the pipes. The tamping shall become progressively heavier as the depth of the backfill increases.

In measuring the length of sewer pipes, laid length between faces of manholes shall only be measured omitting lengths of channels between inside faces of walls of manholes or chambers.

12.05 Providing & laying stoneware pipe of 230 mm dia

-Do- same as item 12.04

12.06 Providing & laying stoneware pipe of 150 mm dia

-Do- same as item 12.04.

12.07 Providing & Laying Stoneware pipe of 100mm dia

-Do- same as item 12.04.

12.08 providing & Laying CI WEE line concealed in structure 150 mm dia with cement joint

All cast iron pipes and fittings shall be approved ISI make, shall be of uniform thickness with strong and deep sockets, free from flaws, air holes cracks hand holes and other defects and conform to IS:1729. The pipes and fittings shall be true to shape smooth and cylindrical and shall ring clearly when struck over with a light hand hammer. All pipes and fittings shall be properly cleaned of all foreign materials before being fixed.

The annular space between the sockets and spigot shall be filled with a gasket of hemp or spun year soaked in nearest cement slurry. The joint shall then be filled with stiff cement mortal 1:2 (1cement: 2 fine sand) well pressed with caulking tool and finished smooth on top at an angle of 45 Deg. Cent. The joint shall be kept wet for not less than 7 days by tying a piece of gunny bag and kept moist joints shall be perfectly air and water tight.

The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimension specified for the corresponding sizes of straight pipes.

The connection between the main pipe and branch pipes shall be made by using branches and bend with access doors for cleaning. Floor traps shall be provided with 25mm dia puff pipe where the length of the waste is more than 1800 mm or the floor trap is connected to a waste stack through bends.

All cast iron pipes and fittings including joints shall be tested by smoke test to the satisfaction of the Engineer and left in working order after completion. The smoke test shall be carried out as standard under:

a) Smoke shall pumped into the pipe at the lowest end from a smoke machine which consists of the bellow and burner. The materials usually burnet is fresh cotton waste which gives out a clear pungent smoke which is easily detectable sight as well as by smell if there is leaking at any point of the pipeline.

Water test and air test shall be conducted as satisfied in IS 5329

12.09 Providing & Laying CI waste water line concealed in structure 100mm dia with cement joint.

-Do- same as item 12.08

12.10 Providing & Laying CI waste water line concealed in structure 75mm dia with cement joint.

-Do- same as item 12.08

12.11 Providing &Laying CI waste water line open with cement joint 75mm dia.

The general specification of the pipe shall be as per item 12.08

Pipes shall be fixed to the wall by GI or MS holder back clamps, unless projection with fixing holder are vertical or to the line and slopes as indicated. The clamps shall concrete blocks (1:2:4) 10cm by making necessary holes in the walls at proper places. All holes and breakage shall be made good. The clamps shall be kept 25mm clear of the finished face of the walls to facilities cleaning and painting of pipe. CI pipe and fittings which are exposed shall be first cleaned and then painted with two coats of bitunastic paint.

The pipe shall be tested as specified in item 12.08

12.12 Providing & laying CI waste water line open with cement joint 100mm dia.

-Do- same as item 12.11

12.13 Providing & laying CI soil pipe line 100mm dia.

The general specification for the pipe shall be as per item 12.08. All plug points drainages pipes shall be provided with inception and cleaning caps. Covers for which shall be fixed nuts and screws.

12.14 Providing & Laying CI soil pipe line 150mm dia

-Do- same as item 12.13

12.15 Providing & Laying Ci soil pipe 100mm dia with lead joint.

CI pipe with socket and spigot shall be provided with lead caulked joints wherever specified and the joints shall conform to the requirements of IS : 3114

The general specification shall be same as per item 12:13

12.16. Providing & Laying CI soil pipe 150mm dia with lead joint

-Do- same as item 12.15

12.17. Providing & Laying CI soil pipe 100mm dia with cement joint in open

The general specification shall be same as item 12.11 and 12.13.

12.18 Providing & Laying CI soil pipe 150mm dia with cement joint in open.

-Do- same as item 12.17

12.19 Providing & laying concealed PVC rain water line 75 mm dia.

The strength of the pipe shall be 4kg.Sq.Cm It shall be of approved make. It shall be provided make. It shall joint with adhesive as per the manufacturers specification.

12.20. Providing & laying concealed PVC rain water line 100 mm dia.

-Do- same as item 12.19

12.21. Providing & Laying concealed PVC rain water line 150mm dia.

12.22 Providing & Laying CI 100mm dia RW line concealed in the structure.

It should be of approved ISI make. It shall be free from pain holes and defects and be neatly finishing form outside and inside, painted with two coats of bitumenastics paint. The joints of the pipe shall be filled with spun yarn soaked with cement slurry and then finished with CM 1:2 (1 cement, 2 coares sand). All necessary bends, plug bends. elbow grating, shoes fixing with holder bat clamps shall be provided pipe shall be cut to require lengths if the site condition demands so. The weight of the pipes of 1.83m long shall be as follows:

Description	75mm dia	100mm dia	150mm dia:
Plain singles socket pipe	14kg/no	19kg/no	34.5 kg/no

Plain double socket	15	20	37.20
Earned singles socket pipe	14.50	19.50	35.40
Eared double socket pipe	15.40	20.40	38.00
Plain short pipes	8.20 kg/m	10.40 kg/m	19.00 kg/m
Plain bend	3.20 kg/no	4.50 kg/no	9.10kg/no
Offsets 55mm projection	2.70	5.00	8.20
75mm projection	3.20	5.50	9.10
115mm Projection	4.10	5.90	9.50
225mm projection	5.00	7.30	11.80
300mm projection	6.00	8.60	12.70
Branches single Y	5.00	7.30	14.50
Branches double Y	6.80	10.00	19.10
Plain shoe	3.20	4.10	8.60
Head	6.40	6.80	11.30
For erosion door fitting	0.90	0.90	1.35
For inspection door	1.80	1.90	2.25

12.23 Providing & Laying CI 150mm dia rainwater line concealed in the structure.

-Do- same as item 12.22

12.24 Providing & Laying CI 100mm dia rain water line in open.

-Do- same as item 12.22 but in open.

12.25 Providing and Laying CI 150mm dia RW line open.

-Do- same as item 12.22 but in open.

12.26 Providing and fixing marble pardi.

It shall be of single piece of marble of approved quality and type and size as specified in the item description. The edges shall be measured cut to the required shape. Both the sides shall be well polished. The pardi shall be properly embedded in the wall with CM 1:2 (minimum 7.5 cm should be embedded)

12.27 Providing & Fixing European WC

Water closets shall be either of white glazed earthward. White glazed vitreous china or white glazed fire clay as specified and shall be of "wash down type". The closets shall be of one pipe construction. Each water closet fixing have 4 holes having a minimum diameter of 6.5 mm for fixing to floor and shall have integral flushing rim of suitable type. it shall also have an inlet or supply horn for connecting the flush. The flushing rim inlet shall connecting the flush be of the self-draining type. The water closet shall have a weep hole at the flushing Intel. Each water closet shall have an integral trap with either "S" or "P" outlet with least 50mm water seal. Where required the water closets shall have an antisiphonage 50mm dia vent horn on the outset side of the trap. The inside surface of water closets and traps shall be uniform and smooth in order to enable an efficient flush. The narrated part of the outlet shall not be glazed externally. The water closed when sealed at the bottom of the trap in line with the back plate, shall be capable of holding not less than 10 litres of water between the normal water level and the highest possible water level of the water closet as installed.

12.28 Providing & Fixing Indian type WC/Orissa Pan

This shall be the long pan pattern with fortresses/ Orissa Pattern, as specified made of white glazed vitreous china or of white glazed fire clay. Each pan shall have an integral flushing rim of suitable type. It shall also have an inlet or supply horn or supply horn for connecting the flush pipe. The flushing rim and inlet shall be of the self draining type. It shall have a weep hole at the flushing inlet to the pan. The flushing inlet shall be in the front unless otherwise specified or ordered by the Engineer. The inside of the bottom of pan shall have sufficient slope from the front towards the outlet and the surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have grooves right angles to the axis of the outlet. Pans shall be provided with a trap "P" or "S" type horn etc. complete.

12.29 Providing & Fixing lipped urinal.

Urinals basins shall be a flat back of corner wall type lipped in front as specified in the item description in the schedule or Quantities. They shall be of white glazed earthenware, white glazed vitreous china or white glazed fire clay, and of size as specified. The urinals shall be provided with not less than two fixing holes of a minimum dia of 6.5mm on each side. Each urinal shall have an integral flushing rim of suitable type and inlet or supply horn for connecting the flush pipe. It shall have a weep hole at

the flushing inlet of the urinal. At the bottom of the urinal, an outlet for connecting to an outlet pipe shall be provided. The exterior of the outlet horn shall not be glazen and the surface be provided with grooves at right angles to the axis of the outlet to facilitate fixing to the outlet pipe. The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing. The bottom of pan shall have sufficient slope from the front, towards the outlet such that there is efficient draining the urinal. The waste fittings shall be chromium plated. Also CP brass spreader and pipe of 100mm dia shall be provided.

12.30 Providing & Fixing wash basin

Wash basins shall be of white glazed earthenware, white glazed vitreous china or white glazed fire clay as specified. These shall be of the following type and sizes indicated against each type:

Types	**Sizes**
Flat back	530 x 450 mm
Flat back	550 x 400 mm
Flat back counter top with Anti splash rim	530 x 430 mm

a) Washbasins shall be of one-piece construction, including a combined overflow. All internal angles shall be designed so as to facilitate cleaning. Each basin shall have rim on all sides except sides in contact with the walls and shall have skirting at the back. Basins shall be provided with single or double top holes as specified. The tap holes shall be square. A suitable tap hole button shall be supplied if one top hole is not required in installation. Each basin shall have a circular waste hole to which the interior of basin shall drain. The waste hole shall be either riveted or be beveled internally with diameter of 63 mmaat top and a depth of 10 mm to suit a waste plug having 64 mm diameter. Each basin shall be provided with a non-ferrous 32 mm washer fitting. Stud bolts to receive the brackets on the underside of the wash basins shall be suitable for a bracket with stud not exceeding 13mm diameter 5 mm high and 305 mm from the back of basin to the entire of the stud. The stud slots shall be of depth sufficient to take 5 mm stud every basin shall have an integral soap holder recess or recesses which shall fully drain into the bowl. The position of the chain stay hole shall fully drain into the bowl. The position of the chain stay hole shall not be lower than the over flow slot. A slot type ov3rflow having an area of not less than 5 sq. cm. shall be provided and shall be so designed as to facilitate cleaning of the overflow. The specifications for waste plug, chain and stay shall be the same as given for sinks.

b) All the waste fittings shall be chromium plates bottle trap conform to IS: 5434 the chromium plating shall be of grade B type conforming to IS: 1068. Also CI brackets shall be provided with screws.

It shall be measured in nos. The rate shall be quoted for providing and fixing washbasin as specified above.

12.31 Providing & Fixing Kitchen sinks

a) The sinks shall be of white glazed earthenware, white glazed vitreous china or white glazed fire clay as specified and shall be of the following sizes.

450 x 300 x 150 mm
600 x 450 x 250 mm

b) They shall be of one piece construction including a combined overflow; the floor of the sink shall gently slope towards the outlet. The outlet shall in all cases be suitable for waste fittings having flanges of 64mm diameter and the waste hole shall have a minimum diameter of 65mm at the bottom to suit the waste fittings. The waste hole shall be either riveted or beveled having a depth of 10mm. Each sink shall be provided with non-ferrous 40mm dia waste fittings. The sink shall have over flow of the waste type and the inverts shall be 30mm below the top edge. Each sink shall be provided with a waste plug of suitable dia. Chain and stay. The plug shall be of rubber of other equally suitable materials and shall be watertight when fitted plug chains shall be of brass 13mm in length and shall be chromium plated.

c) It shall have an overall length from the collar the stay of not less than 300mm. There shall be a triangular or D shackle at each end, one of which shall be brazed to the plug and the other securely fixed to the stay. The 150mm long shank of the waste shall be threaded conforming to the requirements for IS: 2556 for sinks only. The waste fittings and plug fittings shall be chromium plated. The chromium plating shall be of grade B type conforming to IS: 1068.

12.32 Providing & Fixing Stainless Steel sink with drain board.

It shall be of approved make. It shall be provided with fittings and specials like CI brackets, overflow, rubber plugs, CP brass chain, 31mm dia CP brass waste of Synthetic enamel paint.

12.33 PROVIDING & CONSTRUCTING SW 100MM DIA GULLY TRAP

SW gully trap for 100/150mm dia pipe shall be fixed in a chamber of 230 thick wall of size 300 x 300mm, 12mm thick plaster in cm 1:4 inside,100mm thick PCC 1:4:8 bed shall be laid over that 38mm thick IPS flooring shall be provided weight a CI frame and cover.

12.34 PROVIDING & FIXING FLUSHING CISTERNS

a) The flushing cisterns shall be automatic or manually operated high level or low level as specified. For water closets and urinals high level cistern is intended to operate with minimum height of 125cm and a low level cistern with a maximum height of 30cm between the top of the pan and the underside of the cistern. They shall with the requirements of IS:774

b) The body thickness of a cast iron cistern shall not at any place be less than 0.5 cm and that of an earthenware cistern 1.3 cm. The body of pressed steel cistern shall be of a seamless or welded construction, of thickness not less than 1.6 mm before coating, and shall be porcelain enameled or otherwise protected against corrosion by an equally efficient coating. The cistern shall be free from manufacturing faults and other defects their utility. All working parts shall be designed to operate smoothly and efficiently. Cisterns shall be mosquito proof a cistern shall be considered mosquito proof only if there is no clearance anywhere which would permit a 1.6 mm wire to pass through in the permanent position of the cistern, i.e. in the flushing position of filling position.

c) The breadth of a level cistern, from front to back, shall be such that the cover or seat, or both of water closets per shall come to rest in a stable position when raised. The cistern shall be supported on two cost iron or mile steel brackets of size as approved by the Engineer, These shall be properly protected by suitable impervious paint. Alternative, the cistern shall have two holes in the back, set above the overflow level, for screwing into the wall, supplemented by two cast iron or mild steel wall supports. A 5 liter cistern, however may be be supported by lugs or brackets cast on the body of the cistern.

d) Manually operated cisterns shall be of the curved siphon type and shall conform to the specifications given in is :2526. The cistern shall have a removable cover, which shall fit closely on it and be secured against displacement. In designs where the operating mechanism is attached to the cover, this may be made in two sections, but the section supporting the mechanism shall be securely bolted or screwed to the body.

e) The outlet fittings of each cistern shall be securely connected to the cistern. In case of high level cisterns, the outlet shall be of 32 mm nominal bore and in the case of low level cisterns; the outlet shall be of 40 mm nominal bore. Ball cock shall be of screwed type 15 mm in diameter and shall conform to is no. 1703. Ball valves (Horizontal plunger type) including, floats for water supply purposes. In the case of high level manually operated cistern, the level arm of the cistern shall have a suitable hole near the end through which a spilt ring of a (s) hook shall pass. A chain shall be attached to the ring or hook.

f) The chain shall be GTI and strong enough to sustain a suddenly applied pull of 10 KG or a dead load of 50 kg. Without any apartment or permanent deformation of the snipe of the link. The chain shall terminate in a suitable handle of “Pull” which shall be of pottery, galvanized iron non-ferrous metal, or a molding in any heat resisting and non-absorbent plastic.. The finish shall be smooth and free from burrs. In case of law level flushing cisterns, the handle shall be chromium plated.

g) The cast iron cisterns shall be painted with tow coats of black bituminastic paint of the inside and two coats of synthetic enamel paint on the outside. In the case of manually operated cisterns, the siphonic action of the flushing cistern shall be capable of being rapidly brought into action by the operation of level, but shall not self siphon of leak.

h) The discharge rate of the cistern shall be about 5 liters in 2 seconds when connected to an appropriate flush pipe, and there shall be no appreciable change in the force of flush during the period of discharge. The cistern shall have a discharge capacity of 5.10 or 12.5 liters as specified.

12.35 providing & Fixing Flush valve

It shall be of approved make

2.36 Providing & Fixing HCI NAHNI trap

The tap shall be painted with anticorrosive paint and fixed in position with PCC 1:2:3 (1 cement, 2 sand, 4 graded coarse aggregate of nominal size 20mm and down. The brass CP shall be placed over the trap, the flooring around the trap shall be properly finished.

12.37 PROVIDING & FIXING BOTTLE TRAP

It shall be of heavy duty approved quality and make. It shall be provided with necessary connecting pipe, wall flange etc.

12.38 PROVIDING & FIXING PAPER HOLDER

It shall be of approved quality. It shall be glazed with vitreous china recessed type.. It shall have a wooden roller or aluminum or a specified and a roll or paper

12.39 PROVIDING AND CONNECTING MANHOLES

Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as detected by the Engineer. The size indicate the inside dimensions of the manhole.

Excavation and back filling shall; be as per respective specification,.

Manhole shall be built on a bed of brickbat cement concrete 1:4:8: (1 cement 4 sand 6 brickbats of 40 mm nominal size). The thickness of the bed concrete shall be 150 mm unless otherwise specified.
Brick work shall be in cement mortar 1:6 (1 cement: 6 sand). The external joints of the brick masonry shall be finished smooth. The joints of the pipes with the masonry shall be made perfectly leak-proof with cement concerets 1:2:4.

The brick walls of the manholes shall be plastered inside with 12 mm thick cement plaster 1:4 1 (cement : 4 sand) finished smooth with a floating coat of neat cement.

Channels and benching shall be in cement concrete 1:2:4 (1 cement : 2 snad : 4 graded stone aggregate).

The depth of channels and benching shall be as indicated in the table give below:

Size of Drain Mm	Top of channel at the Centre above bed concrete cm	Depth of benching at side walls Above bed concrete cm
100	15	20
150	20	30
200	25	35
250	30	40
300	35	45
350	40	50
400	45	55
450	50	60

The frame of the manhole cover shall be firmly embedded to correct alignment and levels in plain cement concrete 100 mm thick 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate on top of the brick masonry. After completion of the work, manhole covers shall be seared by means of thick grease.

12.40 Providing & Construction Soak Pit

The earth excavation shall be carried out to the exact dimensions as shown in the drawing. The soak pit shall be constructed of honeycomb dry brick work of 250 mm thick in cement mortar 1:6, filled with brick bat upto height as specified. RCC 1:2:4 precast or cast-in-citu slabs 150mm thick for top cover with reinforcement. CI manhole cover 500mm dia of 80 kg. Weight, 150 mm dia sw tee, outlet vent, 75 mm dia CI pipe,

2 m high fixed on masonry pedestal with cowl and bituminastic painting, refilling, watering, consolidating etc., all complete.

12.41 Providing and Construction Drop Connection

In case where branch sewer enters the manhole of main pipe sewer at a higher level than the main sewer, a drop connection should be provided. Pipes; and specials conforming to IS: 1729 shall be of the same size as the branch pipe sewer.

For 150mm and 250 mm main line, if the difference in level between the water line (peak flow level and the invert level of branch line is less than 60 cm, a drop connection may be provided within the manhole by giving a suitable ramp. If the difference in level is more than 60 cm, the drop should be provided externally.

The excavation shall be done for the drop connection at the place where the branch line meets the manhole. The excavation shall be carried up to the bed concrete of the manhole and to the full width; of the branch line excavation and backfilling shall be done as per respective specifications.

All manholes deeper than 1.0 m shall be provided with CI foot rest. These shall be embedded 20 cm deep with 20 x 20 x 10 cm blocks of cement concrete 1:2:4 (1 cement: 2 sand : 4 graded stone aggregate). The block with CI foot rest placed in its center shall be cast-in-situ along with the masonry and the surface finished with 12 mm thick cement plaster 1:4 (1 cement : 4 sand) finished smooth. Foot rests shall be fixed 30 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of the wall. The top foot rest shall be 45 cm below the manhole cover. Foot rests shall be painted with coal tar, the portion embedded in cement concrete block painted with thick cement slurry before fixing.

CI manhole cov3ers and frames shall conform to IS: 1726. The covers and frames shall be cleanly cast and they shall be free from air and sand holes and from cold struts. They shall be neatly dressed and carefully trimmed. All casting shall be free from voids whether due to shrinkage, gas inclusion or other causes. Cover shall have a raised chequered design on the top surfaces to provide an adequate non slip grip. The cover shall be capable of easy opening and closing it shall be fitted in the frame in workmanship like manner. The cover shall be gas tight and Water tight covers and frames shall be coated with a black bituminous paint. It shall not flow when exposed to a

temperature of 63 Deg. Cent and shall not be brittle as to chip off at temperature of 0 Deg. Cent.

Manhole cover and frame shall conform to medium duty 500 mm internal diameter and shall weight not less than 75 kg unless otherwise mentioned in the item description (weight of cover 58 kg. And weight of frame 58 kg.).

Manholes shall be measured in numbers. The depth of the manhole shall be reckoned from top level of CI cover to the invert levels of channel. The depth shall be measured correct to centimeters.

Sewers of unequal sectional area shall not be joined at the same invert level in a manhole. The invert of the smaller sewer at its junction with main shall be, at a height at least 2/3 the diameter of the main, above and the invert of the main. The branch sewer should deliver sewage in the manhole in the direction of main flow and the junction must be made with care so that flow in the main is not impeded. No drains from house fittings e.g. GT, soil pipe etc., exceeding a length of 6 m shall be connected unless it is inevitable.

At the end of branch sewer line SCI tee shall be fixed to the line, which shall be extended through the wall of manhole by a horizontal piece of SCI pipe to form an inspection of cleaning eye. The open end shall be provided with chain and lid. The SCI drop pipe shall be connected to the tee at the top and to the SCI bend at the; bottom. The bend shall be extended through the wall of the manhole by a piece of pipe, which shall discharge into the channel. Necessary channel shall be made with cement concrete of grade M-150 and finished smooth to connect the main channel. The joint between SCI pipe and fittings shall be lead caulked. The joint between SCI tee and SW branch line shall be made with cement mortar 1:1 (1 cement: 1 fine sand) as for encased alround with minimum 15 cm thick concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) and cured. For encasing the concrete around the drop connection, the necessary centering and shuttering shall be provided the holes made in the walls of the manhole shall be made good with brick work in cement mortar 1:5 (1 cement : 5 3 fine sand) on the inside of the manhole wall. The excavated earth shall be back filled in the trench in level with the original ground level.

12.42 Providing and Constructing Road gully chambers / Yard gully

The chamber shall be of brick masonry and shall have a CI grating with frame fixed in 150mm thick cement concrete of grade M-150 at the top. The size of the chamber shall be taken as clear internal dimensions of the CI frame. The chamber shall have a SW connection pipe, the length of which between road gully chamber and the point of discharge to drain or to open ground shall be measured separately. The chamber shall be built at the locations indicated in the drawings.

Bed concrete, brickwork, plastering RCC work. Excavation, backfilling etc., shall be as per details given on the drawing and in compliance with the requirements laid down in the specifications for the respective items.

The MS grating cover shall be hinged to the frame to facilitate its openings for cleaning and repairs. The weight of grating shall be 75 kg. Minimum.

After the completion of the work the exposed surfaces of the grating and the frame shall be painted with two coats of synthetic enamel paint.

12.43 Providing and Constructing Septic tank

Septic tanks shall be built as per the drawings. The cost of all works such as excavation backfilling, concrete, reinforcement etc., shall be paid under the respective items included in the specification.

Note:

1. The foundation should be designed for the building considering the soil bearing capacity of the ground & provision should be kept for vertical expansion of the plant building for storage light materials, office accommodation & the roof design should be adequate for installation of solar panel for solar power.
2. As mentioned in the tender document the plinth level of the plant from the internal finish road should be +1100mm and boiler, refrigeration, LT, HT & administrative building..etc should be at +600mm.
3. The process, product, refrigeration & boiler section should be designed in such a way so that the additional equipments can be installed for enhancement of the capacity of the plant in future.
4. Pre-project investigation like soil bearing capacity, ground water, contour survey, including temporary & permanent power supply from the electricity authority is in the scope of the bidder.
5. The cold room clear height from finish floor level to ceiling of puff panel is 3.0 meter. For air circulation Clear space of 1.5 meter may be provided in between puff panel ceiling to roof top.
6. The grading plaster mixed with water proofing compound with proper gradient towards rain water pipe should be maintained for disposal of rain water is to be considered.
7. The anti termite treatment in an around the buildings should be considered.
8. Odisha fire prevention & fire safety rules guideline should be followed for providing of fire safety equipment & same should be installed at Plant.
9. The building should be designed with KB/CB/fly ash considering the first quality available in the area.
10. The internal electrification works & electrical fitting/items should be energy efficient with LED fittings.
11. The Effluent Treatment plant shall be designed as per OSPCB guideline.

SPECIAL CONDITION OF CONTRACT
PART – II For Plant Works

Item	Topic Number
1 .	Definitions
Country of Origin	
	Equivalency of standards and codes
	Performance Security
	Inspection and Tests
	Delivery and Documents
	Insurance
	Incidental Services
	Spare Parts
	Warranty
	Payment
	Resolution of Disputes
	Notices

The following Special Conditions of Contract shall supplement the General Conditions of Contract. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract.

Definitions

(a) The Project Authority is Odisha State Cooperative Milk Producers' Federation Ltd. and would include the term "Owner".

(b) The Supplier is (Name of Supplier).

2. Country of Origin

The place where the goods were mined, grown or produced from which the services are supplied.

3. Equivalency of Standards and Codes

Wherever reference is made in the contract to the respective standards and codes in accordance with which goods and materials are to be furnished, and work is to be performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly set forth in the Contract. Where such standards and codes are national in character, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Purchaser's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Supplier and submitted to the Purchaser at least 30 days prior to the date when the Supplier desires the Purchaser's approval. In the event the Purchaser determines that such proposed deviations do not ensure equal or higher quality, the Supplier shall comply with the standards set forth in the documents.

Performance Security (Clause 7)

The Performance Security shall be in the amount of 10% of the Contract price.

Inspection and Tests

The inspection of the Goods shall be carried out to check whether the Goods are in conformity with the technical specifications attached to the purchase order form and shall be in line with the inspection/test procedures laid down in the Schedule of Specifications and the Contract conditions.

Manufacturer must have suitable facilities at their works for carrying out various performance tests on the equipment. The bidder should clearly confirm that all the

facilities exist for inspection and shall be made available to the inspecting Authority.

A load and functional tests as indicated in the specifications must be carried out at the manufacturer's works. Reliability of the equipment shall be demonstrated to the satisfaction of the appointed inspector or inspecting Agency.

Approved supplier's drawings shall not be departed from except as provided in the Bidding Document.

The Purchaser shall have the right at all reasonable times to inspect, at the Supplier's premises all Supplier's drawings of any part of the work.

The supplier shall provide, within the time stated in the contract or in the programme, drawings showing how the plant is to be designed and any other information required for-

a) Preparing suitable foundations or other means of support.

b) Providing suitable access on the site for the plant and any necessary equipment to the place where the plant is to be erected and

c) Making necessary electrical connections from the panel board provided in the individual sections to the machines

Before the goods and equipment are taken over by the Purchaser, the Supplier shall supply operation and maintenance manuals together with drawings of the goods and equipment as built. These shall be in such details as will enable the Purchaser to operate, maintain, adjust and repair all parts of the works as stated in the specifications.

The manuals and drawings shall be in the ruling language (English) and in such form and numbers as stated in the contract

Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purposes of taking over until such manuals and drawings have been supplied to the Purchaser.

The goods will be accepted after inspection by the Purchaser, his representative or any inspection agency appointed by Purchaser and the costs for such Inspector/Agency shall be borne by the Purchaser.

6. Delivery and Documents

Upon shipment/dispatch, the supplier shall notify to the Purchaser by post or email or fax the full details of dispatch including Purchaser order no., description of the goods, quantity, mode of transport, place of loading, date of dispatch etc. The supplier will mail the following documents to the Purchaser with a copy to the Insurance Company:

The Supplier's invoice showing purchase order no. Goods description, quantity, unit price, total amount;

Delivery note/case-wise detailed packing list identifying contents of each package/ lorry receipt;

Manufacturer's/Supplier's guarantee certificate;

Inspection Certificate issued by the nominated inspection agency, and the Supplier's factory inspection report;

Certificate of origin;
Insurance policy;
Excise gate pass / octroi receipts/GST paid receipts wherever applicable, duly sealed indicating payments made; and

Any other document evidencing payment of statutory levies.

The supplier's certificate certifying that the defects pointed out during inspection have been rectified.

Note: The nomenclature used for the item description in the invoice/s, packing list/s and delivery note/s etc. Should be identical to that used in the purchase order. The dispatch particulars including name of transporter, LR no. And date should also be mentioned in the invoice/s.

7. Insurance

a) The "marine / transit" insurance to be taken by the contractor / supplier shall be in an amount equal to 110% of the FOR Destination value of the goods from "warehouse to warehouse" on "All Risks" basis including Strike, Natural calamities but exclusive of War Risks valid for a period not less than 3 months after the date of arrival of Goods at final destination

b) "Storage-cum-erection ALL Risks" insurance for an amount equal to 110% of the contract value valid for a period not less than 3 months after installation, including one month for testing and commissioning, shall be taken by the contractor / supplier.

OR

As an alternative to (a) & (b) above, "Marine-cum-erection ALL Risks" insurance policy, covering storage of equipment and other erection materials at site, for an amount equal to 110% of the contract value of supply, installation & commissioning and valid for a period not less than 3 months after installation, including one month for testing and commissioning, shall be taken by the contractor / supplier.

(c) Third Party Insurance : Before commencing the erection work the contractor / supplier without limiting his obligations and responsibilities, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property including that of Bidder / Purchaser, or to any person including any employee of Bidder / Purchaser.

Such insurances shall be for an amount not less than Rs. 10.00 lakhs per occurrence with the number of occurrence limited to five.

8. Incidental services

8.1 The incidental services for supply, installation and commissioning contract, as follows shall be provided by the Supplier:

(a) Furnishing of tools required for assembly and maintenance of the supplied goods;
(b) Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;
(c) On-site assembly and start-up of the supplied Goods;
(d) Conduct of training of the Purchaser's personnel (approx. for 4 man-weeks); at the Supplier's plant and/or on-site, in assembly, start-up operation, maintenance and/or repair of the supplied Goods.
(e) Furnishing of layout drawing etc. as specified in clause 3 of Special Conditions of Contract Part II.

9. Spare Parts
Supplier shall carry sufficient inventories to assure ex-spare parts and components shall be supplied as promptly as possible but in any case within six months of placement of order.

10. Warranty/Guarantee

The warranty/guarantee shall be as per provision under in General Conditions.

11.0 Payment
Payment for design and supply component follows as per Payment Terms Section:

12. Resolution of Disputes

In the event of any dispute in the interpretation of the terms of the order/contract or difference of opinion between the parties on any point in the order/contract arising out of or in connection with the agreement accepted order/contract or with regard to performance of any obligation hereunder by either party, the parties hereto shall use their best efforts to settle such disputes or difference of opinion amicably by mutual negotiations. In case no agreement is reached, either party may forthwith give to the other, a notice in writing of the existence of such question, dispute or difference of

opinion and the same shall be referred to the adjudication of sole arbitrator to be appointed by Purchaser whose decision in the matter shall be final and binding on the parties.

The Arbitration proceedings shall be governed under the provisions of the Indian Arbitration and Conciliation Act, 1996 and the rules there under or any statutory modifications thereof for the time being in force. In the order/contract, the venue of such Arbitration shall be Bhubaneswar, Odisha and Courts at Bhubaneswar alone shall have jurisdiction regarding any matter arising out of order/contract.

Performance under the Contract shall, if reasonably possible, continue during the Arbitration proceedings and payments due to the Supplier by the Purchaser shall not be withheld, unless they are the subjects of the Arbitration proceedings.

All awards for claims equivalent to Rupees thirty thousand or more shall be in writing and state the reasons for the amounts awarded.

13 Notices

For the purpose of all the notices, the following shall be the address of the Purchaser and Supplier.

Purchaser – Odisha State Milk Co-Operative Federation Limited, Bhubaneswar-751007
Supplier (To be filled in at the time of Contract signature.)

Note:

1. The Milk Pasteurizers should be provided with the PID control system.
2. The CIP system should be provided with four no's suitable size of tanks. One each for acid, alkaline, hot water & raw water. The CIP tanks provided with pneumatic valves.
3. The dairy equipment should be in accordance with the make specified in the tender document. For non specified item the Reputed/BIS/ISI mark shall be considered.
4. Pouch Packing Machine should be double head mechanical with provision for batch coding, photo cell & TTO printer.
5. The cooling tower system with the provision of IBT should be considered for the refrigeration plant.
6. All S.S items for manufacturing unit, milk process pipe line should be S.S 304 grade.

SPECIAL CONDITIONS OF CONTRACT
PART - III FOR ERECTION

Item	Topic Number
1.	Sufficiency of Tender
2.	Programme of installation and commissioning
3.	Preparation of drawings for approval
4.	Supplier's superintendence and employment of erection team and conduct of personnel
5.	Purchaser's instructions
6.	Right of the Purchaser
7.	Supplier's functions
8.	Duties of the supplier vis-a-vis the Purchaser
9.	Supply of tools, tackles and materials
10.	Protection of plant
11.	Unloading, transportation and inspection
12.	Storage of equipment
13.	Approvals
14.	Review and co-ordination of erection work
15.	Extension of time for completion

SPECIAL CONDITIONS OF CONTRACT FOR INSTALLATION PART - II

SUFFICIENCY OF TENDER

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

PROGRAMME OF INSTALLATION AND COMMISSIONING

As soon as practicable after the acceptance of the bid, the Supplier shall submit to the Purchaser for his approval a comprehensive programme in the form of PERT network/ bar chart and any other form as may be required by the Purchaser showing the sequence of order in which the Supplier proposes to carry-out the works including the design, manufacture, delivery to site, erection and commissioning thereof. After submission to and approval by the Purchaser of such programme, the supplier shall adhere to the sequence of order and method stated therein. The submission to and approval by the Purchaser of such programme shall not relieve the Supplier of any of his duties or responsibilities under the Contract. The programme approved by the Purchaser shall form the basis of evaluating the place of all works to be performed by the supplier.

PREPARATION OF DRAWINGS FOR APPROVAL

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

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

b. During the progress of works and within such reasonable times as the Purchaser may require such drawings of the general arrangement and details of the works as the Purchaser may require.

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

Within four weeks from the date of receipt of the Notification of Award, Supplier shall furnish a list of all necessary drawings as briefly described below which the Supplier 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 also.

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

Brief list of drawings:

I. Equipment drawings for fabricated items.

II. Equipment layout for main dairy plant, storage silo system and steam generation plant.

III. Flow diagrams for main processing plant, storage silo system and various services.

IV. Service piping layouts in production, storage silo system and service blocks.

V. Electrical cable, conduit / cable tray / cable trench layout.

VI. Other miscellaneous drawings as required for erection work.

VII. Electrical single line diagram, PCC and MCC general arrangement drawing and wiring diagrams.

VIII. Automation system scheme, controls and network diagrams.

Drawings showing fabrication details, dimensions, layouts and bill of materials submitted for approval shall be signed by responsible representative of Supplier and shall be to any one of the following sizes in accordance with Indian Standards: A0, A1, A2, A3 and A4.

All drawings shall show the following particulars in the lower right hand corner in addition to Supplier's name:

i. Name of the Purchaser.
ii. Project Title.
iii. Title of drawing.
iv. Scale.
v. Date of drawing.
vi. Drawing number.
vii. Space for Purchaser reference or 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 Supplier for approval will be checked, reviewed by the Purchaser, and comments, if any, on the same will be conveyed to the Supplier. It is the responsibility of the Supplier to incorporate correctly all the comments conveyed by the Purchaser on the Supplier's drawings. The drawings, which are approved with comments, are to be re- submitted in quadruplicate to the Purchaser for purpose of records. Such drawings will not be checked / reviewed by the Purchaser to verify whether all the comments have been incorporated by the Supplier.

If the Supplier is unable to incorporate any comments in the revised drawings, Supplier shall clearly state in his forwarding letter such non-compliance along with the valid reasons.

Drawings prepared by the Supplier and approved by the Purchaser shall be considered as a part of the specifications. However, the examination of the drawings by the Purchaser shall not relieve the Supplier of his responsibility for engineering design, workmanship, 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 Supplier shall make such revisions and proceed in the same routine as for the original approval.

Date of submission

In the event, the drawings submitted for approval require many revisions amounting to re- drawing of the same then the date of submission of the revised drawings would be considered as the date of submission for approval. Four sets of all the drawings finally approved for fabrication / execution of works along with their soft copy in AutoCAD on a CD/DVD shall be submitted to the Purchaser.

The Supplier shall furnish to the Purchaser before the works are taken over, Operating and Maintenance instructions together with four sets of hard & soft copy (on CD/DVD) of Drawings of the works as completed, in sufficient detail to enable the Purchaser to maintain, dismantle, reassemble and adjust all parts of the works. Unless otherwise agreed, the works shall not be considered to be completed for the purposes of taking overuntil such instructions and drawings have been supplied to the Purchaser.

SUPPLIER'S SUPERINTENDENCE (AND) DEPLOYMENT OF ERECTION TEAM AND CONDUCT OF PERSONNEL

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

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

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

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

The Supplier's employment records shall include any reasonable information as may be required by the Purchaser. The Supplier should also display necessary information as may be required by statutory regulations.

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

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

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

PURCHASER'S INSTRUCTIONS

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

Any additional drawing and clarifications to exhibit or illustrate details.

Variations or modifications of the design, quality or quantity of work or the additions or omissions or substitution of any work.

Any discrepancy in the drawings or between the schedule of quantities and/or specifications.

Removal from the site of any material brought there by the Supplier, which are unacceptable to the PURCHASER and the substitution of any other material thereof.

Removal and/or re-execution of any work erected by the Supplier, which are unacceptable to the Purchaser.

Dismissal from the work of any persons employed there upon who shall in the opinion of the Purchaser, misconduct himself, or be incompetent or negligent.

Opening up for inspection of any work covered up.

Amending and making good of any defects

RIGHT OF THE PURCHASER

Right to direct works:

The Purchaser shall have the right to direct the manner in which all works under this Contract shall be conducted, in so far as it may be necessary to secure the safe and proper progress and specified quality of the works. All work shall be done and all materials shall be furnished to the satisfaction and approval of the Purchaser.

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

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

Right to order modifications of methods and equipment

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

Right to inspect the work

The Purchaser's representative shall be given full assistance in the form of the necessary tools, instruments, equipment and qualified operators to facilitate inspection.

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

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

Even though inspection is carried out by the Purchaser or Purchaser's representatives, such inspection shall not, however, relieve the Supplier of any or all responsibilities as per the contract, nor prejudice any claim, right or privilege which the Purchaser may have because of the use of defective or unsatisfactory materials or bad workmanship.

SUPPLIER'S FUNCTIONS

The Supplier 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 there from and if the Supplier finds any discrepancy therein, Supplier shall immediately refer the same to the Purchaser whose decision shall be final and binding on the Supplier.

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

VARIATIONS

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

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

No such variations shall be made by the Supplier without an order in writing of the Purchaser. Provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an order given under this clause, but is the result of the quantities exceeding or being less than those stated in the Contract/Bill of Quantities. Provided further that if the Supplier shall within seven days confirm in writing to the Purchaser and such confirmation shall not be contradicted in writing by the Purchaser within 14 days, it shall be deemed to be an order in writing by the Purchaser.

All extra or additional work done or work omitted by order of the Purchaser shall be valued at the rates and prices set out in the contract if in the opinion of the Purchaser, the same shall be applicable. If the contract does not contain any rates or prices applicable to the extra or additional work, then suitable rates or prices shall be agreed upon between the Purchaser and the Supplier. In the event of disagreement the Purchaser shall fix such rates or prices as shall, in his opinion, be reasonable and proper.

Provided that if the nature or amount of any omission or addition relative to the nature or amount of the whole of the works or to any part thereof shall be such that, in

the opinion of the Purchaser, the rate or price contained in the Contract for any item of the works is, by reason of such omission or addition, rendered unreasonable or inapplicable, then a suitable rate or price shall be agreed upon between the Purchaser and the Supplier. In the event of disagreement the Purchaser shall fix such other rate or price as shall, in his opinion, be reasonable and proper having regard to the circumstances.

Provided also that no increase or decrease or variation of rate or price under tender condition 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 Supplier to the Purchaser of his intention to claim extra payment or a varied rate or price,

Or

b. By the Purchaser to the Supplier of his intention to vary a rate or price.

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

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

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

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

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

The Supplier shall, in the joint names of the Supplier and the Purchaser naming Purchaser as the beneficiary, insure the received goods and equipment and so far as reasonably practicable the Works and keep each part thereof insured for the 110% of the Contract Sum or such other value as may be mutually agreed between the Purchaser and the Supplier against all loss or damage from whatever cause arising, other than the excepted risks, from the date of shipment or the date on which it becomes the property of the Purchaser, whichever is the earlier, until it is taken over by the Purchaser. The Supplier shall insure against the Supplier's liability in respect of any or damage occurring whilst the Supplier is on Site for the purpose of making good a defect or carrying out the Tests on Completion.

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

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

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

Whenever proper execution of the work under the Contract depends on the jobs carried out by some other supplier, in such cases the Supplier should inspect all such erection and installation jobs and report to the Purchaser regarding any defects or discrepancies. The

Supplier's failure to do so shall constitute as acceptance of the other supplier's installation / jobs as fit and proper for reception of Supplier's works except those defects which may develop after execution. Supplier should also report any discrepancy between the executed work and the drawings.

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

The Supplier shall keep a check on deliveries of the Goods covered in the scope of erection work and shall advise the Purchaser well in advance regarding possible hold-up in Supplier's work due to the likely delay in delivery of such Goods to enable him to take remedial actions.

The Supplier shall be permitted to substitute equipment of equal on better performance subject to approval by the Purchaser; which approval shall not be unreasonably withheld, provided however that the Supplier establishes to the Purchaser's satisfaction that the performance of the substituted equipment is equal or better than the performance of the equipment specified in the contract and without any increase in the Contract price.

DUTIES OF THE PURCHASER VIS-A-VIS THE SUPPLIER:

The Goods, if any, to be supplied by the Purchaser for erection, testing and commissioning by the Supplier, shall be as listed in the Contract

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

If the Supplier suffers delay from failure on the part of the Purchaser to give possession of the civil works in accordance with the mutually agreed schedule, the Purchaser shall determine any extension of time to which the Supplier is entitled under Clause 21 of GCC.

SUPPLY OF TOOLS, TACKLES AND MATERIALS

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

PROTECTION OF PLANT

The Purchaser shall not be responsible or held liable for any damage to person or property consequent upon the use, misuse or failure of any erection tools and equipment used by the Supplier or any of Supplier's sub- suppliers even though such tools and equipment may be furnished, rented or loaned to the Supplier or any of Supplier's sub-

suppliers. The acceptance and/or use of any such tools and equipment by the Supplier or Supplier's sub- supplier shall be construed to mean that the Supplier accepts all responsibility for and agrees to indemnify and save the Purchaser from any and all claims for said damages resulting from the said use, misuse or failure of such tools and equipment.

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

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

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

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

Adequate lighting, guarding and watching at and near all the storage handling, fabrication, pre- assembly and erection sites for properly carrying out the work and for safety and security shall be provided by the Supplier at Supplier's cost. The Supplier should adequately light the work area during night time also. The Supplier should also engage adequate electricians/wiremen, helper etc. to carry out and maintain these lighting facilities.

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

UNLOADING, TRANSPORTATION AND INSPECTION

The Supplier shall be required to unload all the Goods from the carriers, received at site after Supplier's team arrives at site. The Supplier shall plan in advance, based the

information received from the Purchaser, Supplier's requirement of various tools, tackles, jacks, cranes, sleepers etc. required to unload the material/equipment promptly and efficiently. The Supplier shall ensure that adequate and all measures necessary to avoid any damage whatsoever to the equipment at the time of unloading are taken. Any demurrage/detention charges incurred due to the delay in unloading the material/ equipment and releasing the carriers shall be charged to the Supplier's account. The Supplier shall be responsible for receipt at site of all Goods and Supplier's equipment delivered for the purposes of the Contract.

The Supplier shall safely transport/shift the unloaded Goods and equipment to the storage area.

In case of turnkey contracts, the cost incurred on unloading of all the Goods received by the Purchaser prior to arrival of the Supplier at site shall be debited to the Supplier and all such goods shall be handed over to the Supplier when it reports at site and there upon the Supplier shall inspect the same and furnish a receipt to the Purchaser. The manner in which the inspection shall be carried out is enumerated below:

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

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

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

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

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

STORAGE OF GOODS

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

The Supplier's inspector shall check stored and installed Goods 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 Supplier shall immediately arrange a coat of protective painting whenever required. A record of all observations made on Goods, defects noticed shall be promptly communicated to the Purchaser and Purchaser's advice taken regarding the repairs/rectifications. The Supplier shall thereupon carry out such repairs/ rectifications at Supplier's own cost. In case the Supplier is not competent to carry out such repairs/ rectifications, the Purchaser reserves the right to have this done by other competent agencies at the Supplier's responsibility and risk and the entire cost for the same shall be recovered from the Supplier's bills.

The Supplier's inspector shall also inspect and provide lubrication to the assembled Goods. 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 Goods.

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

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

A suitable grease recommended for protection of surfaces against rusting (refined from petroleum oil with lanclin minimum (70 deg C) and water in traces) shall be applied over all Goods as required once in every six months

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

All the necessary Goods required for protection as described above shall be arranged by the Supplier and such cost shall be included in the Contract Price.

Should the amount of extra or additional work of any kind or any cause of delay referred to in these conditions, or exceptional or adverse climatic conditions, or other special circumstances of any kind whatsoever which may occur, as described in Clause 25 of the General Conditions of Contract, other than through a default of the Supplier, be such as fairly to entitle the Supplier to an extension of time for the completion of the works, the Purchaser shall determine the amount of such extension and shall notify the Supplier accordingly. Provided that the Purchaser is not bound to take into account any extra or additional work or other special circumstances unless the Supplier has within twenty-eight days after such work has been commenced, or such circumstances have arisen, or as soon thereafter as is practicable, submitted to the Purchaser full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

APPROVALS

The Supplier shall obtain the necessary approvals of the Factory Inspector, Boiler Inspector, Electrical Inspector, Weights & Measures Inspector, Explosive Inspector 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. All the necessary details, drawings, submission of application and proformas will be furnished by the Supplier to the Purchaser for verification/ signature. The necessary application duly filled-in, together with the prescribed fees shall be submitted to the appropriate authorities by the Supplier on behalf of the Purchaser. However all the actual statutory prescribed fees paid by the Supplier shall be reimbursed by the Purchaser upon production of the receipt/vouchers.

Wherever necessary or required, the Supplier shall furnish the necessary test and/or inspection certificates etc. from the appropriate authorities as per IER and other statutory regulations and the cost for obtaining these certificates shall be included in the Contract Price.

REVIEW AND CO-ORDINATION OF ERECTION WORK

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

EXTENSION OF TIME FOR COMPLETION

Should the amount of extra or additional work of any kind or any cause of delay referred to in these conditions, or exceptional or adverse climatic conditions, or other special circumstances of any kind whatsoever which may occur, as described in Clause 24 of the General Conditions of Contract, other than through a default of the Supplier, be such as fairly to entitle the Supplier to an extension of time for the completion of the works, the Purchaser shall determine the amount of such extension and shall notify the Supplier accordingly. Provided that the Purchaser is not bound to take into account any extra or additional work or other special circumstances unless the Supplier has within twenty-eight days after such work has been commenced, or such circumstances have arisen, or as soon thereafter as is practicable, submitted to the Purchaser full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

SPECIAL CONDITIONS OF CONTRACT FOR INSTALLATION

PART –IV MECHANICAL INSTALLATION

MECHANICAL INSTALLATION

The installation work would comprise:

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 platforms and tables.

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

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

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/Gas.

i. Testing, commissioning and start-up.

j. Painting including supply of paints as approved by Bidder.

k. Training of personnel.

Detailed specifications are given in the subsequent clauses.

GENERAL INSTALLATION

Positioning of Equipment

The work involves preparation of access for moving of the plant and equipment including their fittings from the work site godown or from the place within the site where they have been unloaded, to the place of erection, decorating and placing on the foundation wherever required. All the civil foundations as per the manufacturer/supplier's drawings shall be arranged by the Supplier. The Supplier shall place the equipment and carry out final adjustment of the foundations including alignment and dressing of foundation surface, embedding and grouting of anchor bolts and bedplates. The Supplier shall be responsible for obtaining correct reference lines for purpose of fixing the alignment of various equipment from master benchmarks provided by Bidder.

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

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

Structural Platforms, Service Pipe Bridge and Tables

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

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

SERVICE PIPING INSTALLATION

General Guidelines

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

Regulations of explosives inspectorate.

Indian Boiler Regulations

All applicable Indian Standards.

All applicable State Government/ Central Government laws/acts.

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

Scope of Supply

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

Scope of Piping Erection

This to be performed by the Supplier as outlined below:

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

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

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

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

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

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

Testing of Piping

The Supplier shall test all piping systems mentioned below including valves and specialties and instruments as per procedure mentioned under 3.4.4.

a) H.P. & L.P. Steam piping
b) Furnace oil & diesel piping
c) Soft and raw water
d) Compressed Air Piping

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

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

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

Sl. No.	Name	Test Pressure Kg/cm²	Test Medium	Duration of Test (Hour)	Allowable Pressure Drop (Kg/cm
1	Steam Pipelines				
1 a	H.P. Steam	27	Water	½	0
1 b	L.P. Steam	8	Water	½	0
2	Water Pipelines				
2 a	Raw Water, Soft water	8	Water	½	0
3	Furnace Oil/ LSHS Pipelines	16	Water	½	0
4	Air Pipelines	12	Air	½	0.1

Other Guidelines

Colour code shall be used to identify pipe material. The Supplier shall be able to identify on request all random piping prior to field fabrication.

The Supplier shall be responsible for the quality of welding done by them and shall conduct tests to determine the suitability of the welding procedure by him.

All piping supports, guides, anchors, hangers, rollers with structural framework shall be supplied and erected by the Supplier. Only anchor fasteners of adequate size shall be provided for anchoring supports from RCC structures and Hilti Gun shall be used for fastening the anchors.

The kinds of pipe supports like CI clamps, PUF/wooden saddles, roller supports and support framework shall be as per the design approved by Bidder prior to taking up the work.

All piping shall be suspended, guided and anchored with due regard to general requirements and to avoid interference with other pipes, hangers, electrical conduits and their supports, structural members and equipment and to accommodate insulation and conform to buildings structural limitations. It is the responsibility to the piping Supplier to avoid all interference while locating hangers and supports.

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

All piping shall be wire brushed and purged with air blast to remove all rust, mill scale from inner surface. The method of cleaning shall be such that no material is left on the inner or on outer surfaces, which will affect the serviceability of the pipes. A thin coat of any lubricating oil shall be applied on entire inner surface of steel pipes (black) to prevent rusting.

Effective precautions such as capping and sealing shall be taken to protect all pipe ends against ingress of dirt and damage during transit or storage.

The outside of the steel pipes (black) shall be painted with two coats of red oxide paint or as directed by Bidder.

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

MS box section pipe supports for services / process equipment shall be provided by the supplier. Box section pipe supports for services and cable trays in other areas shall be of steel of suitable thickness coated with rust preventive paints and finish coated with dark admiral grey of approved shade. Where pipes and clamps are of dissimilar material, gaskets shall be provided in between. Spacing of utilities pipe supports shall not exceed the following:

Pipe size	Spacing between supports
Up to 12mm	1.5m

15 to 25mm	2.0m
30 to 150mm	2.0m
Over 150mm	2.5m

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

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

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

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

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

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

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

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

SPECIAL INSTRUCTIONS AND SPECIFICATIONS

Steam Piping

Steam piping work can be classified into two categories:

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

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

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

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

Water Piping:

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

INSULATION OF PIPING AND EQUIPMENT

Insulation of Steam, condensate and Hot Water Pipe Lines

All the steam and hot water pipelines shall be insulated with mineral wool or equivalent resin bonded pipe section of specified thickness. The insulation shall be carried out in the following manner and should be supplied in the form of properly required sizes.

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

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

In case the insulation does not have the desired insulation properties, the entire

insulation will have to be redone at the Supplier's cost to give the desired results.

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

Aluminum / GI Cladding

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

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

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

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

INTER CONNECTIONS OF SERVICE AND ELECTRICALS WITH EQUIPMENT

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

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

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

CLEAN UP OF WORKS SITE

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

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

If the Supplier fails to comply with these requirements in spite of written instructions from Bidder, Bidder will proceed to clear these areas and the expenses incurred by the Owner in this regard shall be payable by the Supplier. Before completion of the work, the Supplier 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 Bidder. Any packing materials received with the equipment shall remain as the property of Bidder and may be used by the Supplier on payment of standard charges to the Owner and with prior approval of Bidder. At the completion of his work and before final payment, the Supplier shall remove and shall restore the site to neat workman like conditions at his cost.

CLEANING CHEMICALS AND LUBRICANTS

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

TESTING, COMMISSIONING AND START-UP

The Supplier shall operate, maintain and give satisfactory trial run of the plant in such manner and for such periods as has been specified in Section IV (Technical Specifications). All rectification of damages / defects during the trial period should be carried out by the Supplier.

The commissioning shall also include the following for each equipment:

Field disassembly and assembly of equipment, instruments and controls where required for access to fixing or adjustment.

Clean out of lubrication system including chemical cleaning wherever required.

Circulation of lubricant to check flow.

Clean out and check out of all the service lines.

Check out and commissioning of instruments, equipment and plants, filtering of

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

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

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

Closedloop 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 Supplier shall d e m o n s t r a t e p r o p e r working of all mechanical and electrical controls; safety and protective device, in presence of Bidder's engineer and the same should be duly recorded.

Commissioning of automation system:

The supplier should provide a detailed schedule of testing all automation and control systems.

All controlled or monitoring devices on the plant should be tested from the relevant control centre and recorded to be operating as designed, including feedback detection.

A log of these operations is to be maintained, and each completed group of tests to be signed by the supplier's commissioning engineer.
The Purchaser reserves the right to witness as much of these test procedures, as he may feel necessary.

Testing procedures and commissioning period will be as specified in Section IV.

After conducting testing, in case, a particular equipment is not working properly or not giving rated output the Supplier will furnish a detailed report to Bidder stating therein the detailed account on the performance of the equipment with possible reasons for improper or not working of the same and will arrange the visit of the representative of original manufacturers to get the same commissioned satisfactorily.

After satisfactory commissioning and start-up, the Supplier shall keep/depute his representatives at the plant in the manner, for the duration and for the performance of such tasks as specified in Section III. During this period the Supplier shall ensure proper working of complete plant and equipment and attend any works required to be done for proper operation of the complete plant and equipment.

PAINTING

All the equipment / machineries like motors, pumps, HT / LT panel, transformer, switch boards, starters, junction boxes, isolators, storage tanks, supporting structures, pipe supports and MS/GI pipes and all exposed and visible iron parts included in the scope of erection / commissioning shall be given double coat of paint of approved shade over a double coat of anti- corrosive primer wherever necessary irrespective of the condition of original paint of equipment/machineries/ structures/supports. All surfaces, wherever required, must be properly cleaned from scale, dirt and grease prior to painting. Spray painting must preferably be used on all the equipment /machineries and wherever practicable. Suitable and necessary cleaning / wiping of sight / dial glasses, other non-metallic parts, flooring, walls and other surfaces which have been spoiled by paint during painting must also be carried out by the Supplier.

Lettering and other markings, including capacity and flow direction markings, shall also be carried out by the Supplier on the tanks, pipe lines, starters and wherever else necessary, as directed and as per the standard practice of installation. BIS colour codes and colour charts as mentioned in Annexure - II must be adhered to.

Supply of all paints and all other materials required for painting is included in the scope of supply of the Supplier under this contract/order.

TRAINING OF PERSONNEL

Necessary staff as may be deputed by the Owner shall be trained by the Supplier for operating the plant. The personnel will be associated for the training during the installation; testing, commissioning and start-up period and the training tenure shall be extended for a minimum period of one month from the date of commissioning and start-up. This training will be a continuous process during commissioning and stand by period and as described in the Technical Specifications.

- **GENERAL SPECIFICATIONS FOR PIPES AND FITTINGS**

- Flanges shall be of good make. The supply of flanges shall also include supply of bolts, nuts, washers and suitable asbestos fibre/rubber insertion food grade gaskets (minimum 3mm thick).

- The above specifications for valves are general specifications. However, pipes and valves shall be required to be supplied as per details mentioned in Section III - the technical specifications of plant and equipment.

- **LIST OF APPROVED MAKES FOR MAJOR COMPONENTS**

A table of makes of various major components is given under Technical Specifications Section I I I . The supplier will adhere to makes of items as per this list only. For an item not mentioned in
the table or item having more than one preferred / approved make, supplier will obtain approval of the Purchaser for the make before initiating actual procurement.

Piping			
Service	Material	Specification	Ends
HP Steam (IBR Approved)	Heavy duty, seamless Cast Steel	Schedule 40, ASTM A 53	Piping to be welded type
LP Steam	ERW, Heavy duty (C-class)	BIS: 1239, 3601	Piping to be welded type
Air	ERW, Heavy duty (C- class)	BIS, 1239, 3601	Piping to be welded type
Water Supply, bleeds, drains, etc.	Galvanised steel (ERW) medium duty class B	BIS:1239/BIS:3589	Piping to be welded type
SS Duct	TIG welded, annealed and decaled, outside mirror polished & inside pickled as per dairy standards	AISI 304	Welded corci;ar During with Flanged joints
MANUALLY OPERATED VALVES:			
Hp Steam (IBR Approved)	Cast steel body Globe / Piston Valve & NRY with SS working parts		Flanged > 25 Screwed< 25 NB
LP Steam	Cast steel/GM body Globe/ Piston Valve & NRV with SS working parts		Flanged > 25 NB Screwed< 25 NB

Air	Cast steel / GM body Globe/ Piston Valve & NRV with SS working parts rubber (Inert to moisture & oil traces)		Flanged> 25 NB Screwed<25 NB
Soft / Raw water: Over 75 mm Upto 75 mm	CI, butterfly Cs ball valve	IS: 778, 1703	Flanged> 25 NB Weldable up to 25 NB
Water supply, bleeds, And drain	Cast steel ball valve	IS:778	Flanged> 25 NB

ANNEXURE - I

FORMAT OF MAKES OF BOUGHT OUT ITEMS SELECTED BY SUPPLIER:

Sr.	Name of the item	Make Selected by Supplier		
		1st Preference	2nd Preference	3rd Preference
1	Steam Piping			
1 a	MS Ç'class pipes			
1 b	Cast Steel globe valves			
1 c	Bronze globe valves			
1 d	Cast Steel Non- return valves			
1 e	Gun metal Non- return valves			
1 f	Pressure reducing valves, safety valves, strainer, moisture separator, steam trap, expansion joints & other steam fittings.			
1 g	Pressure & temp. gauges			
2	Furnace oil piping/air piping			
2 a	MS Ç'class pipes (Seamless)			
2 b	Cast Steel globe/ Bronze globe valves/ Gun metal gate valves			
2 c	Gun metal NRV			
2 d	Pressure gauges			
3	Water piping			
3 a	GI 'B' Class Pipe			
3 b	CI globe valve			
3 c	Gun metal gate valve			
3 d	Gun metal globe valves/ strainers / non- return valves			
3 e	Water Pump			
3 f	Foot vavle			
3 g	Water meter			
4	Insulation materials			
4 a	Expanded polystyrene			
4 b	Glass/ mineral wool			
4 c	Resin bonded mineral wool			
4 d	Polyurethane foam			
5	Cables			
5 a	Powder Cables			
5 b	Control Cables			
5 c	Instrumentation & Signal cables			

Important note:

The make of all bought out items / components should be got approved at one instance only and the makes thus approved shall only be supplied.

ANEXURE - II

CODE OF PRACTICE FOR PAINTING OF SERVICE PIPE LINES, EQUIPMENT AND STRUCTURAL WORK

PAINTING OF SERVICE PIPE LINES

On Non-insulated Pipe Line

Ground colour to be applied throughout the length of the pipeline.

Colour bands to be applied, over the ground colour, near every valve and branch connections as well as in every room near the entry.

The relative proportional widths of the 1st colour band to the subsequent bands shall be 4:1. The minimum width of colour band shall confirm to the following table:.

Nominal	Width of 1st	Width
80 NB and	100 mm	25
100 NB to	200 mm	50
200 NB to	300 mm	75
350 NB and	400 mm	100

On the 1st band a white arrow to be put to indicate the direction of flow.

The arrows should be put on the bottom of the pipelines so that the same are visible from below in case of horizontal bank of pipes and on sides in case of vertical bank of pipes.

The valves should be painted with the same colour as the ground colour of the pipeline.

On Insulated Pipeline but without Aluminum Cladding Procedure same as above.

On Insulated Pipeline with Aluminum Cladding

Ground colour to be applied in a minimum length of 1000 mm of the pipe all round near every valve and branch connections as well as in every room near the entry. The complete length of the pipeline should not be painted.

Colour bands should be applied in the middle of every ground colour strip. The relative proportional widths of the 1st colour band to the subsequent bands shall be 4:1. The minimum width of colour band shall confirm to the following table:

Nominal Pipes Size	Width of 1st Colour band	Width of 2nd Colour band
80 NB and below	100 mm	25 mm
100 NB to 150 NB	200 mm	50 mm
200 NB to 300 NB	300 mm	75 mm
350 NB and above	400 mm	100 mm

For insulated pipes, nominal pipe size means the outside diameter of pipe with insulation.

On the 1st band a white arrow is to be put to indicate the direction of flow of the fluid.

The arrows should be put on the bottom of the pipelines, so that the same are visible from below in case of horizontal bank of pipes and on sides in case of vertical bank of pipes.

The valves should be painted with the same colour as the ground colour.

The ground colours and the colours of the 1st and 2nd colour bands have been indicated on the enclosed list for the pipe lines carrying various types of fluids and gases. The list also indicates the shade nos. of the colours to be used. In case the exact shade is not available, the nearest possible shade in the same colour may be selected.

Only synthetic enamel paint should be used for the painting and band markings on the pipelines and it should be ensured that the finish should be glossy.

Where no colour bands have been recommended, only the ground colour is to be applied as per the above procedure. If only one colour band is recommended the width of the same should be as per the first band and applied on the ground colour. In case of 2 nos. colour bands, the 1st band and second band of width as per above table should be applied on the ground colour.

To avoid mixing of colours, it is recommended to apply the bands only after the ground colour paint is dry and subsequently to apply the arrow only after the 1st band paint is dry.

PAINTING OF EQUIPMENT & STRUCTURAL WORK

M.S. platforms/pipe supports/ Pipe bridges and any oth Structures
Dark admiral grey shade No.632 of BSI

Feed water tank, Water softening plant.
Dark admiral grey shade no. 632 of BIS
Hot water set, vacuum heating set, Water pumps, geared motor of
Tanks and vats, Gearbox and supports
Original colour

Coal handling equipment	Black

HWG chimney and Generator exhaust Aluminum paint

Air Compressors	Original colour
Weigh scales	Original colour
HT & LT panels	Original colour
LT distribution switchboards	Original

COLOUR CODE FOR PIPELINES AS PER IS 2379-1963

Sr. No.	Services	Application	Ground colour Colour Shade No. per BSI	First Band Colour Shade No. as per BSI	Second Band Colour Shade No. as per BSI
1	HWG Feed Water	HWG feed water piping	Sea Green 217		
2	Drinking Water	Water lines For water coolers	Sea Green 217	French 166 Blue	Signal 537 Red
3	Treated Water	Soft water lines	Sea Green 217	Light 557 Orange	
4	Cold Water	Chilled Water supply & return	Sea Green 217	French 166 Blue	Canary 309 Yellow
		lines			
5	Untreated Water	Raw water lines	Sea Green 217	White	
6	Boiler Feed Water	Boiler	Sea Green 217	Gulf - Red	
7	Condensate	Steam Line	Sea Green 217	Light 410 Brown	
8	Compressed Air	All compressed air pipelines	Sky Blue 101		
9	Instrument air	Instruments	Sky Blue 101	French 166 Blue	
10	Soft Water Equipment	All plant and	Sea Green 217	Light 410 Brown	Signal 537 Red
11	Steam	HP steam lines	Aluminum to IS 2339	French 166 Blue	
		LP steam lines	Aluminum to IS 2339	Canary 309 Yellow	
12	Furnace Oil	Boiler & Furnaces	Light 410 Brown	French 166 Blue	
13	Diesel	Diesel generating set	Light 410 Brown		
14	Light Diesel Oil	Hot Water Generator & Boiler	Light 410 Brown	Brilliant 221 Green	
15	Drainage	All drain lines from Equipment building & OH water Tank	Black		

SPECIAL CONDITIONS OF CONTRACT FOR INSTALLATION
PART – V ELECTRICAL INSTALLATION

Item	Topic Number
1.	Scope
2.	Standards
3.	Equipment and accessories - Specifications
4.	Erection of Equipment
5.	Installation of Cable Network
6.	Earthing Network
7.	Two/Four Pole Structure
8.	Bureau of Indian standards for electrical
9.	Recommended cable sizes for Industrial wiring

SPECIAL CONDITIONS OF CONTRACT
PART - V ELECTRICAL INSTALLATION

The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like high tension switchyard with accessories and equipment, transformers, HT panel vacuum circuit breakers, LT panels and power control centres, motor control centers, distribution boards, capacitor banks & panels, power, control & instrumentation cables, remote push button stations, motors, earthing network, etc. Requirement of a particular project shall be as specified in schedule of quantities/approved drawings or as per the battery limits fixed in the contract.

STANDARDS

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

In addition to the standards as mentioned in 2.1, all works shall also confirm to the requirements of the following:

a). Indian Electricity Act and Rules framed there under. b). Fire Insurance Regulations.
c). Regulations laid down by the Chief Electrical Inspector of the State / State Electricity Board.
d). Regulations laid down by the Factory Inspector of the State.
e). Any other regulations laid down by the local authorities.
f). Installation & operating manuals of original manufacturers of equipment.

EQUIPMENT AND ACCESSORIES – SPECIFICATIONS

This defines specifications and requirements mainly for the equipment and accessories which are generally supplied by the erection agency and do not cover the specification of main electrical equipment such as Transformers, HT and LT panels, switch boards and motors etc., which may be supplied by Bidder.

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

All similar materials and removable parts shall be uniform and interchangeable with one another.

Makes of bought out items selected by the Supplier must be furnished by him.

Power Cables (HT)

Three core, Aluminium conductor, screened, XLPE insulated, armored shielded and PVC sheathed cables suitable for 11 / 22 / 33 KV, earthed system, conforming to IS 7098 (Part
II) - 1988 amended upto date.

Power Cables (LT)

Power cables for use on 415 V system shall be of 1100 volt grade, aluminum conductor, XLPE insulated, PVC sheathed, armoured and overall PVC sheathed, strictly as per IS: 7098 (Part I) / 88. Conductor of cable shall be solid type .

Cable Trays

Functional requirement: Cable trays are used (based on the site condition) for laying the power and control cables inside the plant from PCC to the MCC & MCC to all motors/sub panels and wherever required.

Fabrication: These shall be perforated type, heavy duty, return flange or inward bend shape, manufactured from mild steel conforming to IS-2062 and hot dip galvanized as per IS 2629/BS-729. Width of cable tray shall be as per the requirement. Height to be minimum 50 mm and thickness of plate to be 1.5 mm up to 300 mm cable tray width. For cable trays having width more than 300 mm, height to be 75mm and thickness of plate to be 2.0 mm. Cable trays to be supplied to site in standard lengths of 2.5 M. Necessary accessories of cable trays such as coupler side plates for joining cable trays, bends, riser, inside riser, tee etc. must also be factory fabricated. Plain cable tray covers 1.5 mm thick to be supplied if specially required. Sample of cable tray to be got approved from Purchaser before supply. Cable tray for automation network /instrument /signal cables shall be separate from power & control cables.

Cable Glands

These shall be provided at both ends of armoured/ unarmoured electrical cables. Cable glands to be manufactured as per performance requirements of BS-6121 & IP 65 as per IS 13947 (Part I) amended as on date, with BRASS material accurately machined and NICKEL finish. These shall be of heavy- duty single compression type for cable conductor sizes above
35 sq.mm and weather proof double compression type for cable conductor sizes upto 35 sq.mm. Single compression cable glands to be complete with check nut, gland body, 3 nos. metal washers, and outer seal rubber ring and compression nut. Double compression glands to be complete with check-nut, gland body, neoprene inner ring,

armour clamping cone, armour- clamping ring, armour clamping nut, neoprene outer ring, skid washer & outer seal nut. Sample of cable gland to be got approved from the Site In charge before supply.

Cable Connectors

Cable connectors, lugs/sockets, shall be of copper/aluminum alloy, 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.). The current rating of the lugs shall be the same as that of the respective cable conductors. If the aluminum lug is terminated on a brass stud or copper bus bar then bimetallic washer shall be used.

Cable Route Markers

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

Cable Indicators

These shall be self-sticking type and of 2 mm thick lead Strap for overall cable. PVC identification numbers, Ferrule shall be used for each wire.

Pipes for Cables

For laying of cables under RCC floor, GI class 'A' pipes shall be used. For laying cable in air where cable trays are not being used, GI 'A' class pipe shall be used. Size of pipe shall depend upon the overall outer diameter of cable to be drawn through pipe. NO 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. If length of pipe is more than 30 M, free area may be increased to 50%. All cable (power / control / instrument / signal) drops shall be in conduit pipe. The open ends of power/control cables at termination shall be protected through suitable conduit. Instrument/signal cable/wire drops upto termination point shall be also routed through conduits. The automation cables (plant/system/field bus, instrument/signal cables/wires shall be laid in cable trays through GI conduit.

Motor Isolators

These shall be in Aluminum cast housing, completely dust, vermin and weather proof (IP 65), suitable for 30/25 A, 415 volts, 50 Hz with rotary type switch complete with cable gland for incoming and outgoing cables. Final finish of housing to be

buffer mirror or powder coated grey. Instead of AL cast housing, thermoplastic housing with IP 55 / 65 protection can also be used. From isolator to motor, adequately sized flexible copper wire in suitable heavy duty (wire ribbed) PVC flexible conduit to be used. Sample of isolator housing and conduit to be got approved before supply. Isolators shall be used for all on line started motors receiving single cable.

Motor Junction Box/Control Junction Box

These shall be in Aluminum cast housing or unbreakable, self extinguishing thermoplastics of high quality, completely dust, vermin and weather proof (conforming to minimum IP 65 class of protection), suitable for 25A, 415 volts, 50 Hz, with heavy duty bakelite /equivalent connector, complete with cable/conduit gland. These junction boxes are required on all floors near equipment for final connection of multi core control cables/signal cables to various field devices. They may also be used for star delta started motors for final connection to motor, through adequately sized flexible copper wire in suitable heavy duty (wire ribbed) PVC flexible conduit. Sample to be got approved before supply.

Remote Push Button Stations

These shall be used for remote ON-OFF for motors, away from MCC. These shall be suitable for surface/structure mounting in Cast Aluminum housing having IP-65 class of protection i.e., completely weather proof. For each motor, one ON, one OFF red mushroom half turn to lock button, one LED type indication lamp to be provided with a heavy duty connector inside the housing to receive control cables. If more than one motor is nearby, a common ON-OFF station can be used of suitable size made from SS 304 2thk. Indication lamp can be combined with 'ON' (Green) push button in place of providing separate indication lamp and push button. Riveted type plastic nameplate to be provided for each feeder. If functionally required Ammeter also can be located in such ON-OFF station.

ERECTION OF EQUIPMENT

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

Transformer Erection

Transformer complete with radiators, bushings, conservator and miscellaneous accessories shall be thoroughly inspected and any damage noticed shall be reported to the Engineer-in-charge. Before erection of transformer the level of rails on foundation shall be checked and minor corrections if necessary shall be carried out. After the completion of erection, necessary stoppers shall be provided at the wheels. All loosely supplied fittings/accessories shall be cleaned and mounted on the transformer and connections made. If the transformer oil is supplied in drums by the manufacturer, the same shall be tested for dielectric strength etc. and only approved oil "on test" shall be filled into the tank through filtration system. While filling in transformer with oil, samples shall be taken from the bottom and conservator and tested for dielectric strength. Fresh silica gel shall be filled in the breather. After complete assembling installation, filling and topping the transformer with oil, the transformer shall be cleaned and touch- up paint supplied by the manufacturer applied wherever necessary. All tank cover bolts shall be checked for proper tightness.

Testing

For testing of the dielectric strength of insulating oil in oil-immersed equipment, test samples of oil shall be drawn from equipment after filling. In case oil is supplied in separate containers for filling or topping up at the site, a test also shall be made with samples drawn from such oil container before the equipment is filled.

Minimum acceptable values for each test will be indicated by the Engineer- in-charge. However, dielectric strength of oil should be about 40 KV (RMS) for one minute.
By measuring the dielectric strength of the oil in the transformers, if tests indicate the presence of undue amount of moisture, the insulation oil shall be filtered by steam line filter. No extra charges shall be paid for filtration and the supplier shall arrange his own filtration machine, oil testing kit and other accessories.

Winding insulation resistance shall be measured from primary and secondary to ground and between primary and secondary.

Test the operation of Buchholz relay in accordance with the manufacturer's instructions.

Test the operation of the tap changer. Measure primary and secondary voltage ratios are as per nameplates.

Check the polarity of terminals and the phase's sequence.

Performa for Transformer Tests

1. Transformer nameplate

2. Insulation resistance test with 1000 V Megger

   a. between primary to earth .... Mega ohm
   b. Between secondary to earth .... Mega ohm
   c. Between primary and secondary .... Mega ohm

3. Dielectric strength of oil in the transformer (test Voltage 40 KV for one minute).

4. Operation of Buchholz relay as per manufacturers Instructions.
5. Operation of the tap changer Operation of the tap at
   tap no.1
   tap no.2
   tap no.3
   tap no.4
   tap no.5

6. Polarity marking and phase sequence.
7. Condition of silicated crystals.
8. Earth resistance: Neutral / tank

(This proforma shall be jointly signed by the Engineer-in-charge and the supplier).

Power control centres, MCC, Distribution Boards, Control Panels & Bus Ducts

Erection

Electrical panels and bus duct shall be delivered in convenient shipping section by the manufacturers. The Supplier shall be responsible for final assembly and inter-connection of busbars/wiring. Foundation channel shall be grouted in the flooring by the Supplier. Switchgear Panels shall be aligned and leveled on their base channels and bolted or tack welded to them as per the instructions of the Engineer-in-charge. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall be mounted and connected on the switchgear. The contacts of the draw-out circuit breakers shall be checked for proper alignment and inter- changeability.

After erection the switchboard shall be inspected for dust and vermin proof. Any hole, which might allow dust or vermin etc. to enter the panel, shall be plugged suitably at no extra cost.

If the instrument transformers are supplied separately they shall be erected as per the direction of the Engineer-in-charge. The Supplier shall fix the cable glands after drilling the bottom / top plates of all switchboards with suitable holes at no extra cost.

Range of overload relays/timers etc. shall be checked with requirement of motor systems actually to be connected at site and if the same is under- sized/over-sized, it shall be brought to the notice of Engineer-in-charge, who shall arrange procure ment of correct rated components. However, the supplier shall not charge anything extra for labour for such replacements.

The bus duct shall be suitably supported between Power Control Centre and transformer. The opening in the wall where the duct enters the switchgear room shall be sealed to avoid rainwater entry. The foundation of the Power Control Centre shall be raised suitably for minor adjustment to ensure proper alignment and connection of the bus duct at no extra cost. Expansion joints, flexible connection, etc. supplied by the manufacturer of the bus duct shall be properly connected.

Testing

Before electrical panel is energized, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contact open.

Before switchgear is energized, the insulation resistance of all DC control circuits shall be measured from line to ground.

Before switchgear is energized, the test covered above shall be repeated with each breaker in its normal operating position.

Capacitor banks in capacitor control panel shall be tested as per manufacturer's instructions. In addition test for output and/or capacitance, insulation resistance test and test for efficiency of discharge device shall be carried out.

All electrical equipment alarm s shall be tested for pr oper oper ation by causing alarms to sound under simulated abnormal conditions.

The Supplier shall arrange testing and calibrations of relays. The testing equipment including primary and secondary injection sets (if required) etc. shall also have to be arranged by the Supplier. Payment for above work shall be deemed to have been included in the erection of switch boards/control panels.

Proforma for PCC, DB, Motor Control Centres test

1. Circuit (breaker or Supplier module designation/ bus no.).

2. Insulation resistance test (contacts open, breaker racked in position).

a. Between each phase of bus ---------: Mega ohm b. Between each phase and earth ---------: Mega ohm c. DC and AC control & auxiliary Circuits
---------: Mega ohm d.

Between each phase of CT/PT & between CT & PT circuit, if any ---------: Mega ohm

3. CT checks:
a. CT ratio
b. CT secondary resistance
c. CT polarity check
4. Check for contact alignment and wipe.

5. Check/test all releases/relays.

6. Check mechanical interlocks.

7. Check electrical interlocks.

8. Check switchgear/control panel wiring.

9. Checking breaker/Supplier circuits for

a. Closing- local and remote (wherever applicable)
b. Tripping-local and remote (wherever applicable)

10. Opening time of breaker/contactor.

11. Closing time of breaker/contactor.

(The Engineer-in-charge and the Supplier shall jointly sign this proforma.)

Sealed Maintenance Free Batteries & Battery Charger

Batteries shall be erected on powder coated MS stands and insulators supplied by the manufacturer of the batteries. Inter connectors shall be made with leads supplied by the manufacturer. Charging discharging and recharging shall be carried out under the supervision of the Engineer-in- charge or his authorized representative Erection of battery charger and DC board will be carried out by the Supplier under the supervision of the Engineer-in-charge or his authorized representative. The Supplier shall also offer such facilities as may be required for carrying out tests on the complete battery charger and DC board/AC board.

Battery charger shall be tested for proper operation and to verify the charger delivers i t s maximum r a t e d o u t p u t . The Supplier shall supply skilled /unskilled labour for carrying out the test by the engineer-in-charge.

Batteries shall be given a boost charge in accordance with the manufacturer's instructions and adjusted for float operation before being placed in regular service.

GEARED MOTORS AND GEAR BOXES:

These are required in feed plant for driving various slow speed machines. All slow speed machines to be run by geared motors only unless gear boxes have been specified in individual machines specification. The geared motor should use helical gears. The electric motor and helical gear box should be built as one unit. The geared motors / gear boxes should be suitable for minimum 15 start/stops per hour without undue heating, for continuous duty and minimum safety factor of 1.4.

The electric motors used for geared motors / gear boxes should be TEFC, degree of protection IP-55, squirrel cage, induction type, with class `F' insulation suitable for 415 V, 50 Hz, 3 phase AC supply.

Geared motors / boxes to be c o m p l e t e including key in t h e driven shaft, oil level indicator, oil filling plug, oil breather and drain plug. Suitable grade gear oil for first charge of geared motor / boxes should not be filled but should be packed separately in a drum and sent along with geared motor/boxes. Gear oil would be filled at site.

Electric Motors

All electric motors shall be energy efficient motors and shall comply with the following:

a) All poly phase motors of 0.375 kW or more shall have a minimum acceptable nominal full load motor efficiency not less than shown in Table below or as per the IS 12615 – 2004(Rev 1) for Eff1 energy efficient motors.

Table for Minimum Acceptable Motor Efficiencies

	Efficiency (%)	
Motor Size (KW)	2 Pole	4 Po -
0.37 (0.5 hp)	70.2	69.
0.55. (0.75 hp)	74	72
0.75. (1 hp)	78.5	74.
1.1(1.5 hp)	82.2	83.
1.5 (2 hp)	84.1	85.
2.2 (3 hp)	85.6	86.
3.0(4 hp)	86.7	87.
4.0(5.5 hp)	87.6	88.

5.5 (7.5 hp)	88.6	89.
7.5(10 hp)	89.5	90.
11.0 (15 hp)	90.6	91.
15.0 (20 hp)	91.3	91.
18.5 (25 hp)	91.8	92.
22.0 (30 hp)	92.2	92.
30.0 (40 hp)	92.9	93.
37.0 (50 hp)	93.3	93.
45.0(60 hp)	93.7	93.
50.0 (75 hp)	94.0	94.
75.0 (100 hp)	94.6	94.
90.0 (120 hp)	95.0	95.
110.0 (150 hp)	95.0	95.
132.0 (180 hp)	95.3	95.
160.0 (215 hp)	95.5	95.
180.0 (240 hp)	95.5	95.
200.0	95.8	96.
225.0		96.
250.0		

b) Motor nameplates shall list the nominal full-load motor efficiencies and the full-load power factor.

c) Certificates shall be obtained and kept on record indicating the motor efficiency.

Erection and testing

Erection and coupling of motors with machines will be done under the mechanical erection. However, earthing, cable termination, testing and commissioning are covered under this section. Before starting the alignment and coupling of motors with machines, the insulation resistance of the motors will be measured and recorded by the Supplier. Wipe, brush or blow accumulated dirt from the frame and air passages of the motor. Feel for air being discharged from the cooling air ports. If the flow is weak or unsteady then clean it. Dry the motor before installation if it motor has been lying in the store for a long time. Motors having low meager readings because of contamination by moisture, oil or conductive dust should be thoroughly cleaned and dried. The direction of the rotation of the motor shall also be checked before the driven equipment is finally coupled. Motor bearings are to be checked and rectified including supply and changing of grease (if required), checking of fans coupling with bodies etc. The Supplier shall take adequate precaution and care while executing the work.

For all damage due to negligence etc. the Supplier shall be responsible to replace/repair at his own cost.

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

Motors shall be operationally tested together with the starting gear and auxiliary apparatus such as push button stations, the contactors, level and pressure controls, signal and alarm apparatus, power and control circuits etc.

- Check the anti-condensation heater and its circuit (if installed)

- Check the setting of the thermal overload protection / single-phase preventer. Testing of these devices is to be done wherever required as per the instructions of the Engineer-in- charge.

All motors shall run uncoupled for a maximum period of 4 hours before the driven equipment is placed in regular service.

Proforma for motor testing

1. Name plate details: Voltage.... HP.... KW....
   Mounting.... Current.... RPM.... Frame size...
   Make....S No..... Others.....

2. Insulation test (before cable connection).

   a. Between phase and earth ... Mega ohms.

   b. Between each phase ... Mega ohms.

3. Insulation test (after cable connection).

   a. Between phase and earth. .. Mega ohms.

   b. Between each phase ... Mega ohms.

4. No load current: R Phase …..Amps. Y Phase …..Amps. B Phase …..Amps.

5. Full load current:

6. R Phase …..Amps.

7. Y Phase …..Amps.

8. B Phase …..Amps.

9. Temperature rise after 4 hours run: On no load ^{0}C.

10. On full load ^{0}C .

11. Ambient temperature during test ^{0}C .
12. Operation of thermal overload relay:

i. At normal FL current of motor

ii. At twice FL current of motor : trip in Seconds.

(This proforma shall be jointly signed by the Engineer- in-charge and the Supplier.)

DG Sets

Erection & Testing

The preassembled DG Set shall be placed over the foundation and aligned properly. Before termination of cable to the alternator, the insulation resistance of the alternator will be measured and bearings shall be checked. All pipe connections etc of the engine shall also be checked. Also, the level of lubricant & coolant in the engine. The setting of various protection & releases, power and control circuits of the DG set panel shall be checked before switching on the DG Set.

Proforma for Alternator testing

1. Name plate details: Voltage.... HP.... KW....
Mounting.... Current.... RPM.... Frame size... Make.... SNo..... Others .....

2. Insulation test (before cable connection).

a. Between phase and earth ... Mega ohms.
b. Between each phase ... Mega ohms.

3. Insulation test (after cable connection).

a. Between phase and earth. .. Mega ohms.
b. Between each phase ... Mega ohms.

4. R …..A
No mps. …
5. R …..A
Ful mps. …

6. Temperature rise after 4 hours run: On no load ^{0}C. On full load ^{0}C . Ambient temperature during test ^{0}C .
7. Operation of thermal overload relay: At normal FL current of motor

8. No load & full load regulation :

Proforma for Diesel Engine testing

1. Speed regulation from no load to full load

2. Frequency at no load, 50% load & 100% load

3. Safety controls & protective devices

4. Specific fuel consumption:

INSTALLATION OF CABLE NETWORK

Cable network shall include power, control, signal & instrumentation and lighting cables which shall be laid in underground trenches, Hume pipes, open trenches, cable trays, GI/ SS pipes, or on building structure surfaces as detailed in the relevant drawings, Cable schedules or as per the Engineer- in-charge's instructions. Supply & installation of cable trays, GI / SS pipes/ conduits, cable glands sockets at both ends, isolators, junction boxes, remote push buttons stations, etc. shall be under the scope of the Supplier.

General requirements for handling of cables.

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

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

Sharp bending and kinking of cables shall be avoided. The bending radius for PVC insulated and sheath armoured cable shall be as per IS 1255-1983 and shall not be less than 10 D Where `D' is overall diameter of the cable.

While drawing cables through GI / SS pipes, conduits, RCC pipe, ensure that size of pipe is such that, after drawing cables, 40 % area is free. After drawing cable, the end of pipe shall be sealed with cotton/bituminous compound.

High voltage (11 KV and above), medium voltage (230 V and above) and other control cables shall be separated from each other by adequate spacing or running through

independent pipes/trays.

Armoured cables shall never be concealed in walls /floors /roads without GI pipes, conduits / RCC pipes.

Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin type joint shall be made, without any additional cost.

A minimum loop of 3 M shall be provided on both ends of the cable, or after every 50 M of unjointed length of cable and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying if the contract awarded is on item rate basis.

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

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

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

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

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

Laying of Cables (underground system)

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

coming in the way are to be properly shielded / diverted as directed by Bidder.

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

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

For all underground cables, route markers should be used.

a. Separate cable route markers should be used for LT, HT and telephone cables.
b. Route markers should be grouted in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm

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

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

Laying of Cables Under Floors

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

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

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

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

Laying of Cable in Masonry Trenches

Masonry/concrete trenches for laying of cable shall be provided by Owner.

However steel members such as MS angles/flats etc. shall be provided & grouted by electrical Supplier to support the cables without any extra charge. Cables shall be clamped to these supports with aluminum saddles/clamps. More than one tier of cables can be provided in the same trench if the numbers of cables are more. If required, cable trays can also be provided in trenches.

Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

Laying of Cables in Cable Trays

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

Cables shall be laid in cable trays in single tier formation and cables shall be clamped with aluminum flat clamps and galvanized bolts & nuts. Cables from cable tray to individual drive, control panel, remote push button station and other miscellaneous equipment shall be dropped in GI /SS conduit.

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

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

Laying of Cables on Building Surface/Structure

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

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

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

Termination and Jointing of Cables

Use of Glands

All PVC cable upto 1.1 KV grade, armoured or unarmoured shall be terminated at the equipment / junction boxb /isolators/push buttons / control accessories/instruments, etc by means of suitable size compression type cable glands. Armour of cable shall be connected to earth point. The Supplier shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanized threaded reducing bushing shall be used for approved type.

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

Use of Lugs/Sockets

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

The following is the recommended procedure for crimped joints and the same shall be followed:

a. Strip off the insulation of the cable ends with every precaution so as not to severe or damage any strand. All insulations to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

b. The cable should be kept clean as far as possible before assembling it with the terminal/socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the aluminum conductors, the socket should be filled with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket.

c. Correct size and type of socket/ferrule/lug should be selected depending on size of conductor, and type of connection to be made.

d. Make the crimped joint by suitable crimping tool.

e. If after crimping the conductor in socket/lug, some portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.

Dressing of Cable Inside the Equipment

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

For motors of 20 HP and above, terminal box if found not suitable for proper dressing of aluminum cables, the Supplier shall modify the same without any additional cost.

Cables inside the equipment shall be measured and paid for if the contract awarded is on item rate basis.

Identification of Cables/Wires/Cores

After laying & pulling cable, the contractor shall provide the cable identification tags to be tied by GI wire at each end of the cable. Power cables shall be identified with red, yellow & blue PVC tapes for trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear/control panels and control switches.

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

Cable between Isolators/Junction Box & Motors/Controls.

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

Termination of cables of 6.6 kV and above shall be carried out using heat shrinkable sleeves. This termination must be no-tracking and weather resistant.

Testing of Cables

Before energizing, the insulation resistance of every circuit shall be measured between conductors and between each conductor and ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits. Continuity test on each lead of cable shall also be tested.

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

DC High Voltage test shall be made after installation on the following:

All 1100 Volts grade cables in which straight through joints have been made. All cables above 1100 V grade.

For record purposes test data shall include the measured values of leakage current versus time.

The DC High Voltage test shall be performed as detailed below:

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

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

Performa for Testing Cables DATE OF TEST

a. Drum No. From which cable taken
b. Cable from to
c. Length of run of this table meter
d. Insulation resistance test:
   Voltage of Megger ..... Volts

between core-1 to earth....…….. Mega-ohm between core-2 to earth....…….. Mega-ohm between core-3 to earth....…….. Mega-ohm between core 4 (neutral) to earth…Mega-ohm between core-1 to core-2...……. Mega-ohm between core-2 to core-3..... ……..Mega-ohm between core-3 to core-1..... ……..Mega-ohm between core 4(neutral) to core 1..Mega-ohm between core 4(neutral) to core 2..Mega-ohm between core 4(neutral) to core 3..Mega-ohm

a. High voltage test Voltage Duration

between cores and earth

between individual cores

(This proforma shall be jointly signed by the Engineer-in-charge and the Supplier).

Earthing Network

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

Earth Pit with Electrode

Plate or pipe type earth electrode with earth pit shall be provided for this work unless otherwise advised by the Engineer-in-charge due to typical site conditions. Earthing electrode and pit shall be as per I S : 3043-1987 (reaffirmed 2001) - code of practice for Earthing). All earth electrodes shall preferably be driven to a sufficient depth to reach permanent moist soil.

For plate type earth pit, size of earth electrode for body earthing of equipment/ electrical panels (LT/MCC/ Switch Board) shall be 600 mm X 600 mm X 6 mm GI plate whereas that for the neutral earthing of transformer, DG Set, PLC & instrumentation earthing shall be 600 mm X 600 mm X 3 mm Copper plate. For pipe type earth pit, size of earth electrode shall be 100 mm NB GI pipe. For ready reference, sketches for pipe and plate type earth electrode earthing pits have been shown in Annexure – III.

PRIOR APPROVAL OF THE ENGINEER-IN-CHARGE SHALL BE TAKEN FOR SELECTING TYPE OF EARTH ELECTRODE (PIPE OR PLATE).

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

Earthing electrodes for Main plant lighting panel shall be plate type with double earthing.

Earth Bus, Earthing Lead and Earth Wire/Strip

All electrical equipment is to be doubly earthed by connecting two-earth strip/wire conductor from the frame of the equipment to an earthing pit/main earthing ring. The earthing ring will be connected via links to several earth electrodes. The cable armoured will be earthed through the cable glands. Conductor size for connection to various equipment shall be as specified in the drawing / as instructed by the Engineer-in-charge. However, the length of the branch leads from equipment to earthing grid/ring

shall not be more than 10 to 15 meters.

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

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

Following may be considered as general guidelines: Sizing of earthing lead/wire

Sr. No.	Item	Size
1	Control switches/ glands	PVC insulated 4 sq. mm copper conductor wire .
2	Motor /Isolators up to 10 HP	PVC insulated 4 sq. mm copper conductor wire.
3.	Motor /Isolators above 10 HP	PVC insulated 4 sq. mm copper up to 40 HP conductor wire upto Cable tray & GI strip 25 X 3 mm
4.	Motor above 50 HP upto 125	GI strip 40 X 3 mm HP
5.	Motor above 125 HP	GI strip 25 X 6 mm
6.	Switch Board / Motor Control	GI strip 50 X 6 mm Centre
7.	Earthing main in trenches	GI strip 50 X 6 mm
8.	Power Control Centre / LT	GI strip 50 X 6 mm Panel Of Sub Station

When earthing wire is to be drawn under floor / in underground, Copper conductor wire of 4sq mm with PVC insulation shall be used.

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

Copper wire shall be connected to the equipment by providing crimping type socket / lug.

Wherever earthing strip to be provided in cable tray, it shall be suitably clamped on cable tray and electrically bonded to the cable tray at regular interval.

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

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

The neutral of the transformer shall be connected to earth pit independently and earth pit shall have copper earth plate of 600 mm X 600 mm X 3 mm.

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

continuity.

The following selection table shall be followed for starters of motor feeders unless otherwise specified:

Sr. No	415 V Motor HP	Contactor Rating Amps	MCCB Rating Amp.	MPCB Rating Amp.	Type of Starter
1	Up to 3 HP	9	-	9	DOL
2	5 to 10 HP	16	-	16	-Do-
3	12.5 to 15 HP	25	-	25	Star Delta
4	20 to 25 HP	-	-	40	-
5	30 to 35 HP	-	-	50	-Do-
6	40 HP	-	63	-	-Do-
7	45 HP	-	100	-	-Do-
8	50 to 60 HP	-	125	-	Soft Starter
9	65 to 70 HP	-	200	-	-Do-
10	75 to 90 HP	-	200	-	-Do-
11	100 to 125 HP	-	250	-	-Do-
12	150 to 180 HP	-	400	-	-Do-
13	200 to 250 HP	-	400	-	-Do-
14	275 to 400 HP	-	630	-	-Do-

For capacitors, either special capacitor duty contactors shall be used or the rating of contactors / MCCB shall be double of rated current of capacitor.

- The above selection table provides the general guideline. However, technical requirement / specifications, if any mentioned under Section V, will supersede the table given above.

TWO / FOUR POLE STRUCTURE

ISMB 200 x 100 mm to be grounded in concrete 1:2:4 for at least 1/5th length i.e. 2 meters size of concrete pedestal 500x500mm. All necessary civil works such as excavation, centering, concreting and back filling is included in supplier's scope of work.

Interconnecting by aluminum conductor jumpers with connectors/PG clamps etc.

Installation, testing and commissioning of complete two/four pole structure including ISMB & cross channels, G.O. switch, insulators and other items mentioned under equipment supplied for two pole structure.

Complete structure to be provided with two coats of aluminum paint.

ANNEXURE - III

BUREAU OF INDIAN STANDARDS TO BE FOLLOWED FOR ELECTRICAL ERECTION

1. PVC insulated cables (light duty) for - 694-1990 Working voltage up to 1100 V Part I & II

2. PVC insulated cables (heavy duty) for - 1554-1988 Voltage up to 1100 volts Part I

3. -- do -- for voltage 3.3 KV to 11 KV - 1554-1988 Part II

4. Specification for polyethylene insulated PVC - 5959-1970 Sheathed heavy duty electric cables, voltage not exceeding 1100 V Part I

5. -- do -- voltage 3.3 KV to 11 KV - 5959-1970 Part-I

6. Guide for marking of insulated conductors - 5578-1970 or 5575

7. Code of practice for installation and - 1255-1983 Maintenance of power cables up to 33 kV

8. Code of practice for earthing - 3043-1987

9. Guide for safety procedures and practices - 5216-1982 in electrical work

10. Code of practice for installation and - 5214-1969 Maintenance of AC induction motor starters

11. Code of practice for installation and - 900-1992 Maintenance of induction motors

12. Code of practice for installation and - 10118 - 1982 Maintenance of switchgears Part I, II, III, IV

13. Code of practice for installation and - 10028 - 1981 Maintenance of transformers Part I

14. Code of practice for electrical wiring - 732-1989 Installation, voltage not exceeding 650 V

15. Code of practice for electrical wiring - 2274-1963 Installation (system voltage exceeding 650 V)

16. Guide for testing three-phase induction Motor - 4029-1967

17. Guide for safety Procedures & Practices - 5316- In electrical works

18. XLPE Cables for working voltage up to And including 1100 Volts - 7098 – 1988 Part I

19. --- Do --- up to 33 kV- 7098 – 1988 PartII

20. Boxes for enclosures of electrical accessories - 5133

21. Electric Power connectors - 5561-

22. HRC Cartridge Fuse Link up to 650 V - 2208-

23. Code of Practice for Selection, Installation & Maintenance of Fuse up to 650 V -3108-

24. Cables methods of testing - 10810-

25. Danger / Lattice Boards -3551-

26. National Electric Code - SP :30

ANNEXURE – IV

RECOMMENDED CABLES SIZES FOR INDUSTRIAL WIRING

The following selection table shall be followed for cables of motors unless otherwise specified:

3 Phase 415 V Motor H.P	Aluminum Conductor Cable Size- Sq. mm			
	DOL Starter/Soft starter		Star- Delta Starter	
	Supply side	Motor side	Supply side	Motor side
Up to 7.5	4	4	4	2X4
10	6	6	6	2X4
15	10	10	10	2X4
20	16	16	16	2X6
25	25	25	25	2X10
30	25	25	25	2X10
40	35	35	35	2X16
50	50	50	50	2X25
60	70	70	70	2X35
75	95	95	95	2X50
100	120	2X70	120	2X70
125	185	2X95	185	2X95
150	240	2X1200	240	2X120
180	300	2X150	300	2X150
200	2X150	2X150	2X150	2X150
250	2X185	2X185	2X185	2X185
275	2X240	2X240	2X240	2X240
300	2X240	2X240	2X240	2X240
425	2X400	2X400	2X400	2X400
3 Phase 415 V Motor H.P	Copper Conductor Cable Size- Sq. mm			
	DOL Starter/Soft starter		Star- Delta Starter	
	Supply side	Motor side	Supply side	Motor side
Up to 7.5	2.5	2.5	2.5	2X2.5
10	4	4	4	2X2.5
15	6	6	6	2X2.5
20	10	10	10	2X4
25	16	16	16	2X6
30	16	16	16	2X6
40	25	25	25	2X10
50	35	35	35	2X16
60	50	50	50	2X25
75	70	70	70	2X35
100	95	95	95	2X50
125	150	150	150	2X70
150	185	185	185	2X95
180	240	2X120	240	2X120
200	2X120	2X120	2X120	2X120
250	2X150	2X150	2X150	2X150
275	2X185	2X185	2X185	2X185
300	2X185	2X185	2X185	2X185
425	2X240	2X240	2X240	2X240
In case LAPP/Concab / Equi design of steel braided Copper Cables are used then Minimum size for various rating of motors to be laid between MCC & motors shall be as given in the table below				

Sr. No	Motor ratubg HP	Full Load Current (Amp.)	Type of Starter	Power cable rating (At Amb. Temp. of 45 sq.mm.
1	0.5	1	DOL	3 C or 4 C x 1.5 sq. mm
2	0.75	1.3	DOL	3 C or 4 C x 1.5 sq. mm
3	1	1.9	DOL	3 C or 4 C x 1.5 sq. mm
4	1.5	2.6	DOL	3 C or 4 C x 1.5 sq. mm
5	2	3.7	DOL	3 C or 4 C x 1.5 sq. mm
6	3	4.8	DOL	3 C or 4 C x 1.5 sq. mm
7	4	5.2	DOL	3 C or 4 C x 1.5 sq. mm
8	5	7.8	DOL	3 C or 4 C x 1.5 sq. mm
9	7.5	11.2	DOL	3 C or 4 C x 2.5 sq. mm
10	10	16	DOL	3 C or 4 C x 2.5 sq. mm
11	12.5	19	Star delta starter	3 C pr 4 C x 4 sq. mm (2 runs)
12	15	20.8	Star delta starter	3 C pr 4 C x 4 sq. mm (2 runs)
13	20	28	Star delta starter	3 C pr 4 C x 6 sq. mm (2 runs)
14	25	34	Star delta starter	3 C pr 4 C x 10 sq. mm (2 runs)
15	30	40	Star delta starter	3 C pr 4 C x 10sq. mm (2 runs)
16	40	53	Star delta starter	3 C pr 4 C x 16 sq. mm (2 runs)
17	50	65	Soft starter	3 C pr 4 C x 25 sq. mm
18	60	78	Soft starter	3 C pr 4 C x 35 sq. mm
19	75	96	Soft starter	3 C pr 4 C x 50 sq. mm
20	100	131	Soft starter	3 C pr 4 C x 70 sq. mm
21	125	156	Soft starter	3 C pr 4 C x 120 sq. mm
22	150	189	Soft starter	3 C pr 4 C x 150sq. mm
23	180	227	Soft starter	3 C pr 4 C x 185sq. mm
24	215	271	Soft starter	3 C pr 4 C x 240sq. mm
25	250	325	Soft starter	3 C pr 4 C x 300 sq. mm
26	275	360	Soft starter	3 C or 4 x 185 sq. mm-2 runs
27	300	390	Soft starter	3 C or 4 C x 185 sq. mm- 2 runs
28	335	400	Soft starter	3 C or 4 C x 240 sq. mm- 2 runs
29	375	NA	Soft starter	3 C or 4 C x 300 sq. mm- 2 runs

Note: Cables for motors above 20 HP have been indicated considering soft starters.

For motor rating, 200 HP and above, suitable rating of Bus Duct shall have to be provided depending upon the site requirement / as per the Site Engineer's direction.

SECTION – 5

TECHNICAL SPECIFICATION

Part – I : TECHNICAL SPECIFICATION OF CIVIL WORK FOR RENOVATION OF 10,000 LPD DAIRY PLANT AT TIRTOL, BLOCK-NUAPADA, DIST-JAGATSINGHPUR.

A. CIVIL/STRUCTUROAL WORK

I. The successful bidder shall be prepared the load design of civil-structural work, working drawings, estimate, tender specification, float the tender, assign the work & construct the building under his supervision. The successful bidder shall be follow the Odisha Public Works Department rule & regulation for complete the execution of this project.

II. The successful bidder may be visit the Tirtol Dairy for reference before submission of the offer at OMFED.

III. The Plinth Height of the building must be +1100 mm from the finished hard park level.

IV. The Building shall be RCC framed structure with R.C.C roofing for the new construction.

V. The building must be consisting of four side brick masonry wall with internal partition wall as per requirement, finished inside & outside plaster, External walls are evenly coloured with reputed make weather coat paint ,24-gauge chicken wire mesh must be providing at the junction or concrete and brick masonry.

VI. UPVC door & window shall be made in the building.

VII. Proper Drainage provision shall be made at the building.

VIII. Site Clearance for the execution of the project must be considered in the DPR as per actual & any other necessary arrangement must be taken in the project.

IX. Plinth Protection all the side shall be made at the said building.

B. INTERNAL ELECTRIFICATION

I. The internal electrification work for the building shall be designed by the Successful bidder.

II. According to the load design the drawing, estimate, tender specification & work shall be prepared by the successful bidder & same shall be executed under supervision of the successful bidder.

III. The cable, conduit, switch, smog proof light, alarm, panel board, earthing for the building & any other necessary electrical arrangement must be taken in the project.

IV. Cable trench/tray must be taken for laying of cable & conduit.

C.MECHANICAL WORK

TECHNICAL SPECIFICATION

1.Online Pasteuriser – 5KLPH

CAPACITY – 5KLPH (SKID MOUNTED)

Make: IDMC / Tetrapak/ GEA

TEMPERATURE: Programme 5-45-65-80-4 º C.

REGENERATION - 90%

HOLDING TIME - 20 secs in Tubes.

SCOPE OF SUPPLY:

PLATE HEAT EXCHANGER: PHE should be SS 316 with gasket of NBR food grade material which would be consist of fix plate and four intermediate plates. The frame of the PHE should be cladded in SS304 and should be provided with SS ball feet.This PHE will be connected with cream separator after reaching 45-48 degree C. It will also be connected with Homogenizer when milk temperature is 63 to 67 degree C. Flow diversion valve to be provided in the system.

FLOAT BALANCE TANK: - 100 ltrs capacity fabricated from 2 mm thick AISI 304 stainless steel sheet with cover, float, outlet and adjustable stainless steel ball feet.

AUTOMATIC FLOW CONTROLLER :(stainless steel) to maintain the required flow rate irrespective of the pressure loss.

S. S DUPLEX FILTER with suitable pore size to continuously filter the product. The design should be such so as to facilitate quick dismantling of the filter element complete with changeover valves at inlet and outlet and air purging arrangement.

STAINLESS STEEL MILK PUMP (7.5HP) to match with the pasteurizer capacity. The TEFC drive motor should be fitted with SS shroud with louvers for air cooling and suitable arrangement for cabling.
Stainless steel hot water set consisting of mixing chamber auto steam flow regulating valve, pressure relief valve, overflow discharge, hot water circulating pump (Cap-15, 000 LPH) with all inter connecting SS pipes & fittings. The hot water pump should be fitted with SS shroud with louvers for air cooling & suitable cabling arrangement.
Automatic control panel shall consist the following:
The panel should be of floor mounted design dust, weather and vermin proof fabricated from 2 mm thick SS sheets of AISI SS 304 material. It should be lockable type.

1. One no two pen temp. recorder with serving element for recording hot and chilled milk temperature. The recorder will be of circular/ chart type having a range 0 degree, -120 º C with a straight drive suitable for operation on single phase 230 V, 50 C/s AC supply.
2. One no digital temp. indicator mounted on the panel to indicate the hot milk temp. Continuously. This shall be sensed through a PT -100 sensor. PI indicating controller, EPT, Steam flow regulating valve, PT-100 sensor senses the hot milk temp. and gives a signal to PID controller which in turn actuates EPC to give the required air signal to steam flow regulating valve. Thus the flow of steam into the hot water tank is controlled in proportion to hot milk temp. so that the pasteurization or hot milk temp. is maintained at the present value (Temp. accuracy $\pm$ 0.5 º C)
3. Pasteurizer shall also be provided with an **AUTO FLOW DIVERSION VALVE**. This valve is actuated whenever the pasteurization temp goes below the present value, thereby enabling milk to divert back to FBT. There shall be an audiovisual alarm provided for this purpose.
4. An air filter cum pressure regulator shall be provided to control and supply air to instruments at the present value along with a pressure gauge to indicate the pressure.
5. The control panel should also have a minic diagram showing the flow of milk & service media at various stages of the pasteurizer.
6. Set of push buttons, rotary switch indicating lamps should be provided on the panel and prewired to indicate automatic diversion/ forward portions of **FDV** as the situations may be.
   ON and OFF push button with indicating lamps with suitable inscriptions shall be provided for the following pumps:

   Hot water Pump - 1 No.

Chilled water pump - 1 No.
Emulsifying Pump - 1 No.
One no. main alternator with key and indication lamp for On - Off.

7. **Heat Exchange Model PAP -5:**

Plates - The plates shall be made from SS confirming to AISI 304 and of sanitary design. This should be readily removable for cleaning & inspection.

Gaskets:

The sealing gasket shall ensure complete sealing & prevent cross leakage between product and service liquid. The gasket materials shall be NBR food grade Nitrile rubber and withstand the pasteurization temperature & CIP cleaning solutions.

Holding sections:

It shall be designed to hold the product for minimum specified holding time at the pasteurization temperature.

Supporting Frame:

The supporting frame for the plate pack shall be of a self-supporting design made from SS (AISI 304) with necessary tightening arrangement. The frame shall have adjustable ball feet.

Inlets / Outlets:

The inlet and outlets in each sections of the heat exchanger for products and services shall be provided with complete SS (AISI -304) unions. Stainless cavity for thermometers on all the inlets and outlets of products and steel (AISI -304) products services complete with a SS guard of at least 200mm length for mounting glass thermometers five nos. Glass thermometers shall be provided to measure inlet outlet or milk, pasteurized milk outlet inlet and outlet of heating and cooling media.

The heat exchanger shall have inlet & outlet connections for connecting milk clarifier at 45 º C and homogenizer at 65º C. Hence there shall be total 5 sections with necessary dividing plates.

There shall be total 201 nos. of plates having heat transfer areas of 0.40 sqm per plate with a total heat transfer area of 80.4 sqm.

Safety Device.

A safety device shall be provided in the hot water side of heating sections to avoid damage to the heat exchanger caused by excessive pressure. It shall be of sanitary design.

8. One set of suitable size inter-connecting SS pipes and fittings to connect the FDV, Feed Pump, Heat Exchanger duplex filter, FDV to FBT forward diverted line etc. with necessary SS pipe supports & SS clamps.

9. a) Two sets of manual along with relevant drawings including control diagram.
b) A set of standard tools shall be supplied with the equipment.

10. **Flow diversion valve** : Whenever the temperature of the Pasteuriser goes down then standard fixed the forward flow to the Silos will stop and milk will be diverted to Pasteuriser balance tank.

11. **ERECTION & COMMISSIONING:**

SCOPE OF SUPPLY:

Unpacking of the equipment shifting of the equipment to the desired place. Positioning of the equipment in its place. Inter-connection of the equipment with SS & service pipelines.

The erection of the above shall be carried out by you which would also include the followings:

a) Steam diaphram valve.
b) Pipeline connection to inlet of Hot water mixing battery after steam diaphram.
c) Inter-connecting SS piping between FBT, pump, Duplex filter FDV & pasteurizer.
d) Hot water piping between hot water set and pasteurizer and back.
e) Airline from control panel, FDV, Diaphram valves.
f) Control cables from panel board to pasteurizer PT -100.
g) Flow diversion valve etc. pipeline from FDV to FBT.

After installation of equipment, the pasteurizer set shall be put on trial run for a period of 3 days to see the performance, capacity measurement etc.

Drawings:

You shall send us 03 sets of general arrangement & fabrication drawings of all items, diagram of the pasteurizer showing the pass & flow arrangement of milk & service media, drawing for inter connecting pipes and fittings with pipe supports, electric / pneumatic control diagram etc. within 15 days of receipt of the purchase order for our approval. We shall send you the approved drawings within seven days of receipt provided the drawings are in order.

Guarantee:

The equipment shall be guaranteed for a period of 12 months from the date of commissioning and 18 months from the date of supply.

2. Online Milk Homogeniser – 5KLPH (SKID MOUNTED)

Functional Requirement:

5,000LPH capacity Homogenizer at 200 kg./cm² shall be suitable for breaking & dispensing milk fat globules having 4.5% fat & 8.5% SNF to less than 2-3 microns and shall work at more than 90% efficiency.

Make – IDMC, APV , GEA / Bartolli.

Capacity – 5,000LPH

Max. working pressure –200 Kg./Cm², Two stage design with first stage 2500 PSI and second stage 500 PSI.
Electric Power - The motor should be designed accordingly,
No. of Plungers – 3,
Material of plunger – S.S.316 chrome plated.
Homogenizing Head – two stage hydraulic actuated with stellated valve & valve seat. Impo, stellite mall rich.
Homogenized valves – Satellite Grade – 20 materials.

CRANK CASE:
i) Rugged in construction and easily openable.
ii) Open type split crank case body for easy checking and maintenance.

HOMOGENISING HEAD
Homogenising Head shall be two stage, removable type, hydraulically operated with in-built Relief Valve for excess pressure.
Homogenising Valve and valve seats for both 1st and 2nd stage are of Satellite Grade – 20 materials. They are wear and abrasion resistant and of interchangeable and replaceable type.

PLUNGERS
Plungers are made out of Hardened Special Alloy steel in order to ensure good life for plunger packing.

PLUNGERS PACKING
Plunger packing with sealing lip to prevent leakage and easily replaceable.
Cooling is to be done preferably by water.
The plunger seal are of Food Grade quality, able to withstand 90º C temperature.

LUBRICATION:
i) Forced feed lubrication through gear pump mounted on the shaft.
ii) Low & high pressure cut off switches for lubrication system.
iii) Oil level safety switches.

COOLING:
i) Crank case oil cooling through tube type oil cooler to ensure that the temp. of oil does not rise above 55°C.
ii) Gear Box cooling through water jacketed in-built in gear box casing.

POWER TRANSMISSION:

The primary transmission of power in Homogeniser shall be through 'V' belt and pulleys. The device with all the pulleys and 'v' belt etc. shall be on the main frame inside the shroud only. Both the pulleys (i.e. Motor as well as Homogeniser) shall be provided with Luck bush arrangement. The secondary power transmission shall be through a shaft mounted gear box located within the S.S shroud.

FINISH:
All welding joints grounded smoothly. All S.S. surfaces would be polished to 150grit.

JOINT CURVATURE:
There will not be any sharp corner edges on milk contact surfaces.
Also there would not be any thread in contact with the product.

SUITABILITY:
The Homogenizer would be suitable for use on reconstituted skimmed milk mixed with fat in the form on molten butter oil at a temp. of 55 to 65°C. The fat content of the mix would not exceed 12%.

CLEANING:
The Homogenizer should be suitable for CIP cleaning line in line with the pasteurizer.

PAINTING:
The body of the homogenizer to be painted with coat of epoxy primer followed by two coats of epoxy paint after thorough de-rusting.

TOOLS:
1 set of essential tools for commissioning and maintenance of the Machine should be supplied along with the Machine.

MOTOR CONTROL CENTRE
Motor control centre made from CRCA sheet powder coated shall be supplied with STARTER suitable as per the rated capacity given in the technical specification and DOL STARTER for the Hydraulic pump shall be provided. The panel shall be dust and vermin proof.

N.B:
All milk contact surfaces to be made of S.S. confirming to AISI 316. The complete unit would be provided with removable S.S. enclosures to give sanitary outlook.

ACCESSORIES:

- The inlet/outlet for product will be made up of 63.5 mm size with SMS connection.
- Pressure gauge of imported flat diaphragm type, glycerine filled, sanitary design as per standard – 1 No.
- Instruction Manual – 03 No.
- Electrical Control panel with starters & on off switches should be supplied. The panel would be out of M.S. Powder coated.

Note: The bidder shall send their Engineer for installation and commissioning of the homogenizer at site free of cost. The efficiency of the homogenizer shall be shown to us for consecutive runs for more than 90% homogenizing efficiency.

3. Online Cream separator – 5KLPH

Make: HMT / IDMC / Tetrapak / GEA

Rated Capacity	: 5000 Ltrs/hr
Bowl	: Solid wall bowl
Product Discharge	: Closed discharge with double centripetal pump
Cleaning	: Manual cleaning after dismantling of the bowl
Frame	: Cast iron, varnished in RAL 7037, grey
Drive system	: Flat belt drive with centrifugal clutch
Maximum feed pressure	: 1.0 bar
Useful discharge pressure	: 4.0 bar
(Skimmed Milk)	
Useful discharge pressure cream	: 4.0 bar
Product feed temperature	: 45 – 55 Deg C
Cream Fat percentage	: Not less than 60%
Dimensions	: L 815 mm x W 470 mm x H 1035 mm
Bowl weight	: 50 kg
Total weight	: 305 kg
Motor power	: 7.5 kW
Starting type	: Star/delta
Documentation	: 1 set of documentation in English

Accessories:

- 1 foundation frame to be integrated in the floor structure
- 1 set of tools for dismantling, lifting and assembling of the bowl
- 1 set of spare parts for commissioning
- 1 set of manual valves and indicating instruments for the adjustment of skim milk discharge pressure and cream flow

4. Milk Can Washer - 600 Cans/hr.

(STRAIGHT THROUGH CAN WASHER)

CAPACITY: 600 Cans/hr.

FUNCTIONAL REQUIREMENTS:

It would be used for drip draining, washing, sterilising and drying standard milk cans and can lids.

DESIGN REQUIREMENTS

Capacity: 600 Cans/hr.

Configuration: Straight through

Washing Sequence

Fresh water pre-rinse

Pressure hot water first rinse having minimum 3.5 Kg/sq.cm discharge head and 55 Deg. Celsius temp. (return water from after rinse should be used).

Pressure hot detergent cleaning having minimum 3.5 Kg/sq.cm discharge head and 70 Deg. Celsius temp.

Pressure hot water after rinse having minimum 3.5 Kg/sq.cm discharge head and 80 Deg. Celsius temp.

Live steam sterilisation.

Hot air drying at 100 Deg. Celsius temp.

Available Services:

Steam: at 3.4 Kg/sq.cm pressure

Water: Well water at 3 Kg/sq.cm

Finish: All welding joints are to be ground flush and finished to 150 grit. All stainless surfaces are to be polished 150 grits.

SCOPE OF SUPPLY

Main Enclosure: The main enclosure which houses the washing sterilising and drying sections should be made from 2mm thick stainless steel sheet conforming to AISI 430 having removable stainless steel (AISI 4001 inspection doors all along its length at front side for easy access. Can guides should be provided all along the inside length.

3.2 Under Frame : The complete underframe should be made from mild steel. The complete assembly should have sufficient number of solid steel legs with stainless steel ball feet having

50mm vertical adjustment. The complete mild steel frame should be spray galvanised after fabrication and proper surface preparation.

Conveyor Chain: The machine conveyer must ensure that, the individual cans and lids remain properly spaced. The drive motor, transmission, drive shaft and idler shaft should have adequate and accessible provision for adjustment and tensioning.

Drip Saver:

It should be fabricated from 2 mm thick stainless steel sheet confirming to AISI 304. It should be 5500mm long and supplied as an integral part of the machine where drips from emptied cans / lids enter washing section. A suitable stainless steel outlet with stainless steel drain cock should be provided in the drip saver away from the can washer body. It should be given a generous slope towards the outlet for free flow of milk. - 1 no.

Condensate Box: The vapour duct ending in a condensate box should be provided on top of the can washer for condensing flash vapour from the can washer. The warm waters from the condensate box can be used in the hot water section of the can washer. The condenser and duct should be made from stainless steel conforming to AISI 430. There should also be an exhaust blower of suitable capacity mounted on flanged type motor to suck vapour from the can washer and throw out condensable gases. Exhaust fan should have protection against chemical fumes and moisture. The exhaust fan impeller should be of SS casting. -1 no.

Can Discharge: The clean and dry cans should be discharged from the machine on to a clean can conveyor. The system should also be provided with a mechanical arrangement to place the clean lids manually on the cleaned cans.

Washing Stations:

Washing: The pumping and jetting arrangements should apply sufficient washing liquid to the inside an outside surfaces of the cans and the lids.

Filters: In recirculation of liquid in first rinse, detergent section and after rinse plate type suction filters should be provided to prevent choking of pump impeller and nozzles. The filter should be fabricated from AISI 430 SS material -3 set

Sump tanks: These should be made from stainless steel AISI 430 and would be used as feed tanks for various washing liquids. Correct operating levels should be maintained automatic in all the sump tank by necessary float valves. There should not be any intermixing between the different liquids. -3 nos.

Water Heating Arrangement: For hot water direct steam injection system should be provided with steam water ejector for mixing steam with water. For detergent heating indirect system with SS heating coil ending in a steam trap should be provided. Condensate from the coil should be discharged into the hot water tank. Suitable drain points to be provided to drain the used liquid.

Air Heating Arrangement: For can drying hot air to be used and blower, air heater and ducting etc. should be provided. Impeller housing of blower and ducting should be from SS 430 whereas coal of air heater from copper tubes of 14 G.

Jet Nozzles: Nozzles for jets should be made from stainless steel conforming to AISI 316. - 1 lot

No Can No Jet: No can no jet system should be provided for pre-rinse water and steam sterilisation sections.

Dosing Device: Manual gravity operated dosing device fabricated from SS 304 to maintain strength of detergent.

Pumps: The centrifugal monoblock type pump set having cast iron impeller, cast iron body and SS sheet with mechanical seal having 35 MWC discharge pressure should be supplied having capacity 20000 1ph should be supplied. -3 nos.

Instruments: Suitable connections/Thermowell should be provided on the delivery sides of the pumps and on the sump tanks for fixing pressure and temperature gauges

Control Panel: 1 no.

Main Enclosure: The enclosure and supporting structure should be made from stainless steel conforming to AISI 430. The enclosure should be moisture, dust and vermin proof.

Minic Diagram: It should show the complete can washing Process including can conveying system with LEDs showing the operation of various motors.

Push Buttons and Indicating Lamps: ON/OFF push buttons for all the motors and six sets as extra. All the push buttons should have indicating lamps and buttons suitable inscriptions.

3.9.4 Wiring: The control panel should be completely prewired. The wiring should be done by copper wires in accordance with the standard practice.

3.10 Termination Points: All distribution piping should be preassembled and terminated at a single flange for each service connection. Suitable weather proof electrical terminal box with power terminal blocks should be provided. All power wiring through isolators and earthing for various motors from this terminal box should be done with copper conductor multi-core cable in suitable ‘A’ class GI pipes. Erector would provide only power from Motor Control Centre to this terminal box for all motors.

Painting: The spray galvanised under frame should be painted with two coats of epoxy primer.

4.0 REMARK

4.1 Type (L/H or R/H): Facing the front side (side having inspection doors) of can washer, if the can conveyor moves from right to left then the can washer would be called as called left hand type and the reverse as right hand type.

5. Milk Silo - 10 KL

Type : VMST type
Material : a) Inner shell - AISI 304 (3 mm thick)
b) Outer cladding - AISI 304 (2 mm thick)
Finish : 2B with the joints ground & polish to 150 Grit. Pre-coated sheet shall be used for silo construction
Agitation : Single mechanical agitator to ensure uniform fat distribution without any adverse effect on the contents.
Ports and fittings : Inlet/outlet, breather, CIP spray ball, high and low-level sensors (only provision), level transmitter (only provision), temperature sensor, man way, alcove and other standard accessories like light glass, sight glass
Insulation : PUF/THERMOCOLE Insulation of suitable thickness to ensure temp. rise does not exceed 1 Deg. C in 24hours time.
Instruments : RTD and digital temperature indicator to be provided
Volume marking :Silo inner cell should be marked for volume .

6. Two Stage PHE – 1KLPH

PHE should be SS 316 with gasket of NBR food grade material which would be consist of fix plate and four intermediate plates. The frame of the PHE should be cladded in SS304 and should be provided with SS ball feet.

7. Multi Purpose Vat - 1 KL

FUNCTIONAL REQUIREMENTS

Multipurpose vat would be used for heating of milk from 4° C to 85° C and coagulating the same at 85° C for production of paneer & chhana indirectly with live steam at atmospheric pressure in the jacket and cooling at 37ºc by well water.

DESIGN REQUIREMENTS

Capacity : 1000 L

Constructional Features : The vat should be tripled wall welded construction, jacketed and insulated having rectangular cross section.

Dimensions of Vat :

Inner Vat	Inner vat length	Inner vat width	Inner vat depth at outlet side	Inner vat depth at opposite side
1000 L	2000 mm	1250 mm	520 mm	500 mm
Jacket	Jacketed vat length	Jacketed vat width	Jacket depth at outlet side bottom	Jacket depth at opposite bottom
1000 L	2100 mm	1350 mm	50 mm	50 mm
Outer vat	Outer vat length	Outer vat depth	Outer depth at outlet side	Outer vat depth at opposite side
1000 L	2200 mm	1450 mm	620 mm	620 mm

Slope : Both the inner and outer shells should slope towards the whey outlet as per the dimensions given above for free and complete drainage of the liquid.
Finish : All welding joints are to be ground smooth. All stainless steel surfaces are to be polished to 150 grits.
Joint Curvatures: All inside corners should have minimum radii of 25 mm

SCOPE OF SUPPLY

Inner Vat : The inner vat should be made from minimum 3 mm thick stainless steel sheet conforming to AISI 304.

Jacket : Steam jacket of minimum 50 mm width at all the four sides and the bottom should be provided. The jacket should be well supported with SS spacer pipe pieces.

Insulation : 50 mm thick mineral glass wool insulation should be provided after coating inner side of the outer vat and outer side of the jacket by bitumen paint. The insulation material shal be tightly wrapped on the jacket before fixing outer vat.

Outer vat: The outer vat should be made from minimum 2 mm thick stainless steel sheet conforming to AISI 304.

1 No.

Accessories :

Steam Distribution: Steam distribution system should comprise one no. of sparger pipe for 500 L and two Nos. for higher capacity, provided at the bottom jacket. The steam sparger should terminated outside with flange. The flange shall be provided with a steam orifice plate and 25 NB steam valve. 1 set

Over Flow: SS 304 overflow pipe of 38 mm diameter for the jacket ending near the floor level. 1 No.

Condensate drain: At the bottom of the jacket, suitable condensate outlet with valve & steam trap assembly shall be provided.

Safety Valve : In the jacket a safety valve should be provided to avoid any pressure accumulation in the jacket. The jacket shall normally work under ambient pressure.

Chilled Water connection : For cooling application, near to the steam sparger side a chiller water connection of 25 NB compete with valve shall be provided in the jacket.

Whey Outlet : Stainless steel cup type outlet of diameter 51 mm with stainless steel flanged vale (one end flanged other end SMS union) for the vat. Outlet should be at a height of 230 mm from the finished floor level.

1 No.

Drain : Suitable stainless steel 25 mm dia drain with valve for the jacket. This drain connection shall be used for drainage of cooling water from the jacket. 1 No.

Strainer : Sliding type strainer for the whey outlet (item 3.5.6). The strainer should be made from SS 316 wire mesh fixed in frame. 1 No.

Legs : Mild steel legs 38 mm dia with stainless steel (AISI 304) pipe cladding with stainless steel ball feet provided at the bottom of the tank. The ball feet should have provision for height adjustment of 50 mm, 4 Nos. for cap upto 1000 L and 6 Nos. above it.

MANUFACTURING CODE : The multi purpose vat shall be manufactured following good engineering manufacturing practices.

INSPECTION & TESTING : OMFED reserve the right to inspect the equipment during various stages of fabrication. The following tests should be conducted by the manufacturers at their works.

Dye penetration test for all stainless steel welding joints.

Water fill-up test of inner vessel for water tightness and hyd. test at 2.5 kg/cm² for jacket.

DRAWING : Bidder shall submit a GA drawing of the equipment along with the offer giving details of the material of construction, details of the bought out items etc. However, successful bidder has to submit detailed manufacturing drawings for approval from OMFED, prior to start fabrication.

INTALLATION & COMMISSIONING : Installation, testing & commissioning of the multipurpose vat is in the scope of the bidder. Detail scope & general guidelines for installation is given in the separate annexure.

8. Khoa/Rabidi Pan - 240 Ltr

(STATIONARY/TILTING TYPE)

Volume of the dish 240 Ltrs. triple walled with inner of 6 mm thick SS 304 material & intermediate shell of 5 mm thick MS material insulated with 100 mm thick mineral wool and covered with 2 mm thick SS sheet. The Khoa Pan should be specially designed dish, having greater surface area for effective evaporation. The above Khoa Pan shall be fitted with the following accessories and mounting: -

01. Temperature Gauge	0-150 deg. C.	-	1 No.
02. Pressure Gauge	0-50 PSI	-	1 No.
03. Release Valve	½"	-	1 No.
04. Safety Valve	¾"	-	1 No.
05. Steam Trap	½"	-	1 No.
06. C.I. Strainer	½"	-	1 No.
07. S.S. Stirrer		-	2 Nos.
08. Steam Inlet Valve	½"	-	1 No.
09. Thermostatic Airvent	½"	-	1 No.
10. Air Purge Valve	½"	-	1 No.
11. Brake Assembly		-	1 No.
12. ½" SS Braded Hose with Teflon Inner with both side ½" table 'E' flange (galvanized) (at least 3 mtr. running length)		-	2 Nos. (one spare)

The Khoa Pan would be resting on 4 Nos. of MS Legs (ending in MS Flanges, Stationery Type/MS Frame with Flange-Tilting type) and the jacket would be designed to a working pressure of 6 kgs./sq.cm. All the MS parts would be painted with two coats of anti-corrosive epoxy primer followed with two coats of synthetic enamel paint of rose white color.

9. Vacuum Paneer Packing Machine

CAPACITY: UPTO 5 KG PACK SIZE - 02 CYCLES / MIN

1. The double chamber, double seal bar and trolley mounted type vacuum packaging machine shall be used for packing of paneer in the retail packing of 200 grams to 1000 grams or bulk packing of 4 kg in pre-formed pouches of multi-layer oxygen barrier film.

2. The trolley type model shall have AISI 304 lid with see through inspection window and the body fabricated out of stainless steel material confirming to AISI 304. All product contact parts shall be fabricated from food grade stainless steel material confirming to AISI 304. The size of the vacuum chambers shall be sufficient to hold at least five filled pouches of 1000 gms on two seal bars located one on each side of the machine or one pack of 4 kg at a time.

3. The machine shall have facility for inert gas flushing. It shall also have additional seal pressure arrangement. Approximate bag size may be taken as 8" W X 10" L for 1 kg product.

4. Chamber and lid shall be fabricated out of 10 gauge and housing shall be fabricated out of 16 gauge stainless steel material confirming to AISI 304. The lid shall have see through acrylic inspection window.

5. The chamber shall be suitable to hold minimum five packs of retail size at a time or one pack of bulk size.

6. **Seal Bar**: The vacuum machine shall be provided with two seal bar, one on each side. The silicon pressure pad and seal bar shall be suitable for sealing multi-layer oxygen barrier material of thickness up to110 micro. The length of the seal bar is min 475 mm.

7. **Gas flushing**: The machine shall have in-built gas flushing facility to remove effectively air from the pouch and purge inert gas in the pouch as well as chamber. The flushing arrangement shall have necessary controls for calculated quantity of inert gas flushing per cycle.

8. **Seal pressure**: Machine shall be equipped with an in-built facility for applying additional seal pressure particularly when inert gas flushing is done or higher film thickness is used.

9. **Vacuum level**: The maximum vacuum level can be achieved on this machine shall be 99.9% (725 Hg) in any of the cycle and the vacuum level shall remain constant during the operation to achieve batter packing results. To achieve the desired vacuum level, latest design Toshniwal make oil free oil lubricated pump of capacity 35cu.m/hr with 1 HP three phase motor shall be provided.

10. **Additional features**: Digital microprocessor control with 10 memories and accuracy up to $1/100^{th}$ of a second for sealing operation.

11. **Capacity:** Suitable to seal retail packs of 200 gm to 1000 gm, 4 packs at a time or single bulk pack of 4 Kg. The cycle time for sealing shall be 2-cycles/ min. with full vacuum, loading and unloading time shall be at actual.

10. Sweet Curd / Plain Curd filling and sealing machine Capacity– 1000 cups /hr (ROTARY)

FUNCTIONAL REQUIREMENT

The machine shall be used for automatic filling and sealing of sweet curd and plane curd in 80ml/100ml and 200ml/400ml. cups of different diameter/height. The product shall have minimum 20% milk total solid at a temperature of 40º Celcius.

Design consideration

- Filling/sealing capacity - 1000 Cups/hour
- Flexibility in changing of dies within a limited time period.
- Volumetric filling in 80ml/100 ml and 200 ml/400 ml. of different diameter/height Cups.
- Should be suitable for High Impact Polystyrine cups and aluminium foil sealing.
- Double Track filling & sealing.
- PLC Based, servo system to facilitate change of speed and efficiency. Double sealing to ensure 0% leakage.
- Should be operated with 3 phase power supply 400V.
-

SCOPE OF THE BIDDER

- The bidder shall clearly mention the dimension of the machine, requirement of utilities like water, chilled water, steam compressed air, electrical load etc.
- Minor civil works like structural supports, S.S/MS pipe lines/fittings/ valves, electrical cables required for installation is within the scope of the bidder.
- The bidder shall draw all utilities/electrical lines from the main header at his own cost.
- Shifting of the machine to the work place for installation & commissioning.
- One years free after sale service from the date of handing over.

The machine should be supplied with the following spare items.

Dies

80 ml /100 ml - 1 set

200 ml/400 ml – 1 set

PLC Control spares – 1 set

Consumable items like rubber rings/gaskets – 1 set

Tools/Tackels - 1 set

NOTE : Stage inspection shall be made by the OMFED officials prior to delivery.
The bidders are advised to visit site on any working day to assess actual requirement.

11. Ghee Vat – 500ltr

FUNCTIONAL REQUIREMENTS:
Ghee Boiler (steam heated kettle) shall be used for the manufacture of ghee from butter or cream.
DESIGN REQUIREMENTS:
CAPACITY- 500Litres.

Construction features:
Triple walled, having jacket on shell & bottom, top mounted, vertical agitator insulated

Finish
All welded joints to be ground smoothly. All stainless shell surfaces are to be polished to 150 grits or 2B mill finish.

SCOPE OF SUPPLY:-
Inner Shell:
The inner shell cylindrical body & hemispherical bottom shall be fabricated from stainless steel plate of thickness 6mm thick confirming to AISI316 respectively.

Intermediate Shell:
The intermediate shell cylindrical body & hemispherical bottom shall be fabricated from stainless steel plate of thickness 6mm thick confirming to AISI 304
Outer Shell:
The outer shell cylindrical body & bottom dish shall be fabricated from stainless steel plate of thickness 2mm & 3mm thick confirming to AISI 304 respectively.
Insulation:
The entire intermediate jacket shell & hemispherical bottom shall be insulated as follows.
1ST Layer:- 50MM thick resin bonded fiber glass having density **of 24Kg/m3** shall be applied with chicken netting.
2nd Layer:- 50MM thick resin bonded fiber glass having density **of 24Kg/m3** shall be applied with chicken netting.
ACCESSORIES:
Grider: Stainless steel 5 mm thick girder shall be provided for mounting of agitator & top cover. -01 No.
Covers:
Semicircular removable stainless steel (AISI 316) covers of 2mm thick with lifting handles.-1No

Agitator: Sweeping type stainless steel (AISI316) agitator with vertical geared motor of 1HP(Three phase) @20RPM complete with oil seal, supporting arrangement, support on shell & bottom etc. The agitator shaft shall be a solid rod -01No
Leg: Stainless steel legs & bracing pipe shall be provided with stainless steel ball feet. The ball feet shall have provision for the height adjustment of 50mm.

Steam Inlet: Steam inlet connection shall and outside in a flange and counter flange but without valves. The places mentioned below shall be stiffened with stainless steel padding.Where steam inlet pipe joints the intermediate shell. Where steam hits on the outer surface of inner shell.

Condensate Outlet:
Condensate outlet with strainer, float type steam trap and by pass arrangement shall be provided. It shall also be provided with suitable flanges joint for each removable component.
Pressure relief valve and pressure safety valve-These valves shall be provided in the system will save the Ghee boiler from accidents.
Dial Thermometer: Standard thermometers shall be fitted for temperature measurement.
Air Vent:
¾" Socket end connection with Auto air vent valve at top most portion of the steam jacket-1No.

Thermo well:
Thermo well (made from stainless steel confirming to AISI316) and suitable connection shall be provided in the outer shell for fixing steam and dial thermometer to measure the temperature of product. The portion of the thermo well, which is in the steam jacket, shall be insulated with rock wool or equivalent and totally shrouded so that the insulation does not come in contact with stem & is within the scope of supply.- 1No.

Bottom Outlet:
AISI 316 vertical outlet having stainless steel straight through plug type flanged valve ending in complete stainless steel union. The outlet shall be at a clear height of 650mm from the finished floor level to facilitate placement of can under it. Size of outlet valve is 63.5MM.

Side Outlet.

Horizontal stainless steel outlet with stainless steel angular flanged valve ending in complete stainless steel union for taking out clear ghee. Size of side outlet valve is 63.5mm.

TESTS.

The manufacturer at their works should conduct the following tests:

i) Dye penetration test for weld joints.
ii) Water fill-up test of inner vessel for water for water tightness.
iii) Hydro test pressure of jacket at 5Kg/cm2. Pressure.

12. Air Compressor – 15 HP capacity

Tank mounted, Rotary screw type, Oil injected, air cooled, single stage, air cooled pack having actual free delivery of 56.4 CFM (96 m^3/hr) @ 7.5 bar or 48.9 cfm (83.4 m^3/hr) @10bar or 40.3 cfm (68.4 m^3/hr) @13 bar. The compressor should be could be coupled with 11.0 KW (15HP) TEFC squirrel cage electric motor having IP 55 protection and class 'F' insulation. The compressor should be equipped with "ELEKTRONIKON 001 REGULATOR". The entire equipment should be housed inside a sound absorption canopy which limits the sound level to 67 db (A). the compressor is integrated with suitable refrigerant (R 134a) type Air Dryer within same canopy. The compressor is mounted on 270ltr horizontal receiver tank. Motor RPM - 2990.

Should be equipped with special filter UD 25+ range high effiency coalescing filter removing liquid water and oil Aerosol to 0.00009 mg/m^3 (0.00009ppm) and particles down to 0.00009 micron.

13. CIP System – 1KLPH

FUNCTIONAL REQUIREMENTS

GENERAL DESCRIPTION

All milk handling equipment including heat exchanger, storage tank, pumps, road milk tankers, inter-connecting pipes and fittings would be cleaned by this system.

CAPACITY

It should be suitable for a product dairy handling 30,000 L/day. It should consist of the following.

a. Alkali storage tank with steam heating system capacity, 1100 L. -1 no.
b. Acid storage tank with steam heating arrangement capacity, 1100 L. -1 no.
c. Hot water tank with steam heating system capacity, 1100 L. -1 no.
d. Raw water tank capacity 1100 L – 01 no

OPERATING PARAMETERS

Working pressure – 2 kg / cm^2
Working temperature: a)acid & lye solution - 75°c
b) Hot water - 95°c
Chemicals to be handled: 1% solution of sodium hydroxide
1% solution of nitric acid

DESIGN REQUIREMENTS

The tank should be vertical and cylindrical in shape
The inner shell, bi-sectional top cover and flat bottom should be fabricated from 2 mm thick decaled stainless steel conforming to AISI 304.
The outer shell should be fabricated from 3 mm thick mild steel of commercial grade to cover protect and seal the thermal insulation completely and should be firmly fixed to the inner structure.
The tank should be designed to withstand bulging or any other defect under the operating condition mentioned above.
The bottom of the inner shell should be provided with generous slope towards the outlet for free and complete draining of liquid.
Thermal insulation of glass wool or equivalent suitable for an operating temperature of 100 degree Celsius should be provided on the cylindrical portion and bottom of the inner shell in two layers of thickness 50 mm each.
The outer MS shell should have a coating of anticorrosive epoxy primer followed by two coatings of chemical resistant paint of approved shade.
The outer surface must be smooth and free from buckles, dents, weld heads etc.

Each tank should include the following:

Two nos. 51 mm dia CIP return inlets of SS near the top of the tank with SS flanges and counter flanges.
One nos. 51 mm dia water inlet of SS near the top of the tank with SS flanges and counter flanges.
Two nos. 63 mm dia outlet of SS near the bottom of the tank with SS flanges and counter flanges.
One no.51 mm dia drain of SS with SS flanges, counter blank flange and neoprene or equivalent gasket.

One no.63 mm dia. Over flow pipe.
One no. Pocket for temperature sensing unit.
One no. SS capillary type dial thermometer of range 0 to 150 °c

Suitable steam distribution system (SS pipe coil for acid and alkali tanks and steams sparser for hot water tank).

Four nos. tubular Ms legs of 300 mm height with SS cladding should be provided with SS ball feet capable of 50 mm vertical adjustment.

One no. Thermostatic valve on the steam inlet line with sensing element going into the pocket mentioned above this valve is intended to maintain the temperature of the liquid inside tank at the desired level.

One no. Perforated SS basket for lye is to be provided.

The C.I.P system shall include 4 nos of tank, 02 nos pump and 08 nos pneumatic valves

TESTS:

Dye penetration tests for all welding joints.

Water fill up test for inner shell before insulation

FINISH:

The inner SS vessel to be polished to 150-grit polish. All SS welds are to be ground smooth.

The outer MS surface to be finished with 2 coats of epoxy coat over 2 coats of anticorrosive primer.

14. Gas (LPG) Fired Boiler - 300 Kg./hr

1.	DESIGN	:	3 PASS, COIL TYPE (NON - IBR)
2.	MODEL	:	TO BE FILLED BY BIDDER
3.	Steam generation capacity	:	300 KG/HR. FROM 100 ºC FWT
4.	Maximum working Pressure	:	10.5 KG/CM²
5.	Fuel	:	HSD/LPG (Dual fired)
6.	Dryness fraction	:	80%
7.	Thermal efficiency on NCV	:	88% ± 2%
8.	Burner	:	On – Off type, pressure jet atomizing
9.	Fuel consumption at full load considering GCV	:	Maximum 24 Ltr/Hr (Diesel) or LPG equivalent to Diesel.
10.	Overall Dimension (L x B x H)	:	TO BE SPECIFIED BY BIDDER
11.	Electrical Load	:	A.C, 3 – PHASE,4 WIRE , 415 V ± 6%, 50HZ±3 , KW
12.	Over Head OIL Storage Tank	:	300 Ltrs capacity
13.	Steam quality/ dryness fraction	:	80%
14.	Flue Gas Out Let	:	200 MM
15.	Start up time	:	3 to 5 minutes

Note: It is our consent endeavour to improve the design; hence specifications are subjected to change without prior notice. Given Specification are only for the guideline purpose.

SCOPE OF SUPPLY

Boiler mountings and fitting

All mountings and fittings should be provided to facilitate safe, efficient and convenient operation and including:

- Main stop valve with counter flange.
- GM Non-return valve with counter flange.
- Extra valve for auxiliary steam lines.
- One safety valves with 5 m pipe each to lead steam outside boiler room.
- Pressure parts fabricated out of high temperature resistance boiler quality tubes as per BS-3059
- Feed check and shut down valves with counter flanges.
- Blow down valve with counter flanges and blow down piping for economizer and boiler.
- Down firing pressure jet burner comprises of Blower and oil pump with motor, oil filter, Pressure gauge, Burner with Solenoid Valve, Nozzle, Ignition Electrode, Ignition Transformer, Photocell, SS Needle Valve Etc.
- Water level pressure Gauges - 2 sets.
- Pressure gauges
- Set of jointing/rings.
- Suitable thickness insulation to ensure safe working temp.
- Aluminium sheet metal covering for the insulation.
- Inducted/forced draft fan should be provided for supplying intake air to the boiler. if required.
- Fuel gas safty devices should be provided on top of Boiler shell.
- Dust proof prefabricated control panel comprises of : Contractors, over load relays, control fuses, MCB, Sequence controller, anm switches, Hooter, indicating lamps, Push bottom switch, Etc.
- Shell and tube type Economizer.
- Oil Storage Tank

❖ **Feed Water Pump**

Two electrically driven feed water pumps (one standby) to match with the boiler operation. Each should be fitted with a suction strainer, suction insolating valves, non-return valves and pressure gauge.

- ❖ One number steam operated water injector.
- ❖ High and low water level controls and alarms.
- ❖ All controls, motors, starters, fuse, isolators should be mounted in a dust-proof control panel with selectors, indicators and manual controls on the outside. All electricals and control devices should be prewired to this panel which terminates with one main incoming isolator.
- ❖ Technical details of the boiler should be furnished in the enclosed proforma.
- ❖ Three sets of operation and maintenance manuals.
- ❖ One water flow meter of suitable size to be installed in the common suction header of the boiler feed pumps, for checking the rate & cumulative flow of water through the header.

❖ **Flue Gas Ducting and Chimney**

The chimney for the boiler shall be of ground mounted but guy ropes supported type, made out of mild steel sheets of suitable thickness, with stiffeners, helical stakes for safety of the chimney etc. as may be required. Chimney bottom upto 2 M height should be suitably insulated and finally cladded with 3 mm thick mild steel sheet. One opening with suitable cover should be provided near the bottom for removing the soot deposits manually. The Chimney shall be installed outside the boiler room. The chimney shall be suitable painted after installation.

The mild steel cladding should be of butt welded construction and all welds should be ground smooth. The chimney should conform to IS 6533-1971. Minimum chimney height should be 15 m. or as per the requirements of the local Air Pollution Control Authorities.

The chimney shall be complete with chimney hood, monkey ladder, safety cage for ladder starting from 5 metres upto top. Painter's pulley, 5 pronged lightning Arrestor (Copper with GI earth conductor of 25 X 6 mm section including earthing as per specifications, etc. complete duly painted. Necessary foundation bolts required for the chimney shall also be supplied. Details of foundation is to be provided by contractor for necessary civil works.

The Chimney height and specifications should meet the requirements of Air Pollution Control authorities. Smoke sampling platform, with power plug point with cable etc. should be provided if required by the Air Pollution Control authorities.

The contractor shall arrange for inspection & approval of the Pollution Control Authorities and all costs for such inspection & approval shall be included in the contract cost.

Flue gas ducting made of suitable gauge MS sheet shall be provided for connection from Boilers exhaust outlet to the chimney.

❖ **Pressure Reducing Station:**

The pressure reducing station shall comprise of strainer with blow down cock, moisture separator with steam trap, sight glass & moisture drainage pipeline, pressure reducing valve, isolating valves at both ends, safety valve, pressure gauges (upstream & downstream), pressure control stop valve and by-pass pipeline with valves etc. complete as required and generally as per the drawing provided in this document. A suitable MS structural platform & access ladder shall be provided & installed in boiler room for maintenance of the PRS in future.

❖ **Feed Water Tanks**:

One 2000 litres MS water tank of rectangular / cylindrical shape made from 3.15 mm M.S. sheet shall be supplied & installed by the contractor, complete with all accessories like water inlet pipe & outlet pipe with valves of suitable size, over flow pipeline of suitable size & length to carry the after to nearest drainage point or outside the boiler room, water level indicator drain pipe with valve etc.

❖ **Spare Parts:**

List of essential spare parts for normal operation for a period of 2 years should be given along with the offer. Description of spare parts, unit prices should be mentioned in the offer.

❖ **Battery Limits**

Battery limits for this job shall be as under:

a) **Fuel:** Diesel / LPG shall be provided by OMFED.

b) **Safety Lines**: Pipe lines from safety valves upto outside of the boiler house shall be supplied and installed by the supplier.

c) **Condensate drain lines**: Pipeline from steam traps for drainage of Condensate upto nearest drain point or outside boiler room is to be supplied & installed by contractor.

d) **Water:** Scope of work contractor starts from outlet valve on existing soft water tank located over the existing boiler room and shall include all necessary piping to feed water tank, to boiler feed pumps and to boiler.

e) **Steam Pipelines :** The scope includes supply installation, testing & commissioning of H.P/LP steam pipelines & valves with all necessary fittings & supporting materials upto the existing LP steam line near the existing boiler room including inter connection of new LP line to the existing 40 mm dia LP. The LP steam line & water line shall be taken overhead across the road to the existing boiler room through suitable MS structural floor supports depending upon the site conditions.

f) **Blow Down & Drain**: Supply and laying of drain pipelines from blow down valves upto blow down pit is in the scope of the contractor. The contractor shall provide necessary drawings for civil construction of trench & blow down pits.

g) **Electricity**: Wall mounted MCC is included in the scope of work supply, laying & connection at both ends of 4 core X 10 sqmm PVC insulated Al. armoured cable of suitable length as power supply cable from PCC to the boiler MCC is included in scope of work.

Interconnection of MCC to various equipment and instruments including supply and laying of power cables, conduits, cable trays, earthing etc. is in the scope of the contractor. One earth pit for the lightening arrestor shall be supplied and installed by the contractor. The MCC shall be double earthed as per the requirement of Electrical Inspectorate.

h) **Insulation: Supply** and application of insulation of boiler, refractory materials, and brick work is completely in the scope of the contractor. The HP&LP steam pipe lines including non-return valves shall also be insulated with 50 mm thick glass wool or equivalent insulation material by the contractor. This will be cladded with 24 SWG alluminium sheet.

i) **Tools, tackles & instruments**: All tools, tackles, consumables (except coal) and manpower required for work shall be arranged by the contractor at his own cost. Necessary instruments for conducting tests to measure specified parameters and to establish capacity & efficiency of the boiler shall also be brought by the contractor at his cost. All the equipments & instruments required conducting tests to measure all required parameters for inspection & approvals by statutory authorities shall be brought by the contractor at his own cost.

1 **Alternative Offers.**

In addition to the specifications mentioned above, the supplier may also offer any other improved version of boiler and optional accessories, if any, for improving the boiler efficiency. Complete technical and commercial details of such offers shall also have to be furnished. The cost differential for such offers should also be clearly mentioned in the offer.

2 **Standards & statutory regulations**: The boiler should comply with the latest Indian Boiler Regulations (IBR), International Standards Organization (ISO), Air pollution control regulations, and other statutory requirements and as per the specification given above.

The electrical equipment, installation should comply with the latest Indian Electricity Regulations and local regulations.

The boiler and its components should be approved by the appropriate authorities of state of its origin. Also if the concerned authorities of the statewhere it is installed suggest any improvement/modification the same should be carried out by the supplier without any extra charge.

3 **Boilers & its mountings HP steam piping work to be got approved by the boiler inspectorate where it is installed.**

Technical details of the boiler should be furnished in the following format:

Type:

Steam generating capacity 300 Kg/hr at pressure 10.5 Kg/sqcm when feed water temperature available at temperature 35 degree Celsius, using coal of NCV 11840 Kcal / Kg.

Boiler Pressure: Design _____ Operating _____

Overall dimensions of boiler: L X B X H m. _____

Weight of boiler: Dry _____ Flooded _____ (t)

Mechanical Details:

i) Tubes: Plain/Stay Heating surface area: m SQ _____

ii) Shell: Thickness _____ Size _____ Material of Construction: _____.
Design Code: _____
Water content: when full _____ cum

At working level: _____ cum .
Steam space _____cum.
Feed water arrangement:

Pump : Nos.----------/ Type ----------/
Make of Motor----------/
Pump Capacity, head, HP----------/

❖ **Valves in feed water piping :**

Suction side : Size---------- Make----------

Discharge side : Size ---------- Make----------

Pressure gauge : Size ----------Make----------

❖ **Firing arrangement** :

Type of furnace ----------/Volume----------/Type of grate ----------Area ----------/.

Grate loading kg./hr. m SQ----------type of bricks----------

Arrangement for Ash removal----------

Recommended size of coal for firing----------

Excess Air----------

Coal steam ratio----------

❖ **FD/ID fan**

Qty.----------/Type----------/Capacity----------MCU/Min./HP of Motor----------/Head----------of WC

Flue gas opening dia on boiler----------

Chimney

Size & Height----------

Plate thickness----------

Supporting arrangement----------

❖ **Flue gas ducting considered**

i) For new boiler:

Size----------length----------thickness----------

❖ Automatic water level controls

Type----------High/Low----------Make----------

Alarm/Signal----------

❖ **Boiler Mountings**

Sl.No.	**Description** **Type** **Quantity** **Size**
1.	Steam stop valve
2.	Non return valve
2.	Safety Valve
3.	Feed check valve
4.	Blow down valve
5.	Aux steam stop valve
6.	Air vent valve
7.	Water level gauge
8.	Pressure gauge

❖ **Service Requirements:**

i) Water----------ltr./hr.
ii) Coal----------Kg./hr
iii) Electrical Load :
Feed pump----------HP/ID Fan----------HP/FE Fan
----------HP/Miscellaneous----------HP
Total load----------.

❖ **Flue gas temperature/stack temperature** :

❖ **Provision of ladder/platform :**

❖ **Whether conforming to IBR: Yes/No.**

❖ **Any other special features.**

❖ **Details of Boiler Required:**

❖ **NAME OF THE PROJECT: Tirtol Dairy**.

a) **CAPACITY:** Continuous water evaporation rate of 300 Kg./Hour at Pressure 10.5 (WP) Kg./Sq.CM when feed water temp. is available at 35 degree Celsius.

b) **QUANTITY** 1 No.

c) **CHIMNEY:** Height of Chimney 15 m. for diesel / LPG fired boiler min. from finished floor level or as per statutory regulation for Air Pollution Control.

d) **TYPE OF CHIMNEY** : Ground mounted but guy rope supported, outside Boiler house.

e) **LENGTH OF FLUE GAS DUCTING:** Unit rate may be given for ducting to adjust the amount for increase/decrease in quantity.

Note: i) The supplier should provide the following instruments at their cost for establishing capacity and efficiency of the boilers during trial runs:

i) Water meter
ii) CO2 analyzer
iii) Steam Flow meter

These instruments can be taken back by the supplier after successful trials.

2) Contractor has t ensure that the data provided above shall be sufficient for the scope of work covered by the contract. Acceptance of the above data by Purchaser does not release the bidder of his responsibility to provide satisfactory performance of the entire plant, on a turn-key basis.

❖ **Scope of work**

❖ **Mechanical Installation** :

❖ Loading, insurance, transportation of boiler and Accessories from manufacturer's premises and unloading at site & shifting to the new boiler room.

❖ The complete boiler and accessories shall be positioned, installed and interconnected which includes fans, water & steam pipings, ducting, chimney, control panel and all other items covered in the scope of supply.

❖ All foundation bolts shall be supplied by the contractor.

❖ Necessary refractory material, cement and insulation materials shall be supplied and installed, first charge of lubricants, nuts, bolts, gaskets shall be supplied and fixed by the contractor.

❖ Arrangement for bringing coal from coal yard to boiler room & coal transportation trolley is to be provided by the contractor.

❖ Arrangement for ash removal and ash transportation trolley shall be provided by the supplier.

❖ Supply & installation of all water pipelines & fittings from soft water tank placed over existing boiler room to feed water tank (to be supplied & erected by Contractor) to suction header of boilers fed pumps & up to the boilers fed water valves. All pipelines are to be suitably supported by MS structures.

❖ Concrete foundations for boilers & chimney and blowdown pipe trench & blow down pits shall be provided by bidder based on the drawings.

❖ **Electrical Installation:**

Supply, installation of Electrical Control panel required for the boiler including supply, laying & connection of required size not less than at least 4 X 10 mm² PVC insulated. Al. armoured cable of suitable length as main power supply cable to boiler MCC: insulation of control panels and interconnection of all motors and controls including supply and laying of cables through cable trays/GI pipes etc. and earthing. Necessary trays, glands, earth conductors and all other items for this job shall be supplied and installed by the supplier. Trenches shall be provided by the client as per the detail to be furnished by supplier.

Details given in Section IV Part III of the tender.

- **Testing, commissioning & performance trial run:**

The Contractor shall operate, maintain and give satisfactory trial run of the entire steam raising plant for a period of continuous 30 days at the rated output. All rectification of damages, defects and routine trouble shooting should be carried out by the contractor, during this period. Contractor shall incorporate/execute necessary modifications for maximizing operational efficiency. The contractor shall demonstrate proper working of all mechanical and electrical controls, safeties and protective devices in the presence of owner's engineer and the same should be duly recorded. The work shall be deemed to be completed only after satisfactory performance of the entire plant for 30 continuous days at the rated output & after handing over of the same subsequently.

Details given in Section IV part I of the tender.

- **Special notes**

- Bidders are requested to visit the project site for assessment of quantum of work before quoting. This job is a complete turnkey job and accordingly all items necessary to give the rated/designed output are included in scope of work even through it is not specified in the details.
- The work shall be done in a running dairy plant. Hence, the shutdowns for dismantling/installation of equipments & pipelines & pipe interconnections are to be arranged with the Dairy Authorities in such a way that the production of the dairy does not get affected. The contractor shall prepare programmes for shut-down/hooking up/change over from existing to new system, in consultation with the Dairy authorities & submit the same for approval of Project authority at least 30 days in advance. Bidders would note that no extra payment shall be made on this ground.
- The contractor's drawings showing installation details, pipe sizing, location of PRS, feed water tank, valves, structural supports & platforms, power cable routes & conduits etc. are required to e approved by OMFED, before commencement of work at site.

❖ **Approved Makes:**

SCHEDULE - I

Make of Bought Out Items.

1.	Pressure Reducing Station	: Spirax (JN Marshall/Mazda/ Leader/ Thermax
2.	MS 'C" Class pipe	: Tata
3.	CI sluice valve with GM /Ball Valve CS working parts.	: Kirloskar/Leader/ L&T/Audio
4.	Insulation materials glass or: or mineral wool mat.	Mettur Beardsell/Lloyed/Spinte
5.	LT cables/Control cables	: Tropodour/CCI/Closter/Nicco
6.	Electrical isloating switch	: Siemens/L&T
7.	MS structural items	: TATA/SAIL
8.	Pressure & temperature gauges:	JN Marshall/Fiebig/H. Guru

N.B: The bidder should quote for above makes of items only. The difference in prices should be mentioned clearly, while quoting the items of makes other than the specified above.

15. Refrigeration Equipments

FUNCTIONAL REQUIREMENTS

The Plant is required to supply refrigeration requirements of the dairy plant consisting of ice bank system for chilling the milk and maintains a cold store for milk and milk products.

DUTY CONDITIONS

a. To chill 40,000 Ltrs. Of milk per day from 35°C to 4°C. in plate chiller at a rate of 10,000 LPH.

b. To chill 40,000 LPD pasteurized milk from 12°C to 4°C at a rate of 5,000 LPH in a Pasteuriser.

c. To pre-chill 40,000 LPD of milk in a plate chiller at a rate 10,000 LPH from 10°C to 4°C before packing.

d. To maintain a cold store of size 298 Cu.M. for keeping milk and milk products of about 60,000 Ltrs. in plastic crates.

DESIGN REQUIREMENTS AND SCOPE OF WORK

SYSTEM TYPE:

Direct Expansion System:

This system shall be used to provide refrigeration requirements for maintaining low temperature in milk cold store.

ICE BANK SYSTEM:

This system shall be used to provide chilled water required for processing of liquid milk and its products.

DESIGN REQUIREMENTS:

REFRIGERATION COMPRESSORS

COMPRESSORS:

Ammonia heavy-duty industrial type reciprocating compressor of capacity as specified in design data at - 10 Deg. Cent. suction temperature and 45 Deg. Cent. Condensing temperature. Following standard accessories should be provided with each compressor:

a. Automatic unloader, capacity controller.
b. Suction and discharge by pass manifolds with isolating valves.
c. Control panel having low pressure gauge and cutout, high pressure gauge and cutout, oil pressure gauge and differential pressure cutout and indication lamps for all cutouts / safeties, panel board to be complete with frame for floor mounting.
d. Bull's eye type oil sight glass.
e. Complete driving parts, including flywheel, motor pulley, drive belts, belt guards etc.
f. Base plate/frame vibration eliminators and Anchor bolt etc.as per requirement.
g. Standard tool kit including piston ring guide etc.

MOTORS FOR COMPRESSORS:

Screen protected squirrel cage, degree of protection IP23 type, induction motor, horizontal foot mounted suitable for 415 volts, 50 Hz, 3 phase, A.C. supply of rating suitable for continuous duty for compressor specified in 3.2.1.1. Necessary slide rails & foundation bolts to be provided with motor. Thermostat motor protection relay to be provided inside the motor winding. The terminal box of motor should be suitable for receiving aluminum conductors and armored cables.

STARTERS FOR COMPRESSOR MOTORS:

Oil immersed rotor resistant starter/automatic star delta starter floor mounted type of capacity suitable for motor specified in 3.2.1.2 Starter to be complete with single phase preventor, ammeter and first charge oil. Air break rotor resistance type automatic starters are preferred over oil immersed starter.

AMMONIA OIL SEPARATOR:

Separator of size suitable to compressor capacity with counter flanges, float valve and strainer for automatic return of oil to the crankcase with bypass arrangement.

REFRIGERANT PIPING:

Suitable size M.S. "C" class (heavy duty) pipes, fittings and valves to interconnect all refrigeration equipment such as compressors, condensers, receivers, chilled water tank and air cooling unit. The main headers for suction, discharge and liquid etc. are already available in the plant room. Bidder has the responsibility to check them at project site for their suitability for the expanded capacity. In case the headers are not suitable for the expanded capacity, suitable size headers are to be provided, without any extra cost, by the contractor.

Compressor Jacket Cooling:

Suitable size 'B' class GI pipe with necessary gate valves (GM body and GM working parts) to be provided from compressor room to atmospheric condenser and return for compressor jacket cooling. Bidder should mention the pipeline size considered in the design.

ICE BANK SYSTEM

Ice accumulation coil to be fabricated from 32 mm NB 'C' class MS (heavy duty) Pipes in suitable sections and each section to be complete with inlet and outlet headers, oil drainage arrangement etc. The design of ice bank coils should be such as to accumulate a maximum of 50 mm thickness of ice. A suitable ice thickness cut out with solenoid valve should be provided for this purpose. Digital electronic thermometer to be provided for each compartment of ice bank.

All header and ice accumulation coils should be spray galvanised.

Liquid separator complete with float valve, strainer, by-pass arrangement for regulating the flow of liquid refrigerant in the ice bank coils to be provided.

CHILLED WATER TANK

Tank size and no. of compartment as specified in Design Data (7.0) should be strictly maintained .It should be fabricated from MS plate of commercial grade as follows:

Sides and partition walls	---6.0mm
Bottom	---8.0mm

MS structural members as stiffeners, fasteners and supports etc. should be provided for accommodating the coil and to prevent bulging. Tank to be provided with suitable inlet with float valve. Overflow and drain with valve. MS angles are to be provided on top of chilled water tank to support removable covers. The partition plate should be provided with sufficient stiffeners so that in case on compartment is empty and adjacent compartment is full of water, there is no bulging.

Covers

The removable teak wood covers fabricated in two equal layers each of 25 mm thickness of suitable equal size with 2 nos. lifting handles to be provided for complete ice bank tank except near the ends where non stranded sizes can be used. The two layers of teak wood covers should be separated by waterproof paper.

Chilled water tank agitator:

These shall be mechanical type with 3 phase, 415 V, 50 Hz. Squirrel case TEFC degree of protection IP 55 induction motor of suitable size, along with necessary driving parts. Agitator should be designed to ensure uniform melting of ice on the coils. Each compartment of ice bank tank should be provided with suitable agitator and total number of agitators required for the ice bank tank is specified in design data, which should be strictly maintained.

Chilled water pumps:

These shall be centrifugal, monoblock type with capacity 30000 LPH at 25 MWC total head. Impeller of pumps shall be of bronze and motor shall be 3 phases, 415 V, 50 Hz. TEFC squirrel cage type degree of protection IP 55.

Chilled water piping:

Necessary GI class 'B' pipes and fittings for interconnecting ice bank tank, chilled water pumps, including MS fabricated pot type strainers with brass perforated sheet, non- return valves and isolating valves (gate valves with CI body and brass working parts). One no. 100mm dia pressure gauge with isolation cock should be provided. Bidders should mention the pipe size considered for design.

16. DG set - 250 KVA

FUNCTIONAL REQUIREMENTS -:

General Description: The D.G. Set would be used to generate 3 Phase, AC Electricity at 415 volts and 50 Hz. The generating set would be used in the plant to operate certain essential motors in case of power shut down/failure from the main source.

CAPACITY: 250 KVA at 0.8 power factor.

DESIGN REQUIREMENTS -:

The diesel generating set should comprise of diesel engine and alternator of 250 KVA capacity.

The diesel engine should be capable of developing required BHP to match with the alternator of 250 KVA capacity. The engine should be designed for continuous running for 24 hrs. with the overload capacity of 10% for a period of 1 hr. in any 12 hrs. running.

The diesel engine should be complete with the following accessories -:

(i) Fly wheel
(ii) Fly wheel housing
(iii) Inlet manifold.
(iv) Oil bath air cleaner.
(v) Gear type lubricating oil pump.
(vi) Lubricating oil cooler
(vii) Mico bose fuel injection system with injection pump, nozzles and mechanical class A-1 type governor.
(viii) Fuel filter double bowl type.
(ix) Exhaust manifold.
(x) 600 mm long flexible exhaust fitting.
(xi) Turbo charger.
(xii) 2 x 12V electric starting arrangement consisting of starter gear ring, starter motor.
(xiii) 2 x 12V, 180AH dry charged battery with leads.
(xiv) Engine panel consisting of lube oil pressure gauge, water temp. gauge, start / stop button.
(xv) Engine protection unit for low lubricant oil pressure, high water temp. with hooters.
(xvi) Cooling system with radiator, fan for radiator, fresh water pump.
(xvii) Tacho cum hour meter.
(xviii) H.D. absorption type silencer.
(xix) Fuel pipes 2 nos. 1.5 m. long.
(xx) 500 ltrs. Fuel tank.
(xxi) Set of std. tools and tackles.
(xxii) Change over switch of 630A with 3.5 core x 400 mm² cable.

ALTERNATOR:

KEC/ Stamford alternator developing 250 KVA at 0.8 p.f. 415V, 50 Hz, 3 phase while operating at 1500 rpm as per IS 4722:1968 as per following specification –

Normal Rating: 250 KVA at 0.8 power factor.

Voltage: 415V

Voltage regulation: ± 2%

Type: Self-excited self regulated bushels.

Insulation: As per manufacturer's standard.

Control panel:

The generating set should be provided with a control panel enclosed in a fabricated sheet steel box.

The control panel should be floor-mounted type.
The control panel duly wired should be provided with the following components –

- 1 no. A.C. voltmeter, (0 – 600) V, 96 sq.mm
- 1 no. A.C. ammeter, (0 – 600) A, 96 sq.mm
- 1 no. Voltmeter selector switch.
- 1 no. Ammeter selector switch.
- 1 no. Frequency meter, 96 sq.mm
- 1 no. KW meter.
- 1 no. Energy (KWH) meter with CT.
- 1 no. 630A MCCB with over load, short circuit and under voltage protection.
- 1 set of suitable bus bar (Alluminium) as incoming.
- 1 set of suitable bus bar (Alluminium) as outgoing.
- Set of Indicating lamps (for low Lube oil pressure, High coolant temp, Load on set, DC control ON).
- DC excitation - Voltmeter & Ammeter.
- Battery charger - Trickle / Boost type with Ammeter for DC control.
- Set of indicating lamps.
- Base frame: Engine alternator will be supplied on sturdy steel channel base frame duly assembled & coupled, using flexible coupling.

The instrument panel should be provided with the following -

- 1 no. Starting key.
- 1 no. RPM motor.
- 1 no Ammeter for DC circuit with switch.
- 1 no. Lubricant oil temp-gauge and water temp-gauge.
- 1 no. Cutout device for high water temp.
- 1 no. Cutout device for low lube oil pressure.
- Details of cable size and specification.

The diesel engine and alternator should be mounted on specially designed combination plate and MS structure of extreme rigid fabrication. The base plate should be suitable for mounting the set on six nos. suitable cushy feet mounting to be provided with base frame for DG set.
Installation, Commissioning of Gen. set, control panel and inter locking with main LT panel etc. complete in all respects including shifting the DG set to the DG room, loading the DG set on the foundation with all necessary labour, tools and tackles etc. Obtaining approval from Electrical Inspector, Govt. of Orissa after preparing and submitting necessary drawings shall be the contractor's responsibility. The set should be put on trial run for minimum period of seven days to its full load to prove its capacity.

17. MOTOR CONTROL CENTRE (MCC Panel)

1.0 **FUNCTIONAL REQUIREMENTS**:

To receive control and distribute electrical power at 440V, 50Hz, AC in a sheet steel housing.

2.0 **Design Requirement and Scope of supply**:

2.1 **Statutory Requirements**:

Motor control center 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:

2.2 **Housing details**:

2.2.1 The Switch Board shall be fabricated out of 14 SWG Sheet Steel and shall front open able 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.

2.2.2 The Switch Board shall be totally enclosed, dust, weather and vermin proof. Gaskets of durable materials 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.

2.2.3 All hardware shall be corrosion resistant. All joints and connections shall be made by galvanized zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers secured against loosening.

2.2.4 The Switchboard shall be cubical design (each feeder components are housed in individual cubical). Suitable cable and bus bar alleys shall be provided. All components of the switchboard shall be approached from front. Supporting arrangements for dressing of power and control cables in cable alleys also shall be provided.

2.2.5 **Painting**:

All metal surface 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 automobile paint Supplier shall obtain details of approved paint from the purchaser before final painting.

The finished panels shall be dried in storing ovens in dust free atmosphere. Panel finish shall be free from imperfections hike pinholes, orange peels, run-off paint etc.

All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust, corrosion etc.

2.2.6 **Name Plates**:

Nameplates for all incoming and outgoing feeders shall be provided on doors of each compartment. Nameplates shall be fixed by screws only and not; by adhesives. Special danger plates shall be provided as per requirement.
Inside the panels, stickers should be provided for all components giving identification no. as per detailed wiring diagram.

2.3 **Busbar sizing connection and supports**:

The bus bars shall be made from high conductivity electrolytic aluminum confining to grade E 91 E of IS 5082. The bus bars and supports shall be capable of withstanding the rated and short circuit current. Minimum size of main power bus bars shall be 200 Amps rating maximum current density permissible for aluminum bus bars shall be 0.8 Amps sq mm. An earthing bus bar of minimum 150 sq mm section aluminum shall be provided outside panel at bottom through out the length of the panel.

2.3.1 The bus bars shall be provided with heat shrinkable insulating sleeve. Supports for bursars shall be made of suitable size nylon sheets/epoxy compound blocks and these should be adequate in number so as to avoid any sag in the bus bars.

2.3.2 Minimum clearance between phase to phase shall be 25 mm and that between phase to neutral/ earth shall be 20 mm.

2.4 **Power connection**:

2.4.1 **For power interconnection within the panel board:**

Copper conductor PVC insulated cables of adequate cross section shall be used . For current rating above 63 Amps aluminum bus bar strips of adequate rating shall be used. Minimum size of copper conductor to be used shall be 2.5 sq. mm cable lugs/sockets of suitable size and type shall be used for all interconnections.

2.4.2 For all aluminum to copper connections: The copper surface will be silver plate and the aluminum surface will be properly cleaned and supplied with oxide inhabiting grease.

2.4.3 For each outgoing motor (up to 60 HP) feeder, suitable size terminal blocks (Min.3 ways) shall be provided in its cubical and wiring upto these from contactors shall be done by panel suppliers.

2.4.4 To prevent accidental contacts all interconnecting cables/bus bars and all terminals also shall be shrouded.

2.4.5 Standard colour code of red, yel1ow and blue for phases and black for neutral to be followed for all bus bars/conductors.

2.5 **Auxiliary wiring and terminals:**

2.5.1 Wiring for all controls, protection, metering, signaling etc. inside the switchboard shall be done with 650 V gray 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.

2.5.2 The complete panel would be sub-divided into different sections by purchaser & each section 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. Supplier shall do control wiring up to these terminal block.

2.5.3 All control wiring should be provided with necessary cable sockets/lugs at both ends.

2.5.4 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.

2.5.5 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.

2.6 Switch gears:

2.6.1 **Switches**:

Switches shall be load break, heavy duty, air break having continuous maximum rating type with manual quick make/break mechanism. 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.

2.6.2 **Fuses**:

These shall be HRC cartridge link type with operation indicator, which will be visible without removing fuses for the service. These shall be completed with moulded phenolic fuse base and cover.

2.6.3 **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 at 2.7.4 below. Contactor coils shall be suitable for 240 Volts, 50 Hz. unless otherwise specified. All contactors shall be supplied with minimum 2 NO + 2 NC auxiliary contacts. Additional contacts if required, for interlocking etc, shall also be provided.

3.6.1 **Protective Devices**:

Bimetal overload relays shall be provided for all motor feeders. The relays shall be adjustable and self reset type.

Any other relays, if required for motor feeders shall be specified in the feeder details.

2.6.5 **Timer:**

The timers shall be electronic type, suitable for 240 V, 50Hz. Supply.

2.6.6 **Push Buttons** (PBs):

Push buttons shall be with contact elements shall be generally mounted on open able covers. Colours shall be as follow:

Stop/Open/Emergency - Red

Start Close - Green

It should have minimum 1 NO + 1 NC contacts. Push buttons with built-indication lamps shall also be accepted in which case separate indication lamps are not required.

2.6.7 **Indication Lamps**:

Colours shall be as under :

Phases : Red, Yellow & Blue.

Open Stop/Emergency : Red

Close/Start : Green

Indication lamps shall be bunch of LED type and suitable for 240 volts AC supply.

2.7 **Special Requirements**:

2. 7.1 All motor feeders above 10 HP shall have automatic Star Delta starters and up to 10 HP shall have DOL starters unless specified otherwise.

2.7.2 All motor feeders up to 60 HP shall be provided with switch fuse unit and above 60 HP MCCB's with a minimum breaking capacity of 40 KA shall be provided.

2.7.3 All the power contactors of Star-Delta starters shall have same current rating.

2.7.4 The following selection table shall be followed for starters of motor feeders unless otherwise specified:

Sl NO	415v Motor HP	Contractors Rating Amps.	Switch/MCCB Rating Amps.
1.	0 to 10.0 HP	16	25
2.	15HP	16	63
3.	20 to 25 HP	25	63
4.	30HP	32	100
5.	40 to 50HP	40	100
6.	60HP	63	100
7.	75HP	63	200
8.	100 to 125 HP	125	200
9.	150 to 175 HP	125	200

For capacitors, rating of contactors/switch shall be double of rated current of capacitor.

2.7.5 For incoming feeder of rating higher than 600 Amps.. ACB shall be provided unless otherwise stated in the feeder details.

2.7.6 If the outgoing feeder rating is higher than 100 Amps. MCCB shall be provided unless stated otherwise and preferably the shall be located at the lower portion of the panel. These feeders shall also have isolating link for neutral.

Whenever remote control is to be provided for motor feeders, only Red Push Button For 'OFF' shall be provided on the MCC.

2.7.8 Motor starters shall be suitable for AC duty unless specified otherwise.

2.7.9 Maximum length of a shipping section of the panel shall be 2500 mm.

2.7.10 Bidders should specify maximum two "makes" of the following items in order of reference:

1. Contactors
2. Starter realy
3. Timers
4. Switch fuse units
5. MCBs
6. Push Buttons
7. Indicating lamps
8. Control and power wires
9. Terminal blocks
10. Instruments
11. Instrument Transformers

All the major components of a MCC shall be of same "Make".

2.7.11 All feeders above 10 HP shall be provided with CT operated ammeter of suitable range and with a selector switch. The Supplier should prepare and get the purchaser's approval of the following drawings in respect of each of the panels prior to taking up fabrication

2.7.12

a) General arrangement drawing.
b) Power circuit drawing.
c) Control wiring drawing.
d) MCC for product (Wall mounting type):- One No.

All Cable Entry from Top

SL. NO.	FROM	TO
01	MAIN L.T PANEL BOARD	BOILER PANEL BOARD
02	MAIN L.T PANEL BOARD	PROCESS PANEL BOARD
03	MAIN L.T PANEL BOARD	PRODUCT PANEL BOARD
04	MAIN L.T PANEL BOARD	ETP PANEL BOARD

MAIN L.T. PANEL

INCOMING FEEDER:

(01) One no 800 Amp.3ph+Neutral ACB with breaking capacity of 45 KA r.m.s. 415V a.c. with-

(i) One no. Overload release with a relay range of (250-400) A.
(ii) One set. Suitable CTs ratio of 600/5 A.
(iii) One no. Ammeter and scale range of (0-500) Amp.
(iv) One no. Neutral link.
(v) One no. 'ON' indicating lamp.
(vi) One set of Aluminum bus bar of 600A capacity 3-ph. + N.
(vii) One no. Suitable KWH meter for recording power consumption.
(viii) One no. Single phasing preventor 3-ph., 415V
(ix) One no Voltmeter with a range of suitable rating.
(x) One no. Instantaneous E/F relay with suitable CT range.
(xi) One no. Power factor meter with a range of 0.5 lag to 0.5 lead.

(02) One no change over switch 4-pole, 830 A 415V to draw power from D.G. in the event of main power supply fails with inter locking arrangement, if necessary, to Energies the main bus bar from only one source either from electricity department or from D.G.

OUTGOING FEEDER:

(01) One no. Outgoing feeder of 4-pole 400Amp, MCCB for Refrigeration motor control equipped with -

(i) One no. Magnetic short circuit release
(ii) One set of 'ON' indicating lamps.
(iii) Three nos CTs of ratio (400/5) Amp for metering.

(02) One no. Outgoing feeder of 4-Pole, 250Amp MCCB for Boiler equipped with
(i) One no. Magnetic short circuit release.
(ii) One no. Thermal overload relay with appropriate range.

(03) One no. Outgoing feeder of 4-Pole 250Amp, 415V a.c. MCCB for Process equipped with

(i) One no. Magnetic short circuit release.
(ii) One no. 'ON & OFF' indicator.

(04) One no. outgoing feeder of 250 Amp, 415V a.c MCCB for Product and Packing Section.

(i) One set of 'ON' indicating lamps.

(05) One no. Outgoing feeder of 100Amp, 4-Pole MCCB for E.T.P. equipped with

(i) One no. Magnetic short circuit release.
(ii) One set of 'ON' indication lamp.

(06) Two no spare of 100 Amp, 4pole MCCB (spare).

MOTOR CONTROL CENTER FOR REFRIGERATION

INCOMING FEEDER:

(01) **One no 400Amp, TPN SFU having a symmetrical breaking capacity of suitable Amp at 415V a.c. equipped with –**

(I) One set of CTs ratio of (400/5) Amp. & Accuracy class '1' for metering.

(II) One no Ammeter of size (96x96) mm and scale range of (0-300) Amp.
(III) One no. Three way &off Ammeter selector switch.
(IV) One no. Neutral link.
(V) One no. 'ON & OFF' indicator.
(VI) One no. Voltmeter of size (96x96) mm with a range of (0-500) V.

(VII) One no. Voltmeter selector switch three way &off.
(VIII) One no. Single phasing preventor 3ph, 415V

OUTGOING FEEDER FOR REFRIGERATION:-

SL NO.	FEEDER DESCRIPTION	H.P. RATING	SWITCH IN AMPS	FUSE IN AMPERE	STARTER
01	Ammonia compressor	50	100 TPN	100	Star/Delta
02	Ammonia Compressor	50	100 TPN	100	Star/Delta
03	Ammonia Compressor	50	100 TPN	100	Star/delta
04	Condenser pump	05	25A	25	DOL
05	Condenser Pump	05	25A	25	DOL
06	Chilled water Pump-I	05	25A	25	DOL
07	Chilled water pump-II	05	25A	25	DOL
08	I.B.T.Agitator-I	02	25A	25	DOL
09	I.B.T.Agitator - II	02	25A	25	DOL
10	Spare-I	05	25A	25	DOL
11	Spare-II	05	25A	25	DOL
12	Capacitor	10KVAR	63A	63	SFU
13	Air compressor-I	15	63A	63	Star/Delta
14	Air compressor-II	15	63A	63	Star/Delta

NOTE: - All feeders should be provided with O/L relay of appropriate range and Provision for remote control Start/Stop.

MOTOR CONTROL CENTER FOR BOILER

INCOMING FEEDER:

(01) One no. 250Amp, TPN SFU 415V a.c. provided with arrangements

For -

(i) One no. Under voltage relay for operating of suitable range.

(ii) One set suitable CT of ratio (200/5) Amp for metering and protection.

(iii) One no Ammeter of size (96x96) mm and a range of (0-200) Amps.

(iv) One no. Three way &off ammeter selector switch.

(v) One no Neutral link.

(vi) One no 'ON' indicating lamp.

(vii) One no. Voltmeter of range (0-500) V.

(viii) One no single phasing preventor 3ph, 415V**.**

OUTGOING FEEDER FOR BOILER:

SL. NO.	FEEDER DESCRIPTION	H.P.RATING	TPN SFU AMPS	FUSE IN AMPS	STARTER
01	Fuel transfer pump-I	03	25	25	DOL
02	Fuel transfer pump-II	03	25	25	DOL
03	Bore well-I	03	25	25	DOL
04	Bore well-II	03	25	25	DOL
05	Boiler fuel pump	02	25	25	DOL
06	Feed water pump	02	25	25	DOL
07	Blower Motor –I	02	25	25	DOL
08	Blower Motor-II	02	25	25	DOL
09	Water softener	02	25	25	DOL
10	Welding	-----	63	63	SFU
11	Spare-I	03	25	25	DOL
12	-Do-	03	25	25	DOL

MOTOR CONTROL CENTER FOR PROCESS

INCOMING FEEDER:

01. One no. 250,415 V a.c. TPN SFU equipped with-

(i) One set. Suitable CTs of ratio (200/5) Amps.

(ii) One no. Ammeter of suitable meter and scaled (0-200) Amps.

(iii) One no. 3 way &off ammeter selector switch.

(iv) One no. Neutral link.

(v) One no 'ON&OFF' indicator.

(vi) One no. Single phasing preventor 3ph, 415V.

OUTGOING FEEDER FOR PROCESS:

SL.NO.	FEEDER DESCRIPTION	H.P. RATING	TPN SFU IN AMPS	FUSE IN AMPS	STARTER
01	Hot Water Pump	1.5	16	16	DOL
02	Agitator Ghee Vat	1.0	16	16	DOL
03	Milk Pump-I	3.5	32	32	DOL
04	Milk Pump-II	3.5	32	32	DOL
05	Milk Pump-III	3.5	32	32	DOL
06	C.I.P.-I	3.0	32	32	DOL
07	C.I.P.-II	3.0	32	32	DOL
08	Spare-I	3.0	32	32	DOL
09	Spare-II	3.0	32	32	DOL
10	Agitator MP Vat	2.0	32	32	DOL
11	Homogeniser	20	63	63	Star/Delta
12	To Reception	25	100	SFU	Only
13	To Polypack	25	100	SFU	Only

M.C.C. FOR PRODUCT AND PACKING PANEL

INCOMING FEEDER:

(01) One no. 100Amp, 415V a.c. TPN SFU with one voltmeter
Of size (96x96) mm voltmeter range (0-500) V.

OUTGOING FEEDER:

SL.NO.	FEEDER DESCRIPTION	H.P.RATING	TPNSFU IN AMPS	FUSE INAMPS	STARTER
01	---	3	16	16	DOL
02	---	3	16	16	DOL
03	---	3	16	16	DOL
04	---	3	16	16	DOL
05	---	3	16	16	DOL

NOTE: - All feeders should be provided with O/L relay of appropriate range and Provision for remote control Start/Stop.

SECTION - 6
COMMERCIAL BID

COMMERCIAL BID FOR REFERANCE ONLY

I. CIVIL WORKS

SCHEDULED OF QUANTITY FOR RENOVATION & MODERNISATION OF TIRTOL DAIRY , AT –NUAPADA , JAGATSINGHPUR, ODISHA.					
PART –A (NEW CONSTRUCTION)					
Sl no.	**Description**	**Quantity**	**Unit**	**Rate Per Unit**	**Total Amount (In Rs.)**
1.0	**Land Development And Landscaping: -** Levelling the existing garden with good quality earth. Develop the earth by separating the unwanted weeds, stone..etc . The Rose, Marigold flower plants & grasses at the entrance area of the Tirtol Dairy.	1.0	L.S.		
2.0	**Construction New store room for SMP & Packing Material materials: - Plinth Height** must be **+1100** mm from finished hard park level and Roof Height **3.0 Mtr**. from finished floor level. RCC framed structure with clear floor height 3.00 Mtr. 24 gauge chicken wire mesh at the junction or concrete and brick masonry. Flooring should be **I.P.S with ironite** flooring with 150 mm height Dado. The outside plater must be 16 mm thick & inside/ceiling plaster 12 mm thick. External & Internal walls finished with Exterior Grade Acrylic emulsion paint and texture paint. The door, window and Rolling Shutter may be design looking to the proper ventilation & loading & unloading material may carried out smoothly. The **UPVC** Door & window must be taken into consideration at the time of fixing. M. S **Girl.** in the window & **Rolling shutter** with 18 Gauge wherever required. 750 mm height **Parapet** must be provided in the building with proper **rain water** drainage pipe line. **Internal Electrification work (wire & fittings)** may also be design & install as per the electrical load.	75.0	Sqm		

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
3.0	**Construction of New Laboratory: - Plinth Height** must be **+1100 mm** from finished hard park level and Roof Height **3.0 Mtr**. from finished floor level. RCC framed structure with clear floor height 3.00 Mtr. 24 gauge chicken wire mesh at the junction or concrete and brick masonry. Flooring should be **Mandana** flooring with **1500 mm height Dado**. The **platform** at the four side of the wall must be done for **lab equipment.** One no. of R.C.C/Brick work slab **cupboard** also required in the said room. The outside plater must be 16 mm thick & inside/ceiling plaster 12 mm thick. External & Internal walls finished with Exterior Grade Acrylic emulsion paint and texture paint. The door, window and Rolling Shutter may be design looking to the proper ventilation & loading & unloading material may carried out smoothly. The **UPVC** Door & window must be taken into consider at the time of fixing. M. S Girl. in the window & **Rolling shutter** with 18 Gauge wherever required. **750 mm** height **Parapet** must be provided in the building with proper **rain water** drainage pipe line. **Internal Electrification work (wire & fittings)** may also be design & install as per the electrical load.	20.0	Sqm		

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
4.0	**Construction Of New Milk Parlour:- Plinth Height** must be **+1100 mm** from finished hard park level and Roof Height **3.0 Mtr**. from finished floor level. RCC framed structure with clear floor height 3.00 Mtr. 24 gauge chicken wire mesh at the junction or concrete and brick masonry. Flooring should be **Anti Skid Verified Tile** flooring with **1500 mm height Dado inside & frontal wall of the parlour**. The **platform** at the both inside & outside for the dispatch of the milk may consider**.** One no. of R.C.C/Brick work slab **cupboard** also required in the said room. The outside plater must be 16 mm thick & inside/ceiling plaster 12 mm thick. External & Internal walls finished with Exterior Grade Acrylic emulsion paint and texture paint. The door, window and Rolling Shutter may be design looking to the proper ventilation & loading & unloading material may carried out smoothly. The **UPVC** Door & window must be taken into consider at the time of fixing. M. S Girl. in the window & **Rolling shutter** with 18 Gauge wherever required. **750 mm** height **Parapet** must be provided in the building with proper **rain water** drainage pipe line. **Internal Electrification work (wire & fittings)** may also be design & install as per the electrical load.	30.0	Sqm		

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
5.0	**Construction Staff Toilet (Ladies & Gents) With Wash Room & Change Room:- Plinth Height** must be **+1100 mm** from finished hard park level and Roof Height **3.0 Mtr**. from finished floor level. RCC framed structure with clear floor height 3.00 Mtr. 24 gauge chicken wire mesh at the junction or concrete and brick masonry. Flooring should be **Anti Skid Verified Tile** flooring with **1500 mm height Dado inside wall**. The outside plater must be 16 mm thick & inside/ceiling plaster 12 mm thick. External & Internal walls finished with Exterior Grade Acrylic emulsion paint and texture paint. The door, window may be design looking to the proper ventilation & loading & unloading material may carried out smoothly. The **UPVC** Door & window must be taken into consider at the time of fixing. M. S Girl. in the window & **Rolling shutter** with 18 Gauge wherever required. **750 mm** height **Parapet** must be provided in the building with proper **rain water** drainage pipe line. All the **sanitary fitting & PH supply** may taken into consider at the time of construction. **Internal Electrification work (wire & fittings)** may also be design & install as per the electrical load.	20.0	Sqmt		
6.0	**Scrap Yard (New construction) :-** Plinth Height must be **+1100 mm** from finished hard park level with four side brick work up to 1.5 m height with R.C.C foundation. Flooring should be **I.P.S with ironite** flooring	40.0	Sqm		

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
7.0	**Construction of Record Room With Rack:- Plinth Height** must be **+1100 mm** from finished hard park level and Roof Height **3.0 Mtr**. from finished floor level. RCC framed structure with clear floor height 3.00 Mtr. 24 gauge chicken wire mesh at the junction or concrete and brick masonry. Flooring should be **Anti Skid Verified Tile** flooring with **150 mm height Dado inside wall**. The outside plater must be 16 mm thick & inside/ceiling plaster 12 mm thick. External & Internal walls finished with Exterior Grade Acrylic emulsion paint and texture paint. The door, window may be design looking to the proper ventilation. The **UPVC** Door & window must be taken into consider at the time of fixing. M. S Girl. in the window. **750 mm** height **Parapet** must be provided in the building with proper **rain water** drainage pipe line. R.C.C shelf may be design to facilitate the storage system. **Internal Electrification work (wire & fittings)** may also be design & install as per the electrical load. **750 mm** height **Parapet** must be provided in the building with proper **rain water** drainage pipe line. **Internal Electrification work (wire & fittings)** may also be design & install as per the electrical load.	30.0	Sqmt		
8.0	**Construction Of Cycle / Motor Cycle Stand:-** All the specification & design to be done by the bidders and to be approved by the competent authority of OMFED.	20.0	Sqmt		
9.0	**Construction and Renovation of Security post :-** All the specification & design to be done by the bidders and to be approved by the competent authority of OMFED	15.0	Sqmt		

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
10.0	**Construction Of Drainage System:-** R.C.C drain with cover slab must be required having the size 300 mm width & 600mm height.	180.0	Rmt		
11.0	**Construction of Approach Road & Hard park:-**	1.0	L.S		
11.01	Construct a **R.C.C road** with proper compaction, filling & levelling.	50	Rmt		
11.02	Construct a **Bitumen road** with proper compaction, filling & levelling.	50	Rmt		
Total Part -A					

PART-B – RENOVATION OF THE PLANT BUILDING

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
1.0	**Renovation of Existing of Plant building: The work include both dismantling & renovation of the existing building. The work carried out as per site requirement & instruction of Engineer-in-charge. Bidder must visit the site before quoting the renovation rate.**				
1.01	Rate Quoted for Dismantling				
a.	R.C.C slab, column, beam ..etc. including reinforcement.	2.0	Cum		
b.	Brick Work	1.5	Cum		
c.	Plastering	5.0	Sqm		
d.	Flooring	5.0	Sqm		
e.	Door & Window	2.0	Sqm		
1.02	Rate for Replace& Renovation				
a.	R.C.C slab, column, beam ..etc.	5.0	Cum		
b.	Brick Work	2.0	Cum		
c.	Plastering	10.0	Sqm		
d.	Flooring	10.0	Sqm		
e.	Door	5.0	Sqm		
f.	Window	5.0	Sqm		
g.	Rolling Shutter	12.0	Sqm		
2.0	**Renovation of the Boundary Wall**				
2.01	Rate for Replace& Renovation				
a.	R.C.C slab, column, beam ..etc.	10.0	Cum		
b.	Brick Work	20.0	Cum		
c.	Plastering	100.0	Sqm		
e.	Stainless Steel Gate	20.0	Sqm		

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
3.0	**Repairing /Replacement of Door, windows & rolling Shutter.**				
3.01	Rate for Dismantling				
a.	Door	2.5	Sqm		
b.	Window	3.0	Sqm		
c.	Rolling Shutter	7.0	Sqm		
3.02	Rate for Replace& Renovation				
a.	Door	5.0	Sqm		
b.	Window	6.0	Sqm		
c.	Rolling Shutter	7.0	Sqm		
4.0	**Repairing Brick Masonry Wall and RCC Roof Asbestos Roof and Chajja**				
4.01	Rate for Dismantling				
a.	R.C.C slab, column, beam ..etc.	2.0	Cum		
b.	Brick Work	3.0	Cum		
c.	Plastering	100.0	Sqm		
d.	Asbestos Roof	10.0	Sqm		
4.02	Rate for Replace& Renovation				
a.	R.C.C slab, column, beam ..etc.	2.0	Cum		
b.	Brick Work	3.0	Cum		
c.	Plastering	100.0	Sqm		
d.	Asbestos Roof	10.0	Sqm		
5.0	**Renovation of Existing Floor.**	**300.0**	**Sqm**		
5.01	Rate Quoted for Dismantling				
a.	Flooring (All type of flooring)	300.00	Sqm		
5.02	Replace/Renovation the flooring				
a.	Mandana Flooring	50.0	Sqm		
b.	Verified tile Flooring	50.0	Sqm		
c.	I.P.S with ironite flooring	50.0	Sqm		
d.	Kota Flooring	50.0	Sqm		
e.	C. I tile Flooring	50.0	Sqm		
6.0	**Painting & Coloring of existing Plant Building: -** Removing the existing colour. Supplying and painting of internal & External walls and ceiling with two or more coats of ACRYLIC emulsion paint which includes two coat of internal putty with a coat of primer all complete.	**5000.00**	**Sqm.**		
				TOTAL- B	

PART-C-BORE WELL

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
1.	Sinking of 200x150 mm size production well through D.T.H or Combination drilling on hard Rock area with PVC/GI Casing Pipes, HP single Phase oil filtered 100 mm dia bore well submegable pump set including 2.5 sqmm three core PVC coated copper flat cable including all fitting & fixture.	1	No's		
				Total Part-C	

PART-D (MACHINE FOUNDATION)

Sl no.	Description	Quantity	Unit	Rate Per Unit	Total Amount (In Rs.)
1.0	**New Foundation Construction for Machine. The work carried out as per site requirement & instruction of Engineer-in-charge. Bidder must visit the site before quoting the rate.**				
1.01	Rate for Construction of Machine Foundation				
a.	R.C.C slab, column, beam ..etc. including reinforcement	50.00	Cum		
b.	Brick Work	6.00	Cum		
c.	Plastering	40.00	Sqm		
d.	Flooring (mandana)	30.00	Sqm		
e.	Coloring	40.00	Sqm		
				Total- D	

SUMMARY for CIVIL WORK

Sl no.	Description	Amount (In Rs.)
1.0	PART – A New Construction Works	
2.0	PART-B – RENOVATION WORKS	
3.0	PART-C – BORE WELL	
4.0	PART-D- MACHINE FOUNDATION	
5.0	**Sub-TOTAL**	
6.0	GST @ 18% (or as applicable)	
7.0	**TOTAL**	

II.	MECHANICAL WORK					
Sl No	**A.MILK PROCESSING / PACKING/EQUIPMENTS**		**Unit**	**Supply (Rs.)**	**Erection (Rs.)**	**Total Amount (Rs.)**
1	Online Milk Pastruriser	1.0	No			
2	Online Milk Homoginiser	1.0	No			
3	Cream Separator	1.0	No			
4	CIP System	1.0	No			
5	Can Washer	1.0	No			
6	Milk Silo (10 KL)	1.0	No			
7	Multi Purpose Vat (1 KL)	1.0	No			
8	Khoa/Rabidi Pan (240 Ltr)	1.0	No			
9	Strengthening of ETP	1.0	LS			
10	Vacuum Paneer Packing Machine	2.0	No			
11	Sweet Curd filling and celling machine Repairing	1.0	No			
12	Ghee Vat & Ghee Packing machine	1.0	No			
13	Weigh bridge(30 MT)	1.0	LS			
	TOTAL (A)					

Sl No	B. SERVICE EQUIPMENT		Unit	Supply (Rs.)	Erection (Rs.)	Total Amount (Rs.)
1.	REFRIGERATION SYSTEM	1.0	L.S.			
i	Condenser	1.0	L.S.			
ii	Compressor	1.0	L.S.			
iii	IBT	1.0	L.S.			
2.	STEAM GENERATION SYSTEM	1.0	L.S.			
3.	Conversion of Boiler to Dual mode (coal fired to LPG System	1.0	L.S.			
4.	WATER HANDLING SYSTEM	1.0	L.S.			
5.	COMPRESSED AIR HANDLING SYSTEM	1.0	L.S.			
6.	DG SET-500 KVA capacity	1.0	L.S.			
7.	Two Stage PHE (1 KLPH)	1.0	L.S.			
8.	Drainage system for waste water	1.0	L.S.			
9.	Crate	1.0	L.S.			
10.	INDUSTRIAL ELECTRICAL LT	1.0	L.S.			
11.	ERECTION materials	1.0	L.S.			
	TOTAL (B)					

	D. INSTRUMANTATION AND AUTOMATION	QTY	Unit	Supply (Rs.)	Erection (Rs.)	Total Amount (Rs.)
1.	Laboratory equipments (Weighing balance, Water Bath)	1.0	L.S.			
2.	CCTV Installation at office & plant	1.0	L.S.			
3.	UPS for Computers - 5 KVA	1.0	L.S.			
4.	Computer-2 no's and printer-2 no's	1.0	L.S.			
5.	Biomatric system	1.0	L.S.			
6.	Internet Lease Line - 10 Mbps	1.0	L.S.			
	TOTAL (C)					

SUMMARY for MECHANICAL WORK

Sl no.	Description	*Amount (In Rs.)*
1.0	PART A– **MILK PROCESSING / PACKING/EQUIPMENTS**	
2.0	PART-B – **UTILITY EQUIPMENTS**	
3.0	PART-C – **INSTRUMANTATION AND AUTOMATION**	
4.0	**Sub-TOTAL**	
5.0	GST @ 18% (or as applicable)	
6.0	**TOTAL**	

(In words …….

…….)

SUMMARY

Sl no.	Description	Total Price (in Rs.)
I.	CIVIL STRUCTURAL WORKS	
II.	MECHANICAL WORK	
	TOTAL (A+B)	
In words (Rs……only)		

SECTION - 7

SECURITIES AND OTHER FORMS
(to be filled by Bidder/Employer)

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/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:

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

Form of Agreement On Non-Judicial Stamp paper of Rs.100/-

THIS AGREEMENT is made and executed on the day of _____20____ between the ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD., a body corporate under the ORISSA CO-OPERATIVE SOCIETIES ACT and having its registered office at Sahid Nagar, Bhubaneswar - 751007 (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 supply of such goods and services, including installation, testing, commissioning and performance trial run & guaranteeing 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 herein after referred to.

2.0 The following documents shall be deemed to form and be read as construed as part of this agreement, viz

i) This Form of Agreement
ii) This Letter of Acceptance
iii) The said bid, Appendix and the price Schedule (BOQ) Thereof
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) Schedule of Materials to be issued by OMFED
xi) Form of Bank Guarantees

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.

3.0 In the consideration of the payment to be made by the OMFED to the Contractor as herein after 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.

*** The bidder shall not fill up this form.**

4.0 The OMFED shall hereby covenants to pay the Contractor in consideration of the execution, completion and guaranteeing 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 affix the day, month and year first above written.

Signed, sealed and delivered for
And on behalf of the within
named OMFED by the hands of its
Authorised signatory.

Authorised Signatory

ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD.

In the presence of:

WITNESS:

1) Signature

Name and address

2) Signature

Name and address

Signed, sealed and delivered for
And on behalf of the within
Named Contractor, the other part.

Authorised Signatory

CONTRACTOR

In the presence of:

WITNESS:

1) Signature

Name and address

2) Signature

Name and address

BID SECURITY (BANK GUARANTEE)

WHEREAS,_____ [name of Bidder] (hereinafter called "the Bidder") has submitted his Bid dated _____[date] for the construction of _____[name of Contract hereinafter called "the Bid"].

KNOW ALL PEOPLE by these presents that We_____ [name of Bank] of_____ [name of country] having our registered office at_____(hereinafter called "the Bank") are bound unto_____[name of Employer](hereinafter called "the Employer") in the sum of_____*for which payment well and truly to be made to the said Employer the Bank itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this_____day of_____,20_____ .

THE CONDITIONS of this obligation are :

(1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;

OR

(2) If the Bidder having been notified to the acceptance of his bid by the Employer during the period of Bid validity :

(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or

(b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or

(c) does not accept the correction of the Bid Price in tender Clause .

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to his owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date_____** days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

DATE_____ SIGNATURE _____

WITNESS _____ SEAL_____

_____

[Signature, name and address]

* The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in tender Clause of the Instructions to Bidders.

** 120 days after the end of the validity period of the Bid. Date should be inserted by the Employer before the Bidding documents are issued.

PERFORMANCE BANK GUARANTEE

To

_____[name of Employer]

_____[address of Employer]

_____

WHEREAS _____ [name and address of Contractor] (hereafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligation in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee :

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, up to a total of_____ [amount of guarantee]*_____ (in words), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____[amount of guarantee] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between your and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 90 days from the date of expiry of the Defect Liability Period.

Signature and Seal of the guarantor_____ Name of Bank_____ Address _____ Date __

_____

_____

* *An amount shall be inserted by the Guarantor, representing the percentage the Contract Price specified in the Contract including additional security for unbalanced Bids, if any and denominated in Indian Rupees.*

BANK GUARANTEE FOR ADVANCE PAYMENT

To

_____[name of Employer]

_____[address of Employer]

_____[name of Contractor]

Gentlemen :

In accordance with the provisions of the Conditions of Contract, sub-clause 51.1 ("Advance payment") of the above-mentioned Contract,_____[name and address of Contractor] (hereinafter called "the Contractor") shall deposit with _____ [name of Employer] a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of _____[amount of Guarantee]*_____ [in words].

We, the_____[bank of financial institution], as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surely merely, the payment to _____[name of Employer] on his first demand without whatsoever right of obligation on our part and without his first claim to the Contractor, in the amount not exceeding _ _ _ [amount of guarantee]* _____[in words].

We further agree that no change or addition to or other modification of the terms of the Contractor or Works to be performed there under or any of the Contract documents which may be made between _____ [name of Employer] and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until_____ [name of Employer] receives full repayment of the same amount from the Contractor.

Yours truly,

Signature and Seal :_____ Name of Bank /Financial Institution_____ Address : _____ Date :__

_____

_____

* *An amount shall be inserted by the Bank or Financial Institution representing the amount of the Advance Payment, and denominated in Indian Rupees.*

INDENTURE FOR SECURED ADVANCES

(for use in case in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)

This indenture made the_____day of_____, 20 BETWEEN _____ _ (hereinafter called the contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) or the one part and the Employer of the other part.

Whereas by an agreement dated_____(hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the Employer that he may be allowed advanced on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to executive at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges)

AND WHEREAS the Employer has agreed to advance to the Contractor the sum of Rupees__ ______ on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account bill for the said works signed by the Contractor on_____and the Employer has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees_____ on or before the execution of these presents paid to the Contractor by the Employer (the receipt where of the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as a for said the Contractor doth hereby covenant and agree with the President and declare as follows :

(1) That the said sum of Rupees_____ so advanced by the Employer to the Contractor as aforesaid and all or any further sum of sums advanced as aforesaid shall be employed by the Contractor in or towards expending the execution of the said works and for no other purpose whatsoever.

(2) That the materials details in the said Account of Secured Advances which have been offered to and accepted by the Employer as security are absolutely the Contractor's own propriety and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnified the Employer against all claims to any materials in respect of which an advance has be made to him as aforesaid.

(3) That the materials detailed in the said account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereafter called the said materials) shall be used by the Contractor solely in the Execution of the said works in accordance with the directions of the Engineer.

(4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same required by the Engineer.

(5) That the said materials shall not be any account be removed from the site of the said works except with the written permission of the Engineer or an officer authorized by him on that behalf.

(6) That the advances shall be repayable in full when or before the Contractor receives payment from the Employer of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Employer will be at liberty to made recovery from the Contractor's bill for such payment by deducting there from the value of the said materials that actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

(7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing of the Employer shall immediately on the happening of such default be repayable by the Contractor to be the Employer together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the **Employer** in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the **Employer** to reply and pay the same respectively to him accordingly.

(8) That the Contractor hereby charges all the said materials with the repayment to the Employer of the said sum of Rupees_____ and any further sum of sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything

in the said agreement and without prejudice to the power contained therein if and whenever the covenant for payment and repayment here in before contained shall become enforceable and the money owing shall not be paid in accordance there with the **Employer** may at by time thereafter adopt all or any of the following courses as he may deem best :

(a) Seize and utilise the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provisions in that behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due to the contractor with the value of work done as if he has carried it out in accordance with the said agreement and at the rests thereby provided. If the balance is against the contractor, he is to pay same to the **Employer** on demand.

(b) Remove and sell by public auction the seized materials or any part there of and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the **Employer** under these presents and pay over the surplus (if any) to the Contractor.

(c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

(9) That except in the event of such default on the part of the contractor as aforesaid interest on the said advance shall not be payable.

(10) That in the event of any conflict between the provisions of these present and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been here-in-before expressly provided for the same shall be referred to the Employer whose decision shall be final and the provision of the Indian Arbitration Act for the time being in force shall apply to any such reference.

Letter of Acceptance

(Letterhead paper of the Employer)

_____(Date)

To

_____ (Name and address of the Contractor)

_____

_____

Dear Sirs,

This is to notify you that your Bid dated _____for execution of the _____ (name of the contract and identification number, as given in the Instructions to Bidders) for the Contract Price of Rupees _____(_____) (amount in words and figures), as corrected and modified in accordance with the Instructions to Bidders[1] is hereby accepted by our agency.

We accept/ do not accept that_____be appointed as the Adjudicator[2]. Your are hereby requested to furnish Performance Security, in the form detailed in Para 34.1 of ITB for an amount equivalent to Rs. _____ within 21 days of the receipt of this letter of acceptance valid up to 28 days from the date of expiry of defects Liability Period i.e. up to_____ and sign the contract, failing which action as stated tender clause.

Yours faithfully,

Authorized Signature Name and title of Signatory

Name of Agency

_____

[1] *Delete "corrected and" or "and modified" if only one of these actions applies. Delete as corrected and modified in accordance with the Instructions to Bidders, if corrections or modifications have not been affected.*

[2] *To be used only if the Contractor disagrees in his Bid with the Adjudicator proposed by the Employer in the "Instructions to Bidders".*

Issue of Notice to proceed with the work

(Letter head of the Employer)

_____(Date)

To

_____(Name and address of the Contractor)
_____
_____

Dear Sirs,

Pursuant to your furnishing the requisite security as stipulated in ITB Clause 34.1 and signing of the Contract for the construction of
_____
_____at a Bid Price of Rs. _____.

You are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s _____agree to abide by this bid for a period _____days for the date fixed for receiving the same and it shall be binding on us and may be accepted at any time before the expiration of that period.

_____

(Signed by an Authorised Officer of the Firm)

_____

_____Title of Officer

_____

Name of Firm

***