DELHI AVIATION FUEL FACILITY PRIVATE LIMITED
AVIATION FUELLING STATION
SHAHBHAD MOHAMMADPUR
IGI AIRPORT
NEW DELHI-110061

TENDER NO: DAFFPL/MOD/FF/2017-18/16

INVITING TENDER FOR CONSTRUCTION OF WATER TANKS & ASSOCIATED PIPING WORKS

BID DUE DATE & TIME: 1500 Hrs. IST on 31st January 2018

OPENING OF TECHNICAL BIDS: 1100 Hrs. IST on 01st February 2018

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Sign & Stamp of Bidder

Contents

NOTE: BIDDERS ARE REQUESTED TO SIGN AND STAMP ALL THE PAGES OF THE TENDER DOCUMENT AND SEND THE SAME BACK IN THEIR OFFER AS A TOKEN OF UNCONDITIONAL ACCEPTANCE OF TENDER FIRMS.

THE DEVIATIONS, IF ANY, SHOULD BE MENTIONED SEPARATELY ON BIDDER"S LETTER HEAD IN TECHNICAL BID. THE DEVIATIONS MENTIONED ANYWHERE ELSE SHALL NOT BE CONSIDERED. IN ABSENCE OF DEVIATION SHEET IT WOULD BE CONCLUDED THAT BIDDER HAS ACCEPTED THE TENDER TERMS WITHOUT ANY DEVIATIONS. CORRECTIONS IN TENDER DOCUMENT WILL NOT BE ACCEPTED.

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DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

TENDER NOTICE
DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

INVITING TENDER FOR CONSTRUCTION OF WATER TANKS AND ASSOCIATED PIPING WORKS AS PER SPECIFICATIONS AS REQUIRED

TENDER NO: DAFFPL/MOD/FF/2017-18/16

Delhi Aviation Fuel Facility (P) Ltd (DAFFPL) invites sealed bids under single stage two bid system from eligible bidders for construction of Water Tanks and associated Piping Works.

Brief Scope of work:

We intend to provide new Water Tanks as per specification as required. Scope of supply includes construction of Water Tanks, Associated Drains and Piping Works with other associated amenities at our DAFFPL facility.

Bid Security (EMD):	As mentioned in the Tender document
Date, Time & Venue for Voluntary Pre-bid Meeting:	22nd January 2018; 1500 HRS (IST) at DAFFPL, Aviation Fuelling Station, Shahabad Mohammadpur, New Delhi-110061
Bid Due Date, Time & Place of Submission:	Upto 15:00 HRS (IST) on 31st January 2018 at the office of Chief Executive Officer, DAFFPL, Aviation Fuelling Station, Shahabad Mohammadpur,

Detailed Invitation for Bids (IFB) along with Pre-qualification Criteria, Bid Document Corrigenda can be viewed and downloaded from DAFFPL's website: **http://www.daffpl.in**

Chief Executive Officer
DAFFPL, New Delhi
9810081078

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CHAPTER 1: INTRODUCTION (COVERING NOTE)

Delhi Aviation Fuel Facility Private Limited (DAFFPL) is a Joint Venture comprising Indian Oil Corporation Ltd. (IOCL), Bharat Petroleum Corporation Ltd. (BPCL), and Delhi International Airport (P.) Ltd. (DIAL). We provide the infrastructure aimed at ensuring an uninterrupted flow of Aviation Turbine Fuel (ATF) to all type of aircrafts at the Indira Gandhi International Airport, New Delhi (IGI Airport) as per international benchmarking.

The bidder/ contractor shall refer to various sections of this tender document for detailed scope of work. It is contractor's responsibility to execute the job in all respects as per detailed drawings, documents / specification furnished by consultant / owner and as per applicable codes, standards & in line of statutory requirements.

The field circumstances shall also be taken into consideration and methods suitable to the site conditions shall be adopted with concurrence of the Engineer-in-charge and in line with manuals, instructions of respective equipment and specified codes and standards. The successful accomplishment of the project is greatly influenced by the team work, workmanship of the workers and supervisors.

The Contractor shall employ only such workers and supervisors who have considerable experience of similar work and who can work, temperamentally in good harmony and co-operation.

Delhi Aviation Fuel Facility Private Limited (DAFFPL) invites sealed tenders in prescribed tender form under two-bid system. For viewing details including EMD, BID QUALIFICATION CRITERIA etc. please visit our web site www.daffpl.in and go to tender section by clicking the link "Tenders". Tender documents are available on our website.

The bid documents can also be collected from our office and the bids are to be submitted in Physical form in the Tender Box kept at the office of the **Delhi Aviation Fuel Facility Private Limited (DAFFPL)** at Shahabad Mohammadpur, New Delhi-110061, India.

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1. The Tender is floated in Two Bid system consisting of Technical Bids (Bid Qualification Criteria - BQC, Technical plus Commercial) and Price Bids.

   Part-I : Bid Security / EMD in accordance with tender document.
   Part-II : BQC (Bid qualification criteria), Technical & commercial Bid, duly filled in & along with all supporting as requested to be submitted in Physical form in the Tender Box.
   Part –III : Price Bid.

2. The bidder should be able to construct the entire size/type/quantity bidded by them. Bidders cannot bid for part items or part quantity.

3. Firstly, the Technical bid (BQC & Techno commercial bids) shall be opened. The Bids shall be initially scrutinized by a team as per tender requirements of BQC (Bid qualification criteria). Technical cum commercial bids of only those vendors who qualify the BQC will be processed further. The price bids of only techno-commercially qualified bidders will be opened, evaluated and shortlisted for Placement of Work Order.

4. Each page of bid documents is to be duly signed & stamped by the bidder before submitting the Tender.

5. The bids submitted should be valid for **four months** from the due date of bid submission for Owners acceptance. Once accepted it will remain firm till completion of contracts/orders.

6. We request the bidder to carefully go through all tender documents before submitting the offer. Please note that any exceptions or deviations to the tender document are necessarily to be recorded in the attached deviation statement only. Any exceptions/deviations brought out elsewhere in the bid shall not be considered.

7. The bidders may be invited for a presentation to DAFFPL during Techno-commercial evaluation before price bid opening.

8. The bidders to provide their bank details/ PAN / Sales Tax /WCT Registration numbers/Goods & Service Tax Registration No. / VAT registration No., as applicable for updating vendor master file. You are also requested to keep us informed of any change in address / status of your business / contact details including email address etc.

9. Party can quote with the deviations as referred in Point No.6 above. Please refer query end date / time in tender calendar after which no query posted by bidder

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shall be considered. However, DAFFPL reserves the right to respond the queries after cutoff date / time mentioned in tender calendar.

10. Please note that queries related to scope of job, tender specifications, terms & conditions etc., should be submitted by means of letter/E mail to reach the owner's office not later than one week before the meeting. It may not be practicable to answer queries received late, but queries and responses/clarifications will be posted in the form letter, E-mail within one week from the date of Pre Bid Meeting. Any modification in the bid document that may become necessary as a result of the Pre-Bid meeting shall be made by the owner exclusively through the issues of corrigendum/ addendum posted at web site and not through the minutes of the pre-bid meeting.

11. UNSOLICITED POST BID MODIFICATION
    Bidders are advised to quote strictly as per terms and conditions of the Bidding Document. After tender submission due date & time/ extended due date & time (as the case may be) the bidders shall not make any subsequent price changes, whether resulting or arising out of any technical / commercial clarifications sought/allowed on any deviations or exceptions mentioned in the bid unless discussed and agreed by DAFFPL in writing.

12. EMD & Techno Commercial bid shall be opened on **01st February 2018 at 11:00 Hrs (IST)** in the presence of authorized representative of bidders (Restricted to one [1] person per bidder only) at the office of DAFFPL. Price Bid of only those bidders whose offer is found meeting both BQC & techno-commercially acceptable, shall be opened on a later date as per convenience of DAFFPL after intimation to the qualified bidders.

13. DAFFPL reserves the right to accept any tender in whole or in part or reject any or all tenders without assigning any reason. DAFFPL reserves right to accept any or more tenders in part. Decision of DAFFPL in this regard shall be final and binding on the bidder.

    QUERIES AND CLARIFICATIONS: Any query or clarification with regard to this tender may please be referred to below address & phone nos. on any working day during office working hours

Mr M Vishnu Vardhan Project Officer Vishnu.vardhan@daffpl.in, rakesh.arora@daffpl.in 8826000228	Mr. Ashim Dutta (Consultant) Project Manager ashimkdutta@gmail.com, saga.amitabh@gmail.com 7738382997 9958849633

14. GOVERNING LAWS: The laws of Union of India shall govern all matters concerning the tender. Any issue arising related to the tender or the selection process shall be adjudged by the courts in Delhi alone.

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15. A Pre-bid meeting is scheduled for **22nd January 2018 at 1500 Hrs IST** at the office of DAFFPL, New Delhi. All prospective bidders can participate in the same. Any clarification with regard to tender shall be sorted out during the pre-bid meeting.
    a. The purpose of the pre-bid meeting is to clarify any doubts of the BIDDER on the interpretation of the provisions of tender.
    b. Bidder(s) are requested to submit their queries, mentioning form name, clause no. & clause, by a letter / e-mail to our office as per schedule in order to have fruitful discussions during the meeting.
    c. All the Bidder(s) are requested to attend the pre-bid meeting to be held at DAFFPL Office as per schedule.

16. **Tender document can be purchased from our office located at Shahabad Mohammadpur at a cost of Rs 1000/- and also can be downloaded from our website www.daffpl.in.**
    - **A bidder who downloads the document from website has to submit a separate DD for an amount of Rs.1000/- along with the EMD document.**
    - **Bidders who purchase the document from our office have to submit a DD for an amount of Rs.1000/- at the time of purchase.**

17. **Earnest Money Deposit (EMD) (also referred to as Bid Security):** Bidder shall be required to submit the Earnest Money Deposit (EMD), either in the form of Bank guarantee as per format (provided as Annexure) or PAY ORDER or BANK DRAFT (in favour of Delhi Aviation Fuel Facility Private Limited, payable at New Delhi) at our office. The EMD in either form has to be submitted on or before the due date & due time of bid submission of this tender with a covering note mentioning the tender no.

    a. The bidders not submitting EMD by due time & date shall be rejected & their bids shall not be evaluated further.
    b. **The EMD amount shall be 2.5 Lakhs INR**
    c. Firms registered with National Small Scale Industries (NSIC)/MSME of India are exempted from submission of bid security. Central Public Sector Enterprises of India and Firms registered with Nation Small Scale Industries Corporation (NSIC) of India are exempted from submission of Bid Security. Central Public Sector Enterprises are requested to give a self-declaration on their letter head to this effect. Bidders registered with NSIC of India are also requested to submit self-declaration on their letter head to this effect along with a copy of their Valid Registration certificate, specifying limit of volume and other details which should be submitted.

18. **Site Restriction:** The job must be done in an area which is inside the premises of DAFFPL Fuel Facility. Successful bidder will have to follow all the security norms and procedures for entry and exit to the facility. The job timings will have to change as

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per the permissions obtained from Operation Dept. All the entry procedures for labours / machinery / raw materials as per the rules of the DAFFPL will have to be followed by the vendor. Contractor shall visit the site and ensure familiarity with the working condition / limitations at the site. Also, the entire works are to be carried out in an operating Location. The contractor may have to follow the timings of the facility and must work under restricted conditions. The normal working hours of facility is 0930 Hrs to 1800 Hrs on Monday to Saturday except holidays. Working beyond above normal working hours /holidays /Sundays are to be with prior permission of Engineer in charge and relevant facility officers. Contractor is required to plan his work within the normal working hours and days and accordingly he has to mobilize the resources to complete the job within the scheduled time. However, all efforts will be made by DAFFPL to give extended working time beyond normal working time in order to help the contractor for early completion of the job. No additional payment / charges shall be payable for such works. Not getting permission for working on holidays/ Sundays or beyond normal working hours will not be considered as reason for delay in work. The contractor and his personnel have to obey all rules and regulations of the plant. Trained and experienced supervisor/ engineer are required to be present at the work spot always.

All hot work like welding, cutting, grinding etc. needs to be done in the closed booth of asbestos cloth. No extra claim on account of the same will be considered. Also the shutdown jobs may get delayed due to operational requirement. Any extra claims on account of the same will not be entertained.

The tenderer must visit the site of the tender and familiarize himself with location, operating / working conditions as well as any other local factors which could influence the working before quoting for the job. His quote should take care of any such restrictions; conditions etc and any claim afterwards will not be entertained. **It is suggested that the Tenderer must visit the site in order to have a better idea of site conditions and factors.**

19. **Completion Time:** Time is the essence of the contract. The time period of contract is **10 (Ten) months** from the date of Letter of Intent including monsoon period. **The time includes necessary time required for mobilizations and demobilizations after the execution of work and includes monsoon period.** Successful bidder is required to provide a bar chart /schedule showing the activities/events with time along with the Technical bid to be scheduled accordingly.

20. The work is required to be done in a working/operating location, the party has to get necessary Hot/cold work permits from the concerned officer in plant as per OISD standards and all workmen should be provided with necessary safety helmet, safety belts, safety shoes and other standard safety equipment's. Any delay on account of non-adherence to safety norms, rules and regulations of plant as well as obtaining

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work permits from the plant shall not be accounted for the delay in completion of job.

21. **Receipt & storage of material at Site**: Contractor is required to make his own arrangement for unloading and storage of materials at site. Contractor is required to inform us prior to dispatch of materials and his representative required to be available for receipt and unloading of materials at site.

22. The successful vendor has to arrange and submit to fuel facility the proper **POLICE VERIFICATION DOCUMENTS** of all the labours, site in charges, supervisors, welders, grinders and all associated workmen who will be coming inside the terminal for carrying out related jobs.

23. For carrying out the jobs inside the depot the vendor must arrange for associated tools, tackles, manpower, machinery of his own and no extra payment will be made to vendor on account of the same.

24. For arranging the electricity vendor to note that only Acoustic Proof, box type DG sets will be allowed inside the depot premises. Vendor to also note that proper GI plate type earthing system as per IS 3042 (LATEST) has to be provided by the vendor for DG set and no extra payment will be done for the same. There should be two nos. earthing system connected in a grid at a location as instructed by DAFFPL site in-charge

25. All the debris, scrap, cut pieces, etc coming out of fabricated plates, excavated earth, area cleaning will have to be shifted by the vendor to a location inside or outside the terminal premises as per the instruction of DAFFPL site in-charge and no extra payment will be done for the same.

THE FORMS /ATTACHMENTS TO THIS TENDER ARE AS UNDER:

1. Covering Note – CHAPTER: 1
2. Instructions To Bidders - CHAPTER: 2
3. Bid-Qualification Criteria - CHAPTER: 3
4. Performance of Work – CHAPTER: 4
5. General Purchase Conditions- CHAPTER: 5
6. Technical Specification Documents - **(Attached separately as Annexure I)**
7. Annexure attached are as follows:
   - Annexure II – DEVIATION SHEET
   - Annexure III – DECLARATION SHEET

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- Annexure IV – FORMAT FOR DRAFT BANK GUARANTEE IN LIEU OF BID SECURITY (EMD)
- Annexure V - FORMAT DRAFT COMPOSITE BANK GUARANTEE FOR SECURITY DEPOSIT/PERFORMANCE GUARANTEE
- Annexure VI – FORM OF LETTER OF UNDERTAKING
- Annexure VII – DECLARATION TO BE SUBMITTED ALONGWITH Technical BID
- Price Bid

Thanking you,
Yours faithfully,
For DELHI AVIATION FUEL FACILITY (P) LTD.

Chief Executive Officer
DAFFPL, New Delhi

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CHAPTER 2: INSTRUCTIONS TO BIDDERS

1. The bidder shall bear all costs associated with the preparation and submission of the bid and Owner will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

2. Vendor is requested to submit their bids taking full notice of all the technical specifications, terms and conditions, forms & attachments to this tender. Bids must be submitted in Physical form only.

3. Owner reserves the right to accept / reject any or all bid qualification documents at their sole discretion without assigning any reason whatsoever.

4. Owner is not responsible for any delays from bidder end.

5. Owner reserves the right to make any changes in terms and conditions of purchase before due date of bid submission and to reject any or all bids received incomplete.

6. Undertaking by the bidder:
    a. I/we hereby undertake that the statements made herein/information given in the bids through Physical Tendering system/annexure/forms referred are true in all respects and that in the event of any such statement or information being found to be incorrect in any particular, the same may be construed to be a misrepresentation entitling DAFFPL to avoid any resultant contract.
    b. I/we further undertake as and when called upon by DAFFPL to produce, for its inspection, original(s) of the document(s) of which copies have been annexed hereto.

7. Owner, at its discretion reserves the right to verify information submitted by the bidders.

8. Bidder to submit documents/information to satisfy the bid qualification criteria. Bidders should also be in a position to produce further information as and when required by DAFFPL with in a time limit of 15 days.

9. DAFFPL reserves their right to negotiate the quoted prices with lowest bidder.

10. Bidders would be qualified based on data and documents submitted by them.

11. Owner's decision on any matter regarding short listing of vendors shall be final and no corresponding in this regards will be entertained.

12. The vendors who are on IOCL/BPCL/DIAL holiday list or delisted will not be

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considered.

13. The bidder is expected to examine all instructions, forms, attachments, terms and specifications in the tender document. The entire tender document together with all its attachments thereto, shall be considered to be read, understood and accepted by the bidder, unless deviations are specifically stated seriatim by the bidder. Failure to furnish all information required in the tender document or submission of a bid not substantially responsive to the tender documents in every respect will be at bidder risk and may result in the rejection of his bid. The bidder scope of supplies as specified in the material requisition shall be in strict compliance with the scope detailed therein and in the bid document.

14. Bidders in their own interest shall ensure that they submit their bid, complete in all respects, well within the specified bid due date and time. No relaxation shall be given for delay due to any unforeseen event in submission of bid.

15. At any time prior to the bid due date, we may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bid document. The amendment will be notified through our portal www.daffpl.in to all prospective bidders and will be binding on them. In order to afford prospective bidder, reasonable time in which to take the amendment into account in preparing their bids, we may, at our discretion, extend the bid due date.

16. The bid prepared by the bidder and all correspondence/ drawings and documents relating to the bid exchanged by bidder and the owner shall be written in ENGLISH language, provided that any printed literature furnished by the bidder may be written in another language so long as accompanied by an ENGLISH translation, in which case, for the purpose of interpretation of the bid, the ENGLISH translation shall govern.

17. Declaration with the bid qualification criteria that bidder has not been banned or delisted by any Government or quasi Government agencies or Public Sector Undertaking (PSU) as per declaration format (provided as annexure) of the tender document should be submitted along with the bid.

18. Bidders are advised to submit bids based strictly on the terms & conditions and specifications contained in the tender document and not to stipulate any deviations. Each Bidder shall submit only one bid. A Bidder who submits more than one bid will be rejected. Alternative bids will not be accepted.

19. The Owner may, at its discretion, extend the bid due date, in which case all rights and obligations of the Owner and the Bidders, previously subject to the bid due date, shall thereafter be subject to the new bid due date as extended. The same will be hosted in the web site.

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20. Bids shall be kept valid for 4 months from the bid due date. A bid valid for a shorter period shall be considered as non-responsive and rejected by the Owner. Notwithstanding above, the Owner may solicit the Bidder consent to an extension of the period of bid validity. The request and the responses thereto shall be made in writing. The EMD (bid security) shall also be accordingly extended.

21. Telex/ Telegraphic/ Telefax / E-mail offers will not be considered and shall be rejected.

22. No bid shall be modified subsequent to the due date & time or extension, if any, for submission of bids. Bidder(s) to note that Price changes after submission of bid shall not be allowed. In case any bidder gives revised prices/price implication, his bid shall be rejected. No bid shall be allowed to be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder. Withdrawal of a bid during this interval shall result in the forfeiture of Bidder s EMD.

23. Bids that do not meet the Bid qualification criteria as specified in the bid document shall be rejected. A bid with incomplete scope of work and/or which does not meet the technical requirements as specified in the bid document, shall be considered as non-responsive and rejected. Conditional bids will be liable for rejection.

24. The Owner will examine the bids to determine whether they are complete, whether any computational errors have been made, whether the documents have been properly signed and whether the bids are generally in order.

25. The bids without requisite EMD and/or not in the prescribed Performa and the time limit will not be considered and bids of such bidder(s) shall be rejected.

26. PRICE EVALUATION CRITERIA: As award is on overall landed lowest basis, part offers will be rejected. Bidder has to quote for all items in a lot for us to consider them.

27. Prior to the expiration of period of bid validity, the owner will notify the successful bidder in writing or by e-mail, that his bid has been accepted. The Notification of Award will constitute the formation of the Contract. Delivery Period shall be counted from the date of notification of award (Letter/Fax/e-mail of Intent).

28. Any efforts by a bidder to influence the owner/ in the owner bid evaluation, bid comparison or contract award decisions may result in the rejection of their bid.

29. ISSUE OF CONTRACT/ PURCHASE ORDER: After the successful bidder has been notified that his bid has been accepted, DAFFPL will send to such bidder a detailed

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contract/purchase order incorporating all the terms and conditions agreed between the parties. Within 15 days of receipt of the detailed purchase order, the bidder shall sign and return to the owner the duplicate copy of the order as a token of their acknowledgement.

30. Vigil Mechanism: DAFFPL has developed the Vigil Mechanism to deal with references/ grievances, if any, that is received from bidders who participated / intends to participate in the tender. The details of the same are available on our website www.daffpl.in

31. VERIFICATION BY OWNER: All statements submitted by bidder regarding experience, manpower availability, equipment and machinery availability etc., are subject to verification by the owner either before placement of order or after placement of order. If any data submitted by the bidder at the bid stage is found to be incorrect, the offer is liable to be rejected or the contract/order is liable to be terminated.

32. SEALING & MARKING OF BIDS

A. Bids shall be submitted separately in THREE SECTIONS in sealed envelopes superscribed with the Bid Document number, bid due date and time, item and nature of bid as under:

- **SECTION - I (Envelope No. 1): Bid Security / EMD:**
  Bid security in accordance with tender document.

- **SECTION - II (Envelope No. 2): Technical Bid:**
  a. Information and documentary evidence establishing bidder's claim for meeting qualification criteria as stipulated in IFB. This section/envelope should necessarily contain all the required back-up documents for Bid Qualification.
  b. Technical bid complete with all technical and commercial details, covering letter and un-priced copy of price Schedule with prices substituted with 'QUOTED' or 'NOT QUOTED' or 'NOT APPLICABLE'. **Deviation sheet duly filled with deviations, if any, shall form part of technical bid.**

- **SECTION - III (Envelope No. 3): Price Bid:**

  a. PRICE BID WITH FULL PRICE DETAILS. The price bid shall contain prices only in the prescribed price schedule formats, without any technical and commercial details. Technical specifications or commercial terms given in unpriced schedule will only be evaluated and the same will be binding on the Bidder. The bids shall be sealed

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and kept in a single envelope with marking as Section - III (Price Bid) / Envelope No. 3: "Original'

b. The bidder shall quote the final prices (excluding taxes, Cess, duties and other levies etc) in the 'PRICE SCHEDULE FORMAT' of bid document ONLY. Prices quoted in any other format shall not be considered for evaluation.
c. The Price bid shall be kept in a larger envelope duly sealed and shall bear the name and address of the bidder.

B. The envelopes containing Section -I, Section -II, Section -III of bid shall be enclosed in a larger envelope duly sealed and pasted and shall bear the name and address of the bidder.
C. Bidder to note that if bid security / EMD (in the Proforma attached with these documents) in original and/or bid document fee (if the bid document is downloaded) is kept in any other envelope and not found in envelope no. 1, the offer of the bidder(s) will be REJECTED during opening.
D. Bidder to note that prices are to be quoted in the format provided in the price schedule formats provided along with the tender without any conditions. Price bids submitted in any other format and conditional price bids will be liable to be rejected. Price bids received in open condition (not in sealed envelope) or kept in any other Section of the bid (i. e, Section - I or II) will also be liable for rejection.
E. If the outer envelope is not sealed and not marked as required, then DAFFPL will assume no responsibility for the bid's misplacement or premature opening.
F. Bidders in their own interest shall ensure that they send their bid complete in all respects well in time to reach the specified office within the specified bid due date and time. No relaxation shall be given for delay due to any unforeseen event in submission of bid.
G. Central Public Sector Enterprises and Firms registered with NSIC are exempted from submission of Bid Security. Central Public Sector Enterprises are requested to give a self declaration on their letter head to this effect, which should be submitted in a sealed envelope marked as Bid Security.
H. Bidders registered with NSIC are also requested to submit self declaration on their letter head to this effect along with a copy of their Valid Registration certificate, specifying limit of volume and other details which should be submitted in a separate sealed envelope no. 1 marked as Bid security.
I. Bid Security strictly in the Proforma attached with these documents shall be submitted in Original along with the Bid. Bids received without original bid security, shall not be opened for evaluation.
J. Tender document complete in all respects must be submitted in the tender box provided at the DAFFPL office before due date and time

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33. DOCUMENTS COMPRISING THE BIDS

The bid prepared by the Bidder shall comprise the following components:

I. **ORIGINAL BID SECURITY (Section - I):** Bidders are advised to instruct their banks not to post Bid Security directly to Owner as the same has to accompany with the bid.

II. **TECHNICAL BID (Section -II):**

- Documentary evidence establishing Bidder's claim for meeting qualification criteria as stipulated in the Bid Document.
- Notarized Audited Annual Report of previous three financial years.
- Documentary evidence establishing Bidder's eligibility to bid and that the offered Goods conform to the Bid Document.
- Price Schedule (with Price figures blanked) completed in accordance with the requirements specified in the bid document.
- Agreed Terms & Conditions duly filled-in.
- Deviation Sheet, if any.
- Declaration with the bid qualification criteria that bidder has not been banned or delisted by any Government or quasi Government agencies or PSU's.
- Any other information/details/documents/data required as per Bid Document.
- Parent Company Guarantee, if applicable

III. **PRICE BID (Section -III):** Bid Form and Price Schedule (Both given along with tender) duly filled in.

34. BID FORM & PRICE SCHEDULE

The bidders shall complete the Bid Form and appropriate Price schedule furnished of Bid Document, indicating the required information for all quoted items.

35. FORMAT AND SIGNING OF BID

a. The Bidder shall prepare required number of copies of the bid, clearly marking each 'Original Bid' and 'Copy of Bid' as appropriate. In the event of any discrepancy between them, the 'Original Bid' shall govern.

b. The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to sign on behalf of the bidder on all pages of the bid. Such authorization shall be indicated by written Power of Attorney accompanying the bid. The name and position held by each person signing must be typed or printed below the signature. The person or persons signing the bid shall initial all pages of the bid, except for unamended printed literature.

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c. The complete bid shall be without alterations, interlineations or erasures, except as may be necessary to correct errors made by the Bidder, in which case such corrections shall be rewritten & initialed by the person or persons signing the bid.
d. All the pages of the price bid shall be signed by the authorized signatory. In case all the pages of the price bid are not signed, the bid shall be rejected.

36. OPENING OF BIDS

Bids will be opened by Owner at DAFFPL Office, New Delhi, in the presence of bidders/bidders authorized representatives available on the opening date and time (duly authorized by a competent person and having the letter of authority).

a. **BID SECURITY / EMD (SECTION-I) AND TECHNICAL BID (SECTION-II):**
   I. On the day and time of bid opening, Bid security (Envelope 1) and Technical Bid (Envelope 2) shall be opened in presence of bidders.
   II. The Bidder's representatives, who are present, shall sign a register/attendance sheet evidencing their attendance.
   III. The Bidder(s) names, presence or absence of requisite bid security will be announced at the opening.
   IV. Bidder (s), whose bids are not opened for any reason, including non receipt of original bid security, will not be allowed to be present during bid opening.

b. **PRICE BID OPENING (SECTION -III):**
   I. Only those bidders whose bids meet the qualification criteria and are technically/commercially acceptable shall be called for opening of Price bid (Envelope 3) at a later date, informed in advance.
   II. The Bidder's representatives, who are present, shall sign a register/ attendance sheet evidencing their attendance.
   III. Bidder(s), whose bids are not opened for any reason, will not be allowed to be present during bid opening.

37. EVALUATION OF BIDS

a. Qualification of Bidder: The experience details and financial & technical capabilities of the bidder(s) shall be examined to determine whether the bidder(s) meet the Bid Qualification Criteria mentioned in the INVITATION FOR BIDS (IFB).
b. The Owner will examine the bids to determine whether they are complete, any computational errors have been made, whether the documents have been properly signed and whether the bids are generally in order.
c. The bids without requisite Bid Security and/or not in the prescribed proforma will not be considered and bids of such bidder Bidder(s) shall be rejected.

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d. To assist in the examination, evaluation and comparison of technical bids, the owner/ may, at its discretion, ask the Bidder clarifications on the bid. The request for such clarifications and the response thereto shall be in writing.

e. Prior to the evaluation and comparison of the bid, the owner will determine the substantial responsiveness of each bid to the bidding documents. For the purpose of this Article, a substantially responsive bid is one, which conforms to all the terms and conditions of the bidding document without material deviations or reservations. A material deviation or reservation is one which affects in any substantial way the scope, quality, or performance of the works or which limits in any substantial way, inconsistent with the bidding document, the DAFFPL's rights or Bidder's obligation under the contract and retention of which deviation or reservation would affect unfairly the competitive position of other bidders presenting substantially responsive bids. The owner's determination of bid responsiveness is to be based on the contents of the bid itself without recourse to the extrinsic evidence.

f. A bid determined as substantially non-responsive will be rejected by the Owner and shall not subsequently be allowed by the Owner to be made responsive by the Bidder by correction of the non-conformity.

Note:

1) **The Bid Shall be submitted in English Language Only**
2) **For any Document submitted in any language other than English, the translation copy in English language shall be submitted.**

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CHAPTER 3: BID-QUALIFICATION CRITERIA:

Bidders need to meet following pre-qualification criteria to qualify for short-listing as a successful vendor, who would be considered for tendering process for the job of "***Construction of Water Tanks and associated Piping Works at DAFFPL"***

- ***Technical Criteria:***

  The bidder shall have satisfactorily executed either of the following during the last 07 years ending 31/12/2017:

  The Bidder should have completed at least **one similar work,** costing not less than **INR 200 lakhs.**

  OR

  The Bidder should have completed at least **two similar works,** of consolidated costing not less than **INR 150 lakhs.**

  Note:

  - Similar works mean "Construction of Cone Roof Vertical Water Tank (CRVT) and Fire Hydrant Piping works".
  - Bidder should compulsory have experience in Cone Roof Vertical Tank as per API 650 Standard and minimum height of 15 meters".
  - Bidder shall submit the following documents in support of full filling the above criteria:
    - ✓ PO copy for the works done in the past, indicating value of work.
    - ✓ Completion Certificate indicating P.O No & Date from User.

- ***Financial criteria for Job:***

  - Bidder shall have minimum average annual turnover of Rs.4 Crore as per audited financial results in the preceding three financial/calendar years. "Turnover shall mean Consolidated Turnover in case of a Bidder having wholly owned subsidiaries"

Both the above criteria (Technical & Financial) to be met for acceptance of the bid.

OTHER INFORMATION OF PQC

1. Parties who are affiliates of one another can decide which affiliate will make a bid.

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Only one affiliate may submit a bid. Two or more affiliates are not permitted to make separate bids directly or indirectly. If 2 or more affiliates submit a bid, then any one or all of them are liable for disqualification. However up to 3 affiliates may make a joint bid as a consortium, and in which case the conditions applicable to a consortium shall apply to them. "Affiliate" of a Party shall mean any company or legal entity which:

a. Controls either directly or indirectly a Party, or
b. Which is controlled directly or indirectly by a Party; or
c. Is directly or indirectly controlled by a company, legal entity or Partnership which directly or indirectly controls a Party. "Control" means actual control or ownership of at least a 50% voting or other controlling interest that gives the power to direct, or cause the direction of, the management and material business decisions of the controlled entity.

2. Bids may be submitted by:
   a. A single person/ entity (called sole bidder);
   b. A newly formed incorporated joint venture (JV) which has not completed 3 financial years from the date of commencement of business;
   c. A consortium (including an unincorporated JV) having a maximum of 3 (three) members;
   d. An Indian arm of a foreign company.
3. Fulfillment of Eligibility criteria and certain additional conditions in respect of each of the above 4 types of bidders are stated below, respectively:
   a. The sole bidder (including an incorporated JV which has completed 3 financial years after date of commencement of business) shall fulfill each eligibility criteria.
   b. In case the bidder is a newly formed and incorporated joint venture and which has not completed three financial years from the date of commencement of business, then either the said JV shall fulfill each eligibility criteria or any one constituent member/ promoter of such a JV shall fulfill each eligibility criteria. If the bid is received with the proposal that one constituent member/ promoter fulfils each eligibility criteria, then this member/promoter shall be clearly identified and he/it shall assume all obligations under the contract and provide such comfort letter/guarantees as may be required by Owner. The guarantees shall cover inter alia the commitment of the member/ promoter to complete the entire work in all respects and in a timely fashion, being bound by all the obligations under the contract, an undertaking to provide all necessary technical and financial support to the JV to ensure completion of the contract when awarded, an undertaking not to withdraw from the JV till completion of the work, etc.
   c. In case the bidder(s) is/are a consortium (including an unincorporated JV), then the following conditions shall apply:
      I. Each member in a consortium may only be a legal entity and not an individual person;
      II. The Bid shall specifically identify and describe each member of the

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consortium;

III. the consortium member descriptions shall indicate what type of legal entity the member is and its jurisdiction of incorporation (or of establishment as a legal entity other than as a corporation) and provide evidence by a copy of the articles of incorporation (or equivalent documents);

IV. One participant member of the consortium shall be identified as the "Prime member" and contracting entity for the consortium;

V. This prime member shall be solely responsible for all aspects of the Bid/ Proposal including the execution of all tasks and performance of all consortium obligations;

VI. The prime member shall fulfill each eligibility criteria;

VII. a commitment shall be given from each of the consortium members in the form of a letter signed by a duly authorized officer clearly identifying the role of the member in the Bid and the member's commitment to perform all relevant tasks and obligations in support of the

VIII. Prime/lead member of the Consortium and a commitment not to withdraw from the consortium;

IX. No change shall be permitted in the number, nature or share holding pattern of the Consortium members after pre-qualification, without the prior written permission of the Owner.

X. No change in project plans, timetables or pricing will be permitted as a consequence of any withdrawal or failure to perform by a consortium member;

XI. No consortium member shall hold less than 25% stake in a consortium;

XII. Entities which are affiliates of one another are allowed to bid either as a sole bidder or as a consortium only;

XIII. Any person or entity can bid either singly or as a member of only one consortium.

d. In case the bidder is an Indian arm (subsidiary, authorized agent, branch office or affiliate) of a foreign bidder, then the foreign bidder shall have to full fill each eligibility criteria. If such foreign company desires that the contract be entered into with the Indian arm, then a proper back to back continuing (parent company) guarantee shall be provided by the foreign company clearly stating that in case of any failure of any supply or performance of the equipment, machinery, material or plant or completion of the work in all respects and as per the warranties/ guarantees that may have been given, then the foreign company shall assume all obligations under the contract. Towards this purpose, it shall provide such comfort letter/guarantees as may be required by Owner. The guarantees shall cover inter alia the commitment of the foreign company to complete the entire

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work in all respects and in a timely fashion, being bound by all the obligations under the contract, an undertaking to provide all necessary technical and financial support to the Indian arm or to render the same themselves so as to ensure completion of the contract when awarded, an undertaking not to withdraw from the contract till completion of the work, etc.

CHAPTER 4: PERFORMANCE OF WORK

1. EXECUTION OF WORKS:
    a. All the works shall be executed in strict conformity with the provisions of the contract documents and with such explanatory detailed drawings, specifications, and instructions as may be furnished from time to time to the contractor by the Engineer-in-Charge whether mentioned in the contract or not. The contractor shall be responsible for ensuring that works throughout are executed in the most substantial, proper and workman like manner with the quality of material and workmanship in strict accordance with the specifications following all safety requirements of DAFFPL and as stipulated in work permits as per the directions and to the entire satisfaction of the Engineer-in-Charge.
    b. Wherever it is mentioned in the specifications that the Contractor shall perform certain work or provide certain facilities/materials, it is understood that the contractor shall do, so at his cost unless otherwise specified.
    c. The materials, design and workmanship shall satisfy the relevant Indian Standards, the Job specification contained herein and codes referred to. Where the job specification stipulate requirements in addition to those contained in the standards codes and specifications, these additional requirements shall also be satisfied.

2. COORDINATION AND INSPECTION OF WORK:
    The coordination and inspection of the day-to-day work under the contract shall be the responsibility of the Engineer-in-Charge. The written instructions regarding any particular job will be normally be passed by the Engineer-in-Charge or his authorized representative. A work order book / logbook will be maintained by the Contractor for each job in which the aforesaid written instructions will be entered. These will be signed by the contractor or his authorized representative by way of acknowledgment within 12 hours. The non-maintaining of the order book or non-signing by the contractor shall not preclude the contractor from complying with the instructions.

3. WORK IN MONSOON AND DEWATERING:
    a. The completion of the work may entail working in the monsoon also. The contractor must maintain a minimum labour force as may be required for the job and plan and execute the construction and erection according to the

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prescribed schedule. No extra rate will be considered for such work in monsoon.

b. During monsoon and other period, it shall be the responsibility of the contractor to keep the construction work site free from water at his own cost.

4. WORK ON SUNDAYS AND HOLIDAYS:
For carrying out work on Sundays and Holidays if needed, the contractor will approach the Engineer-in-Charge or his representative at least two days in advance and obtain permission in writing. No special compensation on this account will be payable.

5. GENERAL CONDITIONS FOR CONSTRUCTION AND ERECTION WORK:
   a. Place of Work: The work has to be executed at specified premises as per the tender. Contractor should apprise himself of all the conditions prevailing in such location and the restrictions placed on movement of personnel and equipment, types of equipment and tools permitted, working methods allowed etc. in the light of security and safety regulations operative in the area. The safety regulations to be complied with, by the contractor will also be provided along with the tender. No idle time wages or compensation for temporary stoppage of work or restrictions would be paid, and the rate quoted for the various items of work should cover the cost of all such contingencies and eventualities. Substantial structures and utilities exist both above ground and underground, adjacent to the work site. (The construction activity gets restrained by the existence of such structures and utilities). Special care is necessary in transportation, storage, working on equipment's and other construction activities to protect the existing features and prevent damage to any facility. Necessary protective structures barricades etc. have to be erected at various places as directed by Engineer-in-Charge. No extra payment of such protective works will be made unless specially provided in the tender.
   b. The working time or the time of work is 48 hours per week normally. Overtime work is permitted in cases of need and the Owner will not compensate the same. Shift working at 2 or 3 shifts per day may become necessary and the contractor should take this aspect into consideration for formulating his rates for quotation. No extra claims will be entertained by the Owner on this account.
   c. The contractor must arrange for the placement of workers in such a way that the delayed completing of the work or any part thereof for any reasons whatsoever will not affect their proper employment. The Owner will not entertain any claim for idle time payment whatsoever.
   d. The contractor shall submit to the Owner reports at regular intervals regarding the state and progress of work. The details and preforma of the report will mutually be agreed after the award of contract.

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6. DRAWINGS TO BE SUPPLIED BY THE OWNER:
    a. Where drawings are attached with tender, these shall be for the general guidance of the contractor to enable him to visualize the type of work contemplated and scope of work involved. The contractor will be deemed to have studied the drawings and formed an idea about the work involved.
    b. Detailed working drawings on the basis of which actual execution of the work is to proceed will be furnished from time to time during the progress of the work. The contractor shall be deemed to have gone through the drawings supplied to him thoroughly and carefully and in conjunction with all other connected drawings and bring to the notice of the Engineer-in-Charge, discrepancies, if any, therein before actually carrying out the work.
    c. Copies of all detailed working drawings relating to the works shall be kept at the contractor's office of the site and shall be made available to the Engineer-in-Charge at any time during the contract. The drawings and other documents issued by the Owner shall be returned to the Owner on completion of the works.

7. SETTING OUT WORKS:
    a. The Engineer-in-Charge shall furnish the contractor with only the four corners of the work site and a level bench mark and the contractor shall set out the works and shall provide efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.
    b. The contractor shall provide, fix and be responsible for the maintenance of all stacks, templates, level marks, profiles and other similar things and shall take all necessary precaution to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the contractor. The, work shall be set out to the satisfaction of the Engineer-in-Charge. The approval thereof or joining in setting out the work shall not relieve the contractor of any of his responsibilities.
    c. Before beginning the works, the contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboos, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme, for bearing marks acceptable to the Engineer-in-Charge. The centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct marks at the centre to enable theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-Charge in writing but such approval shall not relieve the contractor of any of his responsibilities.

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The contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction.

d. Pillars bearing geodetic marks located at the site of work under construction should be protected and fenced by the contractor.
e. On completion of works, the contractor must submit the geodetic documents according to which the work was carried out.

8. RESPONSIBILITY FOR LEVEL AND ALIGNMENT:
The contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectually any errors or imperfections therein. Such rectifications shall be carried out by the contractor, at his own cost, when instructions are issued to that effect by the Engineer-in-Charge.

9. MATERIALS TO BE SUPPLIED BY CONTRACTOR:
   a. The contractor shall procure and provide the whole of the materials required for construction including tools, tackles, construction plant and equipment for the completion and maintenance of the works except the materials which will be issued by Owner and shall make his own arrangement for procuring such materials and for the transport thereof. The materials procured by the contractor shall be DAFFPL approved/specified quality.
   b. All materials procured should meet the specifications given in the tender document. The Engineer-in-Charge may, at his discretion, ask for samples and test certificates for any batch of any material procured. Before procuring, the contractor should get the approval of Engineer-in-Charge for any material to be used for the works.
   c. Manufacturer's certificate shall be submitted for all materials supplied by the contractor. If, however, in the opinion of the Engineer-in-Charge any tests are required to be conducted on the materials supplied by the contractor, these will be arranged by the contractor promptly at his own cost.

10. MATERIALS SUPPLIED BY OWNER:
   a. If the specifications of the work provides for the use of any materials of special description to be supplied from the Owner's stores, price for such material to be charged therefore as herein after mentioned being so far as practicable for the convenience of the contractor but not so as in any way to control the meaning or effect of the contract. The contractor shall be bound to purchase and shall be supplied such materials as are from time to time required to be used by him for the purpose of the contract only. The sums due from the contractor for the value of the actual materials supplied by the Owner will be recovered from the running account bill on the basis of the actual consumption of materials in the work covered and for which the running account bill has been prepared. After the completion of the works,

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however, the contractor has to account for the full quantity of materials supplied to him as per relevant clauses in this document.

b. The value of the materials as may be supplied to the contractor by the Owner will be debited to the contractor's account at the rates shown in the schedule of chargeable materials and if they are not entered in the schedule, they will be debited at cost price, which for the purpose of the contract shall include the cost of carriage and all other expenses whatsoever such as normal storage supervision charges which shall have been incurred in obtaining the same at the Owner's stores. All materials so supplied to the contractor shall remain the absolute property of the Owner and shall not be removed on any account from the site of the work, and shall be at all times open for inspection to the Engineer-in-Charge. Any such materials remaining unused at the time of completion or termination of the contract shall be returned to the Owner's stores or at a place as directed by the Engineer-in- Charge in perfectly good condition, at contractor's cost.

11. CONDITIONS FOR ISSUE OF MATERIALS:

a. Materials specified to be issued by the Owner will be supplied to the contractor by the Owner from his stores/location. It shall be the responsibility of the contractor to take delivery of the materials and arrange for its loading, transport and unloading at the site of work at his own cost. The materials shall be issued between the working hours and as per the rules of the Owner framed from time to time.

b. The contractor shall bear all incidental charges for the storage and safe custody of materials at site after these have been issued to him.

c. Materials specified to be issued by the Owner shall be issued in standard sizes as obtained from the manufacturer.

d. The contractor shall construct suitable godown at the site of work for storing the materials safe against damage by rain, dampness, fire, theft etc. He shall also employ necessary watch and ward establishment for the purpose.

e. It shall be duty of the contractor to inspect the material supplied to him at the time of taking delivery and satisfy himself that they are in good condition. After the materials have been delivered by the Owner, it shall be the responsibility of the contractor to keep them in good condition and if the materials are damaged or lost, at any time, they shall be repaired and/ or replaced by him at his own cost, according to the directions of the Engineer-in-Charge.

f. The Owner shall not be liable for delay in supply or non-supply of any materials which the Owner has undertaken to supply where such failure or delay is due to natural calamities, act of enemies, transport and procurement difficulties and any circumstances beyond the control of the Owner. In no case, the contractor shall be entitled to claim any compensation or loss suffered by him on this account.

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g. It shall be the responsibility of the contractor to arrange in time all materials required for the works other than those to be supplied by the Owner. If, however, in the opinion of the Engineer-in-Charge the execution of the work is likely to be delayed due to the contractor's inability to make arrangements for supply of materials which normally he has to arrange for, the Engineer-in-Charge shall have the right, at his own discretion, to Issue such materials If available with the Owner or procure the materials from the market or elsewhere and the contractor will be bound to take such materials at the rates decided by the Engineer-in-Charge. This, however, does not in any way absolve the contractor from responsibility of making arrangements for the supply of such materials in part or in full, should such a situation occur, nor shall this, constitute a reason for the delay in the execution of the work.

h. None of the materials supplied to the contractor will be utilized by the contractor for manufacturing item, which can be obtained from standard manufacturer in finished form.

i. The contractor shall, if desired by the Engineer-in-Charge, be required to execute an indemnity bond for safe custody and accounting of all materials issued by the Owner.

j. The contractor shall furnish to the Engineer-in-Charge sufficiently in advance a statement showing his requirements of the quantities of the materials to be supplied by the Owner and the time when the same will be required by him for the works, so as to enable the Engineer-in-Charge to make necessary arrangement for procurement and supply of the material.

k. A daily account of the materials issued by the Owner shall be maintained by the contractor indicating the daily receipt, consumption and balance in hand. This account shall be maintained in a manner prescribed by the Engineer-in-Charge along with all connected papers viz. requisition, issues etc. and shall be always available for inspection in the contractor's office at site.

l. The contractor should see that only the required quantities of materials are got issued. The contractor shall not be entitled to cartage and incidental charges for returning the surplus materials, if any, to the stores/location where from they were issued or to the place as directed by the Engineer-in-Charge.

m. Materials/ Equipment supplied by Owner shall not be utilized for any other purpose(s) than issued for.

12. MATERIALS PROCURED WITH ASSISTANCE OF OWNER:

Notwithstanding anything contained to the contrary in any or all the clause of this document where any materials for the execution of the contract are procured with the assistance of Owner either by issue from Owner's stock or purchase made under orders or permits or licences issued by Government, the contractor shall hold the said materials as trustee for the Owner and use such materials economically and solely for the purpose of the contract and not dispose them off without the permission of the owner and return, if required by the Engineer-in-Charge, all

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surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason, whatsoever on his being paid or credited such prices as the Engineer in-Charge shall determine having due regard to the condition of the materials. The price allowed to the contractor however, shall not exceed the amount charged to him excluding the storage charges if any. The decision of the Engineer-in- Charge shall be final and conclusive in such matters. In the event of breach of the aforesaid condition, the contractor shall in terms of the licenses or permits, and/or for criminal breach of trust, be liable to compensate the Owner a double rate or high rate, in the event of those materials at that time having higher rate or not being available in the market, then any other rate to be determined by the Engineer-in-Charge and his decision shall be final and conclusive.

13. MATERIALS OBTAINED FROM DISMANTLING:
    If the contractor in the course of execution of the work is called upon to dismantle any part for reasons other than those stipulated in clauses 64 & 68 hereunder, the materials obtained in the work of dismantling etc. will be considered as the Owner's property and will be disposed off to the best advantage of the Owner.

14. ARTICLES OF VALUE FOUND:
    All gold, silver and other materials, of any description and all precious stones, coins, treasure relies, antiquities and other similar things which shall be found in, under or upon the site, shall be property of the Owner and the contractor shall duly preserve the same to the satisfaction of the Engineer-in-Charge and shall from time to time deliver the same to such person or person indicated by the Owner.

15. DISCREPANCIES BETWEEN INSTRUCTIONS:
    Should any discrepancy occur between the various instructions furnished to the contractor, his agents or staff or any doubt, arise as to the meaning of any such instructions or should there be any misunderstanding between the contractor's staff and the Engineer-in-Charge's staff, the contractor shall refer the matter immediately in writing to the Engineer-in-Charge whose decision thereon shall be final and conclusive and no claim for losses alleged to have been caused by such discrepancies between instructions, or doubts, or misunderstanding shall in any event be admissible.

16. ALTERATIONS IN SPECIFICATIONS AND DESIGNS AND EXTRA WORK:
    a. The Engineer-in-Charge shall have power to make any alterations in, omissions from, additions to of substitutions for, the schedule of rates, the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out such altered / extra / new items of work in accordance with any instructions which may be given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall not invalidate the contract and any altered

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additional or substituted work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respect on which he agree to do the main work. The time for completion of work may be extended for the part of the particular job at the discretions of the Engineer-in-Charge, for only such alteration, additions or substitutions of the work, as he may consider as just and reasonable. The rates for such additional, altered or substituted work under this clause shall be worked out in accordance with the following provisions:

- If the rates for the additional, altered or substituted work are specified in the contract for the work, the contractor is bound to carry out the additional, altered or substituted work at the same rates as are specified in the contract.
- If the rates for the additional, altered or substituted work are not specifically provided in the contract for the work, the rates will be derived from the rates for similar class of works as specified in the contract for the work. The opinion of the Engineer-in-Charge as to whether the rates can be reasonably so derived from items in the contracts will be final and binding on the contractor.
- If the rates for the altered, additional or substituted work cannot be determined in the manner specified in sub-clause (a) and (b) above, then the contractor shall inform the Engineer-in-Charge of the rate which is his intension to charge for such class of work supported by analysis of the rate or rates claimed, and the Engineer-in-Charge shall determine the rates on the basis of the prevailing market rates of materials, labour cost at schedule of labour plus 10% to cover contractor's supervision, overheads and profit and pay the contractor accordingly. The opinion of the Engineer-in-Charge as to the current market rates of materials and the quantum of labour involved per unit of measurement will be final and binding on the contractor.
- Provisions, contained in sub-clause mentioned above shall not, however, apply: Where the value of alterations / additions / deletions or substitutions exceeds beyond plus or minus 25% of the estimated contract value (i.e. quoted item rates of contractor shall hold good for variations etc. within plus or minus 25% of estimated contract value)

b. In the event and as a result of such alternatives / additions / substitutions / deletion, the scope of contract work exceed the value stipulated in the contract by more than the limits given in clause above, the Contractor shall claim revision of the rates supported by the proper analysis in respect of such items for quantities in excess of the above limits, notwithstanding the fact that the rates for such items exist in the tender for the main work or can be derived in accordance with the provision of sub-clause (b) of Clause 61 A, and the Engineer-in-Charge may revise their rates having regard to the prevailing

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market rates, and the contractor shall be paid in accordance with the rates so fixed. But, under no circumstances the contractor shall suspend / stop / slowdown the work on the plea of non-settlement of rates of items falling under this clause.

17. ACTION WHERE NO SPECIFICATIONS ISSUED:
In case of any class of work for which there is no such specification given by the Owner in the tender documents, such work shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same the work should be carried out as per standard Engineering Practice subject to the approval of the Engineer-in-Charge.

18. ABNORMAL RATES:
The contractor is expected to quote rate for each item after analysis of cost involved for the completion of item/work, considering all specifications and conditions of contract. This will avoid loss of profit or gain, in case of curtailment or change of specification for any item. In case it is noticed that the rates for any item, quoted by the tenderer unusually are high or unusually low it will be sufficient cause for the rejection of the tender unless the Owner is convinced about the reasonableness of the rates on scrutiny of the analysis for such rate to be furnished by the tenderer on demand.

19. INSPECTION OF WORK:
    a. The Engineer-in-Charge will have full power and authority to inspect the works at any time wherever in progress either on the Site or at the contractor's premises / workshop where situated premises /workshops of any person, firm or corporation where work in connect with the contract may be in hand or where materials are being or are to be supplied, and the contractor shall afford or procure for the Engineer-in-Charge every facility and assistance to carry out such Inspection. The contractor shall at all time during the usual working hours and at all other time for which reasonable notice of the intention of the Engineer in-Charge or his representative to visit the works have been given to the contractor, either himself be present to receive order and instructions or post a responsible agent duly accredited in writing for the 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. The contractor shall give not less than seven days, notice in writing to the Engineer-in-Charge before covering up or placing any work beyond reach of inspection and measurement any work in order that the same may be inspected and measured. In the event of breach of above the same shall be uncovered at contractor's expense carrying out such measurement or inspection.
    b. No materials shall be dispatched by the contractor before obtaining the approval of Engineer-in-Charge in writing. The contractor is to provide at all

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times during the progress of the work and the maintenance period, proper means of access with ladders, gangways, etc. and the necessary attendance to move and adopt as directed for inspection or measurement of the works by the Engine in-Charge.

20. ASSISTANCE TO THE ENGINEERS:
The contractor shall make available to the Engineer-in-Charge, free of cost necessary instruments and assistance in checking of setting out of works and taking measurement of work.

21. TESTS FOR QUALITY OF WORKS:
a. All workmanship shall be of the respective kinds described in the contract documents and in accordance with the instructions of the Engineer-in-Charge and shall be subjected from time to time to such test at contractor's cost as the Engineer-in-Charge may direct at place of manufacture or fabrication or on the site or at all or any such places. The contractor shall provide assistance, instruments, labour and materials as are normally required for examining, measuring and testing any workmanship as may be selected and required the Engineer-in-Charge.
b. All the tests necessary in connection with the execution of the work as decided by Engineer-in-Charge shall be carried out at the field testing laboratory of the Owner by paying the charges as decided by the Owner from time to time. In case of non-availability of test facility with the Owner, the required test shall be carried out at the cost of contractor at government or any other testing laboratory as directed by Engineer-in-Charge.
c. If any tests are required to be carried out in connection with the work or materials workmanship not supplied by the contractor, such tests shall be carried out by the contractor as per the instructions of Engineer-in-Charge and cost of such tests shall be reimbursed by the Owner.

22. SAMPLES:
The contractor shall furnish to the Engineer-in-Charge for approval when requested or if required by the specifications, adequate samples of all materials and finishes to be used in the work. Such samples shall be submitted before the work is commenced and in ample time to permit tests and examinations thereof. All materials furnished and finishing applied in actual work shall be fully identical to the approval samples.

23. ACTION AND COMPENSATION IN CASE OF BAD WORK:
If it shall appear to the Engineer-in-Charge that any work has been executed with unsound, imperfect or unskilled workmanship or with materials of any inferior description, or that any materials or articles provided by the contractor for the execution of the work are unsound or of a quality inferior to that contracted for, or otherwise not in accordance with the contract, the contractor shall on demand in writing from the Engineer-in-Charge or his authorized representative, specifying the

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work, materials or articles complained of, notwithstanding that the same have been inadvertently passed, certified and paid for forthwith shall rectify or remove and reconstruct the works specified and provide other proper and suitable materials or articles at his own charge and cost, and in the event of failure to do so within a period to be specified by the Engineer-in-Charge in his demand aforesaid, the contractor shall be liable to pay compensation at the rate of 0.5% of the estimated cost of the whole work, for every week limited to a maximum of 10% of the estimated cost of the whole work, while his failure to do so shall continue and in the case of any such failure the Engineer-in-Charge may on expiry of notice period rectify or remove and re-execute the work or remove and replace with others, the materials or articles complained of as the case may be at the risk and expenses of the contractors in all respects. The decision of the Engineer-in-Charge as to any question arising under this clause shall be final and conclusive.

24. SUSPENSION OF WORKS:

The contractor shall, if ordered in writing by the Engineer-in-Charge or his representative, temporarily suspend the works or any part thereof for such period and such time as so ordered and shall not, after receiving such written order, proceed with the work therein ordered to be suspended, until he shall have received a written order to proceed therewith. The contractor shall not be entitled to claim/ compensation for any loss or damage sustained by him by reason of temporary suspension of the works aforesaid. An extension of time for completion, corresponding with the delay caused by any such suspension of the works as aforesaid will be granted to the contractor, should he apply for the same, provided that suspension was not consequent to any default or failure on the part of the contractor.

25. OWNER MAY DO PART OF WORK:

Upon failure of the contractor to comply with any instructions given in accordance with the provisions of the contract, the owner has the alternative right, instead of assuming charge for entire work to place additional labour force, tools, equipments and materials on such parts of the work, as the owner may designate or also engage another contractor to carry out the work. In such cases, the owner shall deduct from the amount which otherwise might become due to the contractor, the cost of such work and materials with ten percent added to cover all departmental charges and should the total amount thereof exceed the amount due to the contractor, the contractor shall pay the difference to the owner.

26. POSSESSION PRIOR TO COMPLETION:

The Engineer-in-Charge shall have the right to take possession of or use any completed or partially completed work or part of the work. Such possessions or use shall not be deemed to be an acceptance of any work completed in accordance with the contract agreement. If such prior possession or use by the Engineer-in-Charge

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delays the progress of work, suitable adjustment in the time of completion will made and contract agreement shall be deemed to be modified accordingly.

27. PERIOD OF LIABILITY FROM THE DATE OF COMPLETION OF WORK:

a. The contractor shall guarantee the installation/site work for a period of 12 (twelve) Months from the date of completion of work, unless otherwise specified. Any damage that may lie undiscovered at the time of issue of completion certificate, connected in any way with the equipment or materials supplied by him or in the workmanship shall be rectified or replaced by the contractor at his own expense as deemed necessary by the Engineer-in-Charge or in default, the Engineer-in-Charge may cause the same made good by other workmen and deduct expenses (for which the certificate of Engineer-in-Charge shall be final) from any sums that may be then or at any time thereafter, become due to the contractor or from his security deposit.

b. If the contractor feels that any variation in work or in quality of materials or proportions would be beneficial or necessary to fulfill the guarantee called for, he shall bring this to the notice of the Engineer-in-Charge in writing. The work will not be considered as complete and taken over by the Owner until all the temporary works etc., constructed by the contractor is removed and work site cleaned to the satisfaction of Engineer-in-Charge.

c. Care of Works:
From the commencement to completion of works, the contractor shall take full responsibility for the care of all works including all temporary works, and in case any damage, loss or injury happens to the works or to any part thereof or to any temporary work, from any cause whatsoever, he shall at own cost repair and make good the same, so that at completion, the work shall be in good order and in conformity in every respect with the requirements of the contract and the Engineer-in-Charge's instructions.

d. Effects prior to taking over: If at any time, before the work is taken over, the Engineer-in-Charge shall

- Decide that any work done or materials used by the contractor or any sub-contractor is defective or not in accordance with the contract or that the works or any portion thereof are defective or do not fulfill the requirements of contract (all such matters being herein after called 'Defects' in this clause) and
- As soon as reasonably practicable, notice given to the contractor in writing of the said decisions specifying particulars of the defects alleged to exist or to have occurred, then the contractor shall at his own expenses and with all speed make good the defects so specified. In the case contractor shall fail to do so, the Owner may take, at the cost of the contractor, such steps as may in all circumstances, be reasonable to make good such defects. The expenditure, so incurred by the Owner shall be recovered from the amount due to the contractor. The decision of the Engineer-in-Charge with regard to the

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amount be recovered from the contractor will be final and binding on the contractor. As soon as the works have been completed in accordance with the contract and have passed the tests on completion, the Engineer-in-Charge shall issue a certificate (hereinafter called completion certificate) in which he shall certify the date on which the work have been so completed and have passed the said tests and the Owner shall be deemed to have taken over the works on the date so certified. If the works have been divided into various groups in the contract, the Owner shall be entitled to take over any group or groups before the other or others and thereupon the Engineer-in-Charge shall issue a completion certificate which will however, be for such group or groups as taken over only.

e. Defects after taking over: In order that the contractor could obtain a completion certificate, he shall make good with all possible speed, any defect arising from the defective materials supplied by the Contractor or workmanship or any act of omission of the contract that may have been noticed or developed after the works or group of the works has been taken over. The period allowed for carrying out such work will be normally one month. If any defect be not remedied within a reasonable time, the Owner may proceed to do the work at the contractor's risk and expense and deduct from the final bill such amount as may be decided by the Owner. If by reason of any default on the part of the contractor a completion certificate has not been issued in respect of every portion of the work within one month after the date fixed by the contract for the completion of the works, the Owner shall be at his liberty to use the works or any portion thereof in respect of which a completion certificate has been issued provided that the works or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completing these works for the issue of completion certificate.

f. The Security Deposit/retention money deducted / furnished shall be retained for the period of liability as given in clause above. This Retention amount or Bank Guarantee furnished against Security Deposit/retention money shall be released only on expiry of the period of liability and also based on the certification of the Engineer-in-charge that no defect/damage has been reported / observed during the stipulated period of liability for the contract.

g. Performance of contractor shall be evaluated on each job by Engineer-in-Charge and recorded. Review of performance will be carried out at appropriate intervals by DAFFPL.

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CHAPTER 5: GENERAL TERMS & CONDITIONS:

1. General:
   The materials and workmanship shall satisfy the relevant Indian Standards, the job specifications contained herein & codes referred to. Where the job specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.

   In the absence of any standard / specification / codes of practice for detailed specifications covering any part of the work covered in this tender document, the instruction / direction of consultant engineer will be binding on the contractor.

   Wherever it is stated in this tender document that a particular supply is to be effected or that a particular work is to be carried out, it shall be understood that the same shall be affected / carried out by the contractor at his cost, unless a different intention is specifically and expressly stated herein or otherwise explicit from the context.

2. Construction Program:
   A detailed bar chart showing various activities shall be prepared by the tenderers. The work shall be executed strictly as per the agreed time schedule. The period of completion shall include, the time required for mobilization and testing as well as rectification, if any, testing & completion in all respects to the entire satisfaction of the consultant.

   A joint programme of execution programme shall be prepared by the contractor.

   Monthly / weekly construction programme shall be made by the contractor. The contractor shall scrupulously adhere to these targets / programme by deploying adequate personal and construction tools and tackles. He shall also supply all materials in his scope of supply in time to achieve the targets set out in the weekly and the monthly programme.

   The contractor shall give every day, a report on labour and equipment deployed along with the progress of the work done on previous day, for each category of work.

3. Construction Water and Power:

   - ✓ Electricity will be provided by DAFFPL @ Rs. 14.50 per Unit.
   - ✓ Water for construction will not be provided by DAFFPL.

4. Safety Rules and Regulations:
   All Safety rules and regulations of the terminal operator have to be followed by the

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contractor without fail. If any damage occurs due to negligence of safety, contractor will be held responsible for the same.

5. Tests and Inspection:
   The contractor shall carry out the various tests as enumerated in the technical specifications of this tender document and the technical documents that will be furnished to him during the performance of the work. No separate payment shall be made.

   The contractor shall carry out at his cost, all the tests either on the field or through external institutions / laboratories, concerning the execution of the work and supply of materials by the contractor.

   Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at this own cost. Results of all inspection & tests shall be recorded in the inspection reports, test reports, etc., which will be approved by the Engineer-in-charge. These reports shall form part of the completion documents.

   Inspection & Acceptance of works shall not relieve the contractor from any of his responsibilities under this contract.

6. Site Cleaning:
   The contractor shall take care to clean the working site from time to time for easy access to work site and for safety. Working site should be always kept cleared to the entire satisfaction of DAFFPL.

   Before handing over any work to the owner, the contractor in addition to other formalities to be observed as detailed in the document shall clear the site to the entire satisfaction of DAFFPL.

7. Coordination with other Agencies:
   Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the contractor. Proper coordination with other agencies will be the responsibility of the contractor. In case of any dispute, the decision of Engineer-in-charge shall be final and binding on the contractor.

8. DAFFPL reserves the right to accept any tender in whole and reject any or all tenders without assigning any reason. DAFFPL also reserves the right to allow public enterprises (Central/State) Price / purchase /contract / service preference as admissible under the Indian Government Policy.

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9. BID PRICES:
    a) Prices shall be furnished strictly in the Price Bid format of the tender document.
    b) Bidder should quote their lowest and best offered price. Prices so quoted will remain firm till satisfactory completion of order. The price will not be subjected to escalation for any reason whatsoever.
    c) Bidders quoted prices shall be deemed to include entire Specification of item and all obligations and responsibilities to be carried out / executed by the Bidder as per terms of tender document. It is clearly understood by the Vendor that it is for the Vendor to ascertain and assess the applicable Acts/ Regulations/ Laws etc., entirely of their own. It is also for the Vendor to ascertain and assess the applicability of taxes, duties, levies etc. In case of any difference of opinion between Vendors proposal and interpretation by any tax/assessing (or similar) authorities, on the rate or terms and conditions related to taxes and duties etc., owners liability shall be strictly as per terms/provisions of the contract based on tender document and Vendors offer.
    d) No other charges accept those mentioned in the tender document will be payable to vendor.

10. The materials should be properly packed so as to withstand all transit hazards. Materials are required to be dispatched by the vendor to the locations, on freight paid DOOR- DELIVERY CONSIGNEE COPY ATTACHED basis along with copies of Inspection release note & internal test certificates & other documents as mentioned elsewhere in this tender document.

11. All shipment shall be under deck unless carriage on deck is unavoidable.

12. Bidder to note that Special Packaging Requirement as in technical specifications of this tender. The materials should be properly packed so as to withstand all transit hazards (both ocean & inland transit).

13. Indian agent Commission will not be paid by the owner.

14. TAXES & DUTIES:
    a) Bidder(s) quoted prices shall be exclusive of all taxes, duties, cess, levies etc.,
    b) The invoice should clearly mentioned that applicable Excise Duty, Education Cess or any other taxes charged and paid / payable on quoted item to enable the owner to claim MODVAT / Input credit.
    c) The statutory variation in Excise duty, Education Cess and Sales tax / VAT on finished goods and introduction of new tax, from bid due date till the contractual completion period shall be to owner account against submission of the documentary evidence. However, any increase in the rate of these

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taxes and duties beyond the contractual delivery period shall be to Seller account. Any decrease in the rate of these taxes and duties shall be passed on to the owner. Any additional excise duty due to increase in turn-over would be to seller account.

d) It is for the Bidder to assess and ascertain the rate of excise duty, education Cess and sales tax/VAT applicable on quoted items. It is clearly understood that Owner will not have any additional liability towards payment of Excise Duty, Education Cess, GST and Sales Tax/VAT which is based on Bidders wrong assessment / interpretation of applicability of such Excise Duty and/or education cess and / or Sales Tax/VAT.
e) Successful bidder shall carry out its obligations towards services at site as mentioned in technical specifications without any extra charges.
f) Octroi/Entry tax, if any, in the any state of India shall be directly paid by the vendor, if applicable.
g) DAFFPL shall not be liable, in case the tax authorities assess the tax elements in a different way on account of any reason, whatsoever.
h) Taxes and duties other than those specified in this document, if any, shall be included in the quoted prices and no separate reimbursement shall be made by DAFFPL.

15. Income Tax / Corporate Tax :

a) As regards Income Tax, Surcharge on Income Tax or any other Corporate Tax payable by the Bidder for reason of the contract awarded, and / or on their expatriate personal, the Owner shall not bear any Tax liability whatsoever, irrespective of the mode of construction of contract / order. The Bidder shall be liable and responsible for payment of such tax, if attracted under the provision of Indian Income Tax Act.
b) Bidder may note that if any tax is deductible at source as per Indian Income Tax Law, the same will be so deducted before releasing any payment to the Bidder and a TDS (Tax deducted at source) certificate will be furnished to the Bidder.
c) Accordingly, Bidder shall have the responsibility to check and include such provision of taxes in the prices.
d) In case of delay in delivery due to reasons attributable to Bidder, any new or additional taxes or duties levied by Statutory authorities during this period shall be borne by the Bidder.

16. EMD / BID SECURITY

a) The bidder shall furnish, as part of his bid, a bid security in original for the amount specified in the tender document by way of pay order, bank guarantee on Rs.100/-value non-judicial stamp paper or demand draft.
b) The bid security is required to protect the Owner against the risk of Bidders conduct, which would warrant the security forfeiture.
c) If bid Security / EMD is in the form of bank guarantee, it shall be in the form

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of irrevocable bank guarantee (in the format attached) issued by any Indian Scheduled Bank (other than Co-operative Bank) will be accepted.

d) Bid Security / EMD shall be issued in favour of M/s Delhi Aviation Fuel Facility (P) Limited, New Delhi. .

e) Unsuccessful bidders bid security without any interest will be discharged/ returned as promptly as possible, but not later than 60 days after the expiry of the period of bid validity prescribed by the Owner.

f) The successful bidder bid security without any interest will be discharged, upon the Bidder accepting the Contract/ Purchase Order and furnishing the Contract performance bank guarantee to DAFFPL.

g) The bid security may be forfeited:
   i. If a bidder withdraws his bid during the period of bid validity or
   ii. In the case of a successful bidder, if the bidder fails or refuses to:
      - Accept the Purchase Order in accordance with agreed terms and conditions.
      - Furnish Contract performance bank guarantee as per bid document/ Purchase Order.
   iii. Detection of submission of false / forged documents and fraud.

h) Bid Security / EMD should be in favour of "Delhi Aviation Fuel Facility Private Limited", payable at New Delhi and submitted to the relevant office of DAFFPL as mentioned in covering note of the tender document. Covering letter to bid Security / EMD must indicate the tender number. This is essential to have proper co-relation at a later date. The bid security / EMD shall be strictly in the form provided in the bid document before the due date & time of bid submission.

i) Central Public Sector Undertaking of Govt. Of India are exempted from furnishing the bid security. Firms registered with NSIC/ MSME are also exempted from furnishing bid security, provided they are registered for the tendered items and up to the monetary limit they intend to quote. Provided further that they submit a copy of the current and valid registration certificate for the quoted item and monetary value along with their bid(s). Owner reserves right to verify the registration certificate provided, with relevant authorities.

17. CONTRACT PERFORMANCE BANK GUARANTEE [CPBG]

a) As a Performance security, the successful Bidder, to whom the work is awarded by, shall be required to furnish within 30 days of notification of award of contract (Letter/ Fax/e-mail of Intent) a Performance Bank Guarantee on RS.100/- VALUE non-judicial stamp paper in favour of the Owner (M/S DAFFPL).

b) The Bank Guarantee amount shall be equal to TEN PERCENT (10%) of the

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Total Order Value and it shall guarantee the faithful performance of the Order in accordance with the Terms and conditions specified in the documents and specifications.

c) CPBG shall be in the form of an irrevocable Bank Guarantee (in the format attached) issued by any Indian Scheduled Bank (other than Co-operative Bank).
d) The Bank Guarantee shall be valid for the entire period of the Contract, namely, till the end of the guarantee / warranty period. The guarantee amount shall be payable on demand to the Owner.
e) In case, the Contract Performance Bank Guarantee stated above gets reduced/ deducted for reasons of non-fulfillment of any Contractual obligations upto the completion of guarantee period, the bidder shall immediately take action to increase the value of Bank Guarantee to TEN PERCENT (10%) of the Contract price, to cover his guarantee/warranty obligations.
f) The Performance Guarantee will be returned to the bidder without any interest at the end of the warranty / guarantee period subject to fulfillment of all contractual obligations by the Bidder. The bank guarantee shall have a claim period of 3 months beyond the contractual guarantee period.
g) The proceeds of performance security shall be appropriated by the owner as compensation for any loss resulting from vendor's failure to complete his obligations under the contract to the prejudice to any of the rights or remedies the owner may be entitled to as per terms and conditions of contract. The proceeds of this performance security shall also govern the successful performance of goods and services and vendors all obligations during the entire period of contractual warrantee / guarantee.

18. PRICE REDUCTION FOR DELAY IN DELIVERY:

a) The completion period quoted must be realistic & specific. The inability of successful bidder to execute orders in accordance with the agreed completion schedule will entitle DAFFPL, at its options, to:
b) Accept delayed delivery at prices reduced by a sum equivalent to half percent (0.5%) of the value of any goods/work not delivered for every week of delay or part thereof, limited to a maximum of 10% of the total order value. Date of completion of work shall be considered for calculation of price reduction
c) The price reduction clause shall become applicable for works done beyond the schedule completion period.

19. INSURANCE

Supplier shall carry and maintain any and all statutory insurance(s) required under Indian Laws and Regulations, including Workmen compensation Act/ESI/Third party liabilities etc. and insurances for their personnel engaged in performance of the work at their own cost.

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20. INSPECTION:

a) Material / construction shall be inspected by owner or its representative. Charges other than third party inspection, is entirely vendor responsibility and in no way should affect the completion schedule.
b) OWNER may, at its own expense, witness any test or inspection. In order to enable OWNER to witness the tests/inspections OWNER will advise the bidder in advance whether it intends to be present at any of the inspections.
c) Even if the inspection and tests are fully carried out, the Vendor shall not be absolved from its responsibilities to ensure that the Material(s), raw materials, components and other inputs are supplied strictly to conform and comply with all the requirements of the Contract at all stages, whether during manufacture and fabrication, or at the time of Delivery as on arrival at site and after its erection or start up or consumption, and during the defect liability period. The inspections and tests are merely intended to prima-facie satisfy OWNER that the Material(s) and the parts and components comply with the requirements of the Contract. The Vendor s responsibility shall also not be anywise reduced or discharged because OWNER or OWNER s representative(s) or Inspector(s) shall have examined, commented on the Vendor s drawings or specifications or shall have witnessed the tests or required any chemical or physical or other tests or shall have stamped or approved or certified any Material(s).
d) Although material approved by the Inspector(s), if on testing and inspection after receipt of the Material(s) at the location, any Material(s) are found not to be in strict conformity with the contractual requirements or specifications, OWNER shall have the right to reject the same and hold the Vendor liable for non-performance of the Contract.

21. GUARANTEE/WARRANTY:

a) Materials shall be guaranteed against manufacturing defects, materials, workmanship and design for a period of 12 months from the date of commissioning or 18 months from the date of dispatch whichever is later. Warranty for replacement of material / accessories should be provided free of charges at our premises. The above guarantee/warranty will be without prejudice to the certificate of inspection or material receipt note issued by us in respect of the materials.
b) All the materials including components and sub contracted items should be guaranteed by the vendor within the warranty period mentioned above. In the event of any defect in the material, the vendor will replace / repair the material at DAFFPL concerned location at vendor risk and cost on due notice.
c) Alternatively, DAFFPL reserves the right to have the material repaired / replaced at the locations concerned, at the vendors risk, cost and responsibility, in case, vendor does not replace / repair the material.
d) The Vendor shall provide similar warrantee on the parts, components, fittings, accessories etc. so repaired and / or replaced.

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e) Vendor shall guarantee that the performance of the EQUIPMENT supplied under the CONTRACT shall be strictly in conformity with the specifications and shall perform the duties specified under the CONTRACT.
f) RISK PURCHASE CLAUSE: We reserve the right to curtail or cancel the order either in full or part thereof if bidder fails to comply with delivery schedule and other terms & conditions of the order. DAFFPL also reserves the right to procure same or similar materials/equipment through other sources at vendor's entire risk, cost and consequences.

22. TEST & PERFORMANCE CERTIFICATES: Bidder shall furnish Material test and Performance Certificates for the materials along with the challans and invoice.

23. PAYMENT TERMS: Generally no payment shall be made for works estimated to cost less than Rs. 50,000/- till the whole of the work shall have been completed. But in case of works estimate to cost more than Rs. 50,000/- the contractor on submitting the bill thereof be entitled to receive a monthly payment proportion to the part thereof approved and passed by the Engineer-in-Charge, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor. This payment will be made after making necessary deductions as stipulated elsewhere in the contract document for materials, security deposit or any moneys due to the Owner etc.

STANDARD PAYMENT TERMS FOR WORKS CONTRACTS

The payment terms given below are subjected to the following conditions:

S. No.	DESCRIPTION	% PAYMENT
1	**PLATE WORK**	-
a	After fabrication & erection of plates.	30%
b	After welding of plates.	40%
c	After radiographic inspection & its acceptance.	10%
d	After hydrostatic testing and calibration.	10%
e	On completion of all works and in final bill.	10%
2	**APPURTENANCES**	-
a	After supply of materials at site incl. submission of test certificates as	50%

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	per requirement.	
b	After Installation of steel structural incl. erection & welding.	30%
c	After hydrostatic testing.	10%
d	On completion of all works	10%
3	**STEEL STRUCTURALS**	-
a	After supply of materials at site incl. submission of Test certificates as per requirement	60%
b	After fabrication, erection and completion of all welding	30%
c	On completion of all works.	10%
4	**GRIT BLASTING AND PAINTING**	-
a	After cleaning, surface preparation and application of first coat of primer.	50%
b	After application of further coats and of finish coats.	40%
c	On completion of all works and in final bill.	10%
5	**CIVIL WORKS**	-
a	On Completion of individual item of work	90%
b	On completion of all works.	10%
6	**FITTINGS**	-
a	After supply, installation and acceptance by site-in-charge	100%
7	Misc (Demolition)	-
a	After completion and clearing of site	100%

24. Only in the event of causes of Force Majeure occurring within the contractual delivery period and if they impede the performance of contract, the delivery dates shall be extended on receipt of application from the bidder / Owner without imposition of penalty. Only those causes which depend on natural calamities, civil wars, fire and national strikes which have duration of more than seven consecutive calendar days are considered the causes of force Majeure. The decision of Owner

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shall be final and binding on vendor.

25. The Vendor must advise the Owner by a registered letter duly certified by Local Chamber of Commerce or statutory authorities and Owner must advise the Vendor by a letter, the beginning and the end of the delay immediately, but in no case later than within 10 days of the beginning and end of such causes of Force Majeure condition as defined above. Provided further that if the performance in whole or part of any obligation under this contract is prevented or delayed by reason of any such event for period exceeding 60 days either party may at its option terminate the contract.

26. Repeat Order: DAFFPL reserves the right to place repeat order up to the order quantity within SIX MONTHS from the date of original order on mutual agreement basis.

27. Any reference to the Govt. Acts /Regulations etc. in the Bid Document is only indicative, and it is entirely for the bidder to ascertain the applicable Acts/Regulations.

28. Rejected material lying in Owner premises must be replaced within 60 days from date of final report on rejection of material.

29. RECOVERY OF SUMS DUE: Whenever, any claim against bidder for payment of a sum of money arises out of or under the contract or in any other form, the owner shall be entitled to recover such sums from any sum then due or when at any time thereafter may become due from the vendor under this or any other form and should this sum be not sufficient to cover the recoverable amount of claim(s), the vendor shall pay to DAFFPL on demand the balance remaining due.

30. PATENTS & ROYALTIES: The vendor shall fully indemnify owner and users of materials specified herein/supplied at all times, against any action, claim or demand, costs and expenses, arising from or incurred by reasons of any infringement or alleged infringement of any patent, registered design, trademark or name, copy right or any other protected rights in respect of any materials supplied or any arrangement, system or method of using, fixing or working used by the vendor. In the event of any claim or demand being made or action sought against Owner in respect of any of the aforesaid matter, the vendor shall be notified thereof immediately and the vendor shall at his/its own expense with (if necessary) the assistance of Owner (whose all expense shall be reimbursed by the vendor) conduct all negotiations for the settlement of the same and/or litigation which may arise thereof.

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31. LIABILITY CLAUSE: In case where it is necessary for employees or representatives of the Vendor to go upon the premises of owner, vendor agrees to assume the responsibility for the proper conduct of such employees/representatives while on said premises and to comply with all applicable Workmen s Compensation Law and other applicable Government Regulations and Ordinances and all plant rules and regulations particularly in regard to safety precautions and fire hazards. If this order requires vendor to furnish labour at site, such vendors workmen or employees shall under NO circumstances be deemed to be in owner s employment and vendor shall hold himself responsible for any claim or claims which they or their heirs, dependent or personal representatives, may have or make, for damages or compensation for anything done or committed to be done, in the course of carrying out the work covered by the purchase order, whether arising at owner s premises or elsewhere and agrees to indemnify the owner against any such claims, if made against the owner and all costs of proceedings, suit or actions which owner may incur or sustain in respect of the same.

32. COMPLIANCE OF REGULATIONS: Vendor warrants that all goods/Materials covered by this order have been produced, sold, dispatched, delivered and furnished in strict compliance with all applicable laws, regulations, labour agreement, working condition and technical codes and statutory requirements as applicable from time to time. The vendor shall ensure compliance with the above and shall indemnify owner against any actions, damages, costs and expenses of any failure to comply as aforesaid.

33. REJECTION, REMOVAL OF REJECTED GOODS AND REPLACEMENT: In case the testing and inspection at any stage by inspectors reveal that the equipment, materials and workmanship do not comply with specification and requirements, the same shall be removed by the vendor at his/its own expense and risk, within the time allowed by the owner. The owner shall be at liberty to dispose off such rejected goods in such manner as he may think appropriate. In the event the vendor fails to remove the rejected goods within the period as aforesaid, all expenses incurred by the owner for such disposal shall be to the account of the vendor. The freight paid by the owner, if any, on the inward journey of the rejected materials shall be reimbursed by the vendor to the owner before the rejected materials are removed by the vendor. The vendor will have to proceed with the replacement of the equipment or part of equipment without claiming any extra payment if so required by the owner. The time taken for replacement in such event will not be added to the contractual delivery period.

34. NON-WAIVER : Failure of the Owner to insist upon any of the terms or conditions incorporated in the Purchase Order or failure or delay to exercise any rights or remedies herein, or by law or failure to properly notify Vendor in the event of breach, or the acceptance of or payment of any goods hereunder or approval of design shall not release the Vendor and shall not be deemed a waiver of any right of the Owner to

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insist upon the strict performance thereof or of any of its or their rights or remedies as to any such goods regardless of when such goods are shipped, received or accepted nor shall any purported oral modification or revision of the order by DAFFPL act as waiver of the terms hereof. Any waiver to be effective must be in writing. Any lone incident of waiver of the any condition of this agreement by DAFFPL shall not be considered as a continuous waiver or waiver for other condition by DAFFPL.

35. NEW & UNUSED MATERIAL: All the material supplied by the vendor shall be branded new, unused and of recent manufacture.

36. CANCELLATION:
    a) DAFFPL reserves the right to cancel the contract/purchase order or any part thereof through a written notice to the vendor if –
        i. The vendor fails to comply with the terms of this purchase order/contract.
        ii. The vendor becomes bankrupt or goes into liquidation.
        iii. The vendor fails to deliver the goods on time and/or replace the rejected goods promptly.
        iv. The vendor makes a general assignment for the benefit of creditors.
        v. A receiver is appointed for any of the property owned by the vendor.
        vi. Any other conditions where owners commercial interest get affected.
    b) Upon receipt of the said cancellation notice, the vendor shall discontinue all work on the purchase order matters connected with it. DAFFPL in that event will be entitled to procure the requirement in the open market and recover excess payment over the vendor s agreed price if any, from the vendor and also reserving to itself the right to forfeit the security deposit if any, made by the vendor against the contract. The vendor is aware that the said goods are required by DAFFPL for the ultimate purpose of materials production and that non-delivery may cause loss of production and consequently loss of profit to the DAFFPL. In this-event of DAFFPL exercising the option to claim damages for non delivery other than by way of difference between the market price and the contract price, the vendor shall pay to DAFFPL, fair compensation to be agreed upon between DAFFPL and the vendor. The provision of this clause shall not prejudice the right of DAFFPL from invoking the provisions of price reduction clause mentioned aforesaid.

37. ANTI –COMPETITIVE AGREEMENTS/ABUSE OF DOMINANT POSITION : The Competition Act, 2002 as amended by the Competition (Amendment) Act, 2007 (the Act), prohibits anti- competitive laws and aims at fostering competition and at protecting Indian markets against anti- competitive practices by enterprises. The Act prohibits anti- competitive agreements, abuse of dominant position by enterprises, and regulates combinations (consisting of acquisition, acquiring of control and M&A) wherever such agreements, abuse or combination causes, or is likely to cause, appreciable adverse effect on competition in markets in India. DAFFPL reserves the

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right to approach the Competition Commission established under the Act of Parliament and file information relating to anti-competitive agreements and abuse of dominant position. If such a situation arises, then Vendors are bound by the decision of the Competitive Commission and also subject to penalty and other provisions of the Competition Act.

38. ASSIGNMENT: The Vendor can / does not have any right to assign his rights and obligations under these general purchase conditions without the prior written approval of DAFFPL.

39. GOVERNING LAW: These General Purchase Conditions shall be governed by the Laws of India.

40. AMENDMENT: Any amendment to these General Purchase Conditions can be made only in writing and with the mutual consent of the parties to these conditions.

41. The following expressions used in these terms and conditions and in the purchase order shall have the meaning indicated against each of these:
    a) **OWNER,** Client, Purchaser, buyer **:** means DAFFPL
    b) **VENDOR**, tenderer, Bidder, Contractor, Seller, Supplier, manufacturer stated anywhere in the tender document carry the same meaning: It means the person, firm or the Company / Corporation to bidding and shall include its successors and assigns.
    c) **INSPECTOR/ TPIA:** Person/agency deputed by Owner for carrying out inspection, checking/testing of items ordered and for certifying the items conforming to the purchase order specifications..
    d) **GOODS / MATERIALS:** means any of the articles, materials, machinery, equipments, supplies, drawing, data and other property and all services including but not limited to design, delivery, installation, inspection, testing and commissioning specified or required to complete the order.
    e) **SITE / LOCATION:** means any Site where DAFFPL desires to receive materials anywhere in India as mentioned in tender
    f) **CONTRACT**, Order or Purchase Order/CALL-OFF means the agreement for supply of goods/ materials for required quantity between Owner and Vendor, for a fixed period of time on mutually agreed terms and conditions.
    g) The term MR means Material Requisition containing technical requirements and scope of work (technical), GPC means General Purchase Conditions containing commercial terms & conditions, PO means Purchase order issued after award of contract incorporating agreed deviations in MR, ATC means Agreed Terms & Conditions , RFQ means Request For Quotation.
    h) For the purpose of contract, the trade terms FOB, CFR and CIF, DAP shall have the meanings as assigned to them by INCOTERMS 2010 published by ICC, Paris.

42. REFERENCE FOR DOCUMENTATION :

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The number and date of Collective Request for Quotation (CRFQ) must appear on all correspondence before finalization of Contract / Purchase Order.

After finalization of Contract / Purchase Order: The number and date of Contract /Purchase Order must appear on all correspondence, drawings, invoices, dispatch advices, (including shipping documents if applicable) packing list and on any documents or papers connected with this order.

43. ARBITRATION

a) Any 'dispute or difference of any nature whatsoever, any claim, cross-claim, counterclaim or set off of the Owner against the Consultant or regarding any right, liability, act, omission or account of any of the parties hereto arising out of or in relation to this agreement shall be refereed to the Sole Arbitration of the nominated Director of the Owner or of some Officer of the Owner who may be nominated by the nominated Director. The consultant will not be entitled to raise any objection to any such arbitrator on the ground that the arbitrator is an officer of the Owner or that he has dealt with the matters to which the contract relates or that in the course of his duties as an Officer of the Owner, he had expressed view on all or any other matters in dispute or difference. In the event of the arbitrator to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason, the nominated Director as aforesaid at the time of such transfer, vacation of office or inability to act may in the discretion of the nominated Director designate another person to act as arbitrator in accordance with the terms of the agreement to the end and intent that the original Arbitrator shall be entitled to continue the arbitration proceedings notwithstanding his transfer or vacation of office as an officer of the Owner if the nominated Director does not designate another person to act as arbitrator on such transfer, vacation of office or inability of original arbitrator. Such person shall be entitled to proceed with the reference from the point at which it was left by his predecessor. It is also a term of this contract that no person other than the nominated Director of the Owner or a person nominated by such nominated Director as aforesaid shall act as arbitrator hereunder. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to the agreement subject to the provisions of the Arbitration & Conciliation Act,1996 or any statutory modification or reenactment thereof and the rules made there under for the time being in force shall apply to the arbitration proceedings under this clause.
b) The arbitrator shall have power to order and direct either of the parties to abide by, observe and perform all such directions as the arbitrator may think fit having regard to the matters in difference i.e. dispute, before him. The

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arbitrator shall have all summary powers and may take such evidence oral and/or documentary, as the arbitrator in his absolute discretion thinks fit and shall be entitled to exercise all powers under the Indian Arbitration & Conciliation Act 1996 including admission of any affidavit as evidence concerning the matter in difference i.e. dispute before him.

c) The parties against whom the arbitration proceedings have been initiated, that is to say, the Respondents in the proceeding, shall be entitled to prefer a cross claim, counter claim or set off before the Arbitrator in respect of any matter in issue arising out of or in relation to the Agreement without seeking a formal reference of arbitration to the nominated Director/officer for such counter-claim, or set off and the Arbitrator shall be entitled to consider and deal with the same as if the matters arising therefore has been referred to him originally and deemed to form part of the reference made by the nominated Director/officer.

d) The arbitrator shall be at liberty to appoint, if necessary any accountant or engineering or other technical person to assist him, and to act by the opinion so taken.

e) The arbitrator shall have power to make one or more awards whether interim or otherwise in respect of the dispute and difference and in particular will be entitled to make separate awards in respect of claims of cross claims of the parties.

f) The arbitrator shall be entitled to direct any one of parties to pay the costs to the other party in such manner and to such extent as the arbitrator may in his discretion determine and shall also be entitled to require one or both the parties to deposit funds in such proportion to meet the arbitrators expenses whenever called upon to do so.

g) The parties hereby agree that the courts in the city of Delhi alone shall have jurisdiction to entertain any application or other proceedings in respect of anything arising under this agreement and any award or awards made by the Sole Arbitration hereunder shall be filed (if so required) in the concerned courts in the city of Delhi only.

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Scope Of Work :

The scope of work referring to this project generally comprises of but not limited to:-

1. Construction of CIVIL facilities at Project site which includes: RCC Ring wall Sand Pad Foundation for Vertical Storage Tanks including Earthwork in excavation for foundation, filling with good quality of borrowed earth/ murram suitable for filling , RCC works , structural works. Approved brand PPC /OPC cement shall be used for concreting works.
2. Supply, Fabrication, Erection, Testing and COMMISSIONING of carbon steel tanks (2 nos. Fire water storage tanks, as per datasheet) required for storing the various products & fire water. The materials, design and workmanship shall satisfy the relevant standards, the job specifications contained in the Technical Specification, API 650, OISD-235 etc.
3. Supply, Fabrication, laying, welding, testing & commissioning of all piping works related to Fire water, recirculation, & their associated RCC pipe supports, as per approved layout/ drawings.
4. Supply, installation, testing & commissioning of miscellaneous items, mechanical level gauges, for fire water storage tanks as per the items provided in bill of quantities & reference specifications.
5. supply & provide all consumables, tools & tackles, testing equipment, chemicals required for cleaning, shims, wedges, packing plates, metallic blinds, temporary gaskets, etc. and arrangement required for pressure testing of pipelines and other equipment, Oil, graphite, molykote grease, cleaning agents, Safety equipment like safety goggles, shoes, gloves, belts, All bolts, foundation bolts, nuts & studs, gaskets, packing, pipe hangers, support / thrust block & any other material though not specified but required for completion of work as per specification and instructions.

TECHNICAL SPECIFICATION

FOR

FABRICATION OF

FIREWATER TANKS

Table of Contents

I. GENERAL INSTRUCTIONS TO TENDERERS

1. GENERAL

1.1. INTRODUCTION

1.2. The scope of this tender consists of construction of carbon steel fire-water tanks and construction of ring-beam foundations for tanks.

1.3. Storage tanks included in this tender are grouped as follows:

Sr.No.	Product	No. of Tanks	Tank Size (Dia. X Ht. or Lg.)	Tank Design Capacity (KL)	Tank Type
1.	FIRE WATER	2	18m X 20m	4705	A/G CRVT

A/G CRVT – Above Ground Conical Roof Vertical Tank designed as per API 650 (latest edition)

1.4. The materials and workmanship shall satisfy the relevant standards, the job specifications contained herein and codes referred to. Where the job specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.
The steel plates required for the fabrication of tanks shall be supplied by the Contractor. The material should be in original plate form procured from reputed Steel Plate manufactures in India.

1.5. In the absence of any standard / specification / codes of practice for detailed specifications covering any part of the work covered in this tender document, Purchaser's instruction / directions will be binding on the contractor.

1.6. Wherever it is stated in this Tender document that a particular supply is to be effected or that a particular work is to be carried out, it shall be understood that the same shall be effected / carried out by the contractor at his cost, unless a different intention is specifically and expressly stated herein or otherwise explicit from the context.

1.7. The tenderer can visit the site before quoting to get himself acquainted with site conditions, availability of water, power, approach etc. No delay whatsoever will be entertained on this account.

1.8. Ring beam foundations shall be provided for supporting the vertical storage tanks.

1.9. CONSTRUCTION PROGRAMME

1.9.1. A detailed bar chart showing various activities shall be prepared by the tenderers. The work shall be executed strictly as per the agreed time schedule. The period of completion shall include, the time required for mobilization and testing as well as rectification, if any, testing and completion in all respects to the entire satisfaction of the site engineer.
In case of any site constraints the contractor shall study the same and take corrective measures to circumvent the same, delays on this account is not acceptable.

1.9.2. A joint programme of execution of work shall be prepared by the contractor in consultation with site engineer.

1.9.3. Monthly / weekly construction programme shall be made by the contractor jointly with Purchaser based on availability of work fronts and the joint construction programme.

1.9.4. The contractor shall scrupulously adhere to these Targets / Programme by deploying adequate personnel and construction tools and tackles to match the agreed completion schedule. He shall also supply all materials in his scope of supply in time to achieve the targets set out in the weekly and the monthly programme.

1.9.5. The contractor shall monitor and report about labour and equipment deployed along with the progress of work done on previous day, for each category of work and report the same to Purchaser.

1.10. AVAILABILITY OF UTILITIES

As per General condition of contract.

1.11. TESTS AND INSPECTION

1.11.1. The contractor shall carry out the various tests as enumerated in the technical specifications of this tender document and the technical documents that will be furnished to him during the performance of the work. No separate payment shall be made.

1.11.2. The contractor shall carry out at his cost, all the tests either on the field or through external laboratories, concerning the execution of the work and supply of materials by the contractor.

1.11.3. Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at his own cost.

1.11.4. Results of all inspection and tests shall be recorded in the inspection reports, test reports etc., which shall be approved by the Purchaser's authorized inspection agency. These reports shall form part of the completion documents.

1.11.5. Inspection and Acceptance of works shall not relieve the contractor from any of his responsibilities under this contract.

II. CONDITIONS AND SPECIFICATIONS FOR FABRICATION OF CONE ROOF TANKS

1. SCOPE OF WORK

1.1. The scope of work of the tenderer shall include designing & preparation of all detail working drawings (plate cutting diagrams for bottom/ roof/ shell plates), preparation of bill of materials, detailed engineering, procurement of raw materials including steel plates, welding consumable, obtaining approval of Purchaser, transportation, storage at site, fabrication, installation, erection, testing, calibration, painting, commissioning and establishing the required parameters to the satisfaction of Purchaser, of the storage tanks inclusive of all fittings, appurtenances and other attachments as enumerated in the specification.

1.2. **Civil Work**

The scope civil works includes followings:

a. RCC ring wall Sand Pad Foundation for Vertical Storage Tanks
b. Associated Pipework to connect to the Fire-water Pumps
c. Pipe Support

The detailed scope and specifications of the civil work required for the tanks are described in Technical Specification for Civil Works.

The complete work shall be done in strict compliance with engineering drawings/data sheets, DAFFFPL standard drawings, specifications from the below mentioned standards/codes. The vertical storage tanks shall be in accordance with API-650 (latest edition). A list of standards and codes recommended are mentioned in clause no. 13.

1.3. Work includes all activity for tank fabrication such as rolling of shell plates to required curvature, jacking up method of fabrication, radiography of weld joints, hydro testing etc. complete in all respects.

1.4. Loading, handling and transportation of all materials from supply point / store of work site, scrap materials to work site storage point after completion of the work including supply of all tools, tackles and accessories etc. are in the scope of the Contractor

1.5. Procurement and supply of materials and consumables as indicated in clause no.2.2 are in contractor's scope of supply.

1.6. Fabrication and erection of tank bottom, shell, wind girders, etc. including cutting of plates and structural sections to required size, edge preparation, rolling, fitting, welding as per the approved optimized plate cutting layouts etc. Erection of the tank shell for vertical tanks shall be by hydraulic jacking arrangement.

1.7. Supply and fixing of all nozzles, flanges, elbow, bends etc. shall be carried out as per DAFFFPL standard drawings and data sheets enclosed with ITB. Fabrication and erection of supports for pipes, instruments etc. on tanks shall also to be carried out.

1.8. Surface preparation and painting of external and internal surfaces shall be done as per requirements specified in painting specifications. It shall also include the provision of requirements like scaffolding, consumables etc.

1.9. NDT tests (Radiography, PT etc.) and all other tests shall be carried out on tanks as per code, drawings, testing procedures approved by Purchaser, work schedule. Routine, visual and dimensional check also forms part of the scope. The Contractor shall arrange necessary tools and tackles for carrying out the tests.

1.10. Hydrostatic test (including supply of water), pneumatic test, vacuum box test, kerosene chalk test and other tests shall be carried out as specified in code/ specifications using tenderer's own equipment.

1.11. Calibration of tanks shall be done by approved agencies like Weight & Measure authority and shall got approved the same from statutory authorities as per IS 2007 and IS 2008. Calibration procedure as acceptable by the statutory authorities, preparation of calculations and calibration charts and certified calibration data of each tank shall be submitted to Purchaser.

1.12. Supply of appurtenances like nozzles, manholes, vents, hatches, earth connections, gauge connection with covers etc. and installation of these items on the tanks shall be done.

1.13. Supply and installation of roof sealing device shall be carried out with its accessories.

1.14. Job site shall be cleared of all surplus material, debris, scrap, construction equipment etc. as per directions of site engineer.

1.15. Any other item of work required for making the storage tank ready for commissioning shall be accomplished.

1.16. Structural supports shall be provided for fixing the tank gauges, welding the nozzles on roof for the gauges including locating and welding dead weights.

1.17. The foundations shall be checked and minor rectification wherever required shall be carried out at the time of commencing the fabrication.

1.18. All detailed and working drawings for various components of storage tanks shall be prepared and duly approved by Purchaser. All drawings and documents shall be supplied as specified.

1.19. Mandatory spares namely 10% of fasteners and gaskets of all grades and sizes but not less than 2 nos. for each size shall be supplied. Cost of these mandatory spares shall be included in the quoted price and no separate payment will be made. Any spares required during erection, commissioning shall be included and separately supplied.

1.20. The fabrication and installation shall be in conformity with regulations of CCOE, OISD and other statutory bodies. The contractor shall render necessary assistance to the Purchaser during inspection by OISD or other statutory authorities without additional cost.

1.21. The scope of work is defined in general and is not limited to above. Bidder has also to carry out job which is not listed here but required for completion and commissioning of tanks.

2. SCOPE OF SUPPLY OF MATERIAL

The steel plates required for tank bottom, bottom sump, annular plate, shell, roof (fixed), reinforcement of shell manhole, wind girders for vertical tanks and for horizontal tanks steel plates required for shell and end plates will have to be supplied by the Contractor. All plate materials will be stored in DAFFFPL yard. The

quantity of mild steel plates shall be ascertained by the supplier. The size of the steel plates will be 6300mm X 2000 mm.

- The steel plates having area less than one square meter shall be used for making reinforcement plates etc wherever possible.
- Left over steel plates having area more than one Square meter but less than full plate if any , will be taken over by contractor. An amount @ Rs. 30,000/- per MT shall be deducted from fabricators bill towards the cost of such steel plates.
- In case , of full plates left out and remains unutilized then the same will be deducted from Contractor's bill @ Rs 46,000 per MT or prevailing rates of MS steel plates whichever is higher.

2.1.1. Basis for supply of steel plates:

I. API 650 has been adopted for the design of the vertical storage tanks.
II. Corrosion allowance of 3 mm has been considered for shell and bottom plate and 1mm for Roof plate.
III. Steel plates supplied conforms to specification of IS:2062 (latest edition), Grade E250, quality 'B', fully killed & in normalized condition.

2.1.2. The arrangement of steel plates considered for procurement by the Purchaser for storage tanks and the thickness of the same are indicated in the enclosed drawings. The contractor shall conform the adequacy of the same.

2.1.3. Material required for parts other than stated above shall be procured by the contractor.

2.2. CONTRACTOR'S SCOPE OF SUPPLY

All material and consumable required shall be procured by the contractor in full compliance with relevant technical specification. Materials, consumables/non-consumables required for satisfactory completion of the job shall be supplied by the contractor inclusive of the following but not limited to the same:

2.2.1. The rates for Loading and transportation of steel plates from DAFFFPL designated yard and Unloading and stacking at site are to be included in the price bid. Tenderer to note this point while quoting the rates.

2.2.2. All welding rods, erection / jacking materials, scaffolding, bending and cutting machine, oxygen, acetylene, grease, oils, labour.

2.2.3. For CR tanks, supply of structural's & appurtenances shall include trusses, girders, rafters, curb angles, hand railing on tank top, spiral staircase with railing, landing platforms, appurtenances such as hinged/ bolted type shell manholes, inlet and outlet nozzles, water draw off sump, water draw off nozzle including pipe, temperature nozzle with hatch, dip pipe with hatch, nozzle with hatch for central dipping, roof vents (PV Valves-wherever specified), roof manholes, pad plates for all openings in shell and roof, painters hooks, tank name plate, tank history plate, structure for wind girders (including railing, stiffeners etc.), splice plate, cleats, earthing boss with bolts, pressure relief line, water Overflow arrangement incase of Fire water tank etc.

2.2.4. Item also includes provision of nozzles on each tank for fixing temperature sensor and radar gauges etc.. The tank fabricator shall install tank gauging system.

2.2.5. It also includes supply & fixing of all attachments fasteners such as studs, bolts, nuts, washers & CNAF gaskets at contractors cost.

2.2.6. Weld neck flanges, blind flanges, slip on flanges, plugs, nipples, bolts, nuts, gaskets etc. or any other equipment required for hydrostatic, pressure and vacuum tests for tanks/ tank components.

2.2.7. Blast cleaning media, primers and all paints and thinners.

2.2.8. Any other structure or appurtenance as required to complete the tank fabrication work as per standard drawings and specifications but not mentioned above shall also be supplied and fabricated by contractor without any additional cost.

2.2.9. Providing tools, tackles, hoist/crane, jacks, instruments, supervision etc. required for completion of the work as per drawing, specification and codes.

2.2.10. All materials required for execution of civil works.
The contractor shall hand over test certificates for all items supplied by him to purchaser for approval.

3. DESIGN AND DRAWING REQUIREMENTS

a. DRAWINGS

3.1. GENERAL

3.1.1. All basic and standard drawings as listed in LIST OF ENCLOSURES (VOLUME-1) with design data and material specifications are attached with this tender specification for tendering quotation. Final drawings with revisions if any shall be prepared and submitted for approval after award of contract or Purchase Order by the contractor. All drawings shall be of A1 size.

Depending on the requirements, it may be necessary to change the steel plates thickness & size before commencement of work or during the process of work. Contractor shall have no extra claim on account of such changes and shall agree to accept final measurement of the finished job without any allowance whatsoever.

3.1.2. Tank heights that are indicated in the tender are nominal and the actual heights might undergo minor changes to suit the construction.

3.1.3. The fabrication drawing shall be prepared by the Contractor on AUTO-CAD with the minimum of wastage and in line with the requirements laid down in DAFFFL's standard drawings and codes as applicable. The drawings shall be approved by purchaser before commencement of work.

3.1.4. The detailed fabrication drawings shall include materials specifications, sizes, quantities and component wise weight of tank bottom, shell, roof and all other fittings and appurtenances required to complete the desired tanks.

b. DESIGN

3.2. GENERAL

3.2.1. In case of conflict the order of precedence document shall be as follows:

I. Codes

II. DAFFFPL Standards

As a general rule, the most stringent requirements shall govern.

3.3. SYSTEM OF UNITS

The units and symbols to be used in text, notes, tables, data and all dimensions shown on drawing shall be according to the metric system of units.

3.4. ALLOWABLE STRESSES

3.4.1. The allowable stresses for structural members and bolts shall be as per applicable code.

3.5. CORROSION ALLOWANCE

3.5.1. The corrosion allowance for each tank is considered as 3 mm. Corrosion allowances is added to shell, bottom and to internal parts exposed to the medium. Fixed roof has no corrosion allowance. Components made of corrosion resistant material do not require corrosion allowance.

3.5.2. Removable internal parts, bolted or clamped in place shall have extra thickness equal to specified corrosion allowance over the minimum required thickness.

3.6. SHELL

3.6.1. Nominal tank diameter shall be the inside diameter of the tank.

3.6.2. Tank shell courses shall be aligned in such a manner that inside diameter of all shell courses are same.

3.7. FIXED ROOF

3.7.1. All fixed roofs shall be of cone roof type supported by structure i.e. rafter with trusses (columnless). Roof plates shall be supported on the supporting members only by resting on it without getting attached to it.

3.7.2. Roof structure shall be as per DAFFFPL standard.

3.7.3. The slope of the roof at the top angle attachment shall not exceed 1: 16.

3.7.4. For Cone roof tanks during erection, precautions shall be taken to maintain the slope of the roof sheets to the edge of the curb angle to prevent the development of flat areas in the roof.

3.7.5. Roof to shell joint shall be frangible type.

3.8. BOTTOM

3.8.1. The tank bottom shall be concave shape with the slope towards the centre ranging from 1:40 to 1:100 depending upon the diameter of the tank so that central depression should not exceed 250mm.

3.9. NOZZLE

3.9.1. Nozzles for suction shall be provided with stiffeners.

3.9.2. Manholes and nozzles with blind flanges/covers shall be provided with gaskets and bolting.

3.9.3. Nozzles of size 250 NB and above may be fabricated from plate and shall be 100% radiographed.

3.10. FLANGES

3.10.1. Flanged joints shall be minimized. All flange joints should be provided with jumpers.

3.10.2. Flanges shall conform to ASME B 16.5 for dimensions.

3.10.3. Unless and otherwise specified, Slip-on flanges shall be used for class 150 rating.

3.11. WIND GIRDER

Wind Girder shall be provided on the tank as per requirement of the code. Drain holes of 20 mm diameter (by machine drilling) suitably staggered shall be provided on the horizontal plates of girder.

3.11.1. Appurtenances and Accessories

Tanks shall be provided with all appurtenances specified in the respective data sheet for specific tanks and comply with the requirements as mentioned in this paragraph.

All the appurtenances shall be located such that they are clear off the plate joints and or structural members as the case may be.

I. Shell Manholes

Minimum number of shell manholes shall be 2 nos.

II. Roof Manholes

Minimum number of roof manholes shall be 2 nos or as per drawings.

III. Platforms and Stairways

- Tanks with instruments/accessories located on the roof shall be provided with platform on roof. This top landing platform shall be sized and located so as to permit easy access to those items.
- Primary access to roof shall be by means of spiral stairways. Intermediate landings shall be provided for spiral stairways, preferably at every 5m interval. Spiral staircase shall be clear of foundation.
- Platform, walkways, stairs and ladders shall be meeting the requirements of as per API 650 & OSHA (Occupational Safety and Health Administration) requirements.

- Hand railing shall be provided for stairways and all around the tank roof. All rough spot welds on handrail shall be ground smooth.
  No interconnecting catwalks shall be provided for storage tanks.

IV. Other Accessories

a. Gauge hatch

- Gauge hatch shall be spark proof type. Gauge well pipes for Radar Gauge/Temperature transmitter shall be located accessible to Top landing platform.
- Level Gauge

b. Draw – Off Sumps

- When specified in data sheet, tank bottom shall be provided with draw-off sumps, in accordance with the code.
- Water draw-off nozzle shall be located to suit the drainage in the tank farm.

c. Grounding

- No. of earthing connections shall be provided as per code.
- Earthing bosses shall be located equidistant on shell depending on site condition.

4. MATERIAL SPECIFICATION

4.1. STEEL PLATES

Plates shall be of IS 2062 Gr.E250 Quality B.

4.2. STRUCTURAL SECTIONS

- Structural steel shall conform to IS 808.
- Structural steel will be of SAIL, SALEM STEEL, IISCO, Vizag Steel, KL Steel, KL Concast or TISCO make. Angles up to 50 x 50 mm, flats and square bars can be of any BIS approved manufacturer after approval of site Engineer.

4.3. WELDING ELECTRODES

- Manual arc welding electrodes shall conform to E-60 & E-70 classification series (E-6010, E 6013, 7018 and E 7018-1) in American Welding Society (latest edition), AWS A 5.1 “Carbon Steel covered Arc Welding Electrodes”.
  Welding electrodes of any of the following makes may be allowed:

M/s. ESAB India Ltd.	M/S Honavar Electrodes Ltd.
M/s. Advani Orlekon	M/s. Modi Arc Electrodes Co
M/s. D & H Sechron Electrodes Ltd.	M/S GEE Limited

M/s. D & H Welding	M/s. Kobe Steels
M/s. Fusion Engineering Products Ltd	

4.4. PIPES

All pipes for nozzles on product/ Water tanks shall be as per ASTM A 106 Grade B, of min. Schedule 40. The pipes used for water services shall be as per IS-1239 / IS-3589 (Heavy grades).

4.5. FLANGES

- Material for flanges shall conform to ASTM A-105 for nozzles up to 400 mm dia and IS-2062 Gr. B for nozzles beyond 400 mm dia.
- Flanges shall conform to ASME B 16.5 for dimensions upto NPS 24 and ASME B 16.47 for dimensions for dimensions above NPS 24.
- All flanges will have raised serrated faces finished to 125 AARH.

4.6. STUDS AND NUTS

All bolts and nuts shall conform to A 193 Gr.B7 and A194 Gr.2H respectively and washers to IS-2016.

4.7. GASKETS

Gaskets shall be of Compressed Non Asbestos Fibre (CNAF) 3mm thk. Conforming to IS 2712.

5. FABRICATION AND ERECTION OF SITE FABRICATED TANKS

5.1. GENERAL

5.1.1. The scope of work under erection and fabrication services of the contract shall include supply of all materials required for the entire work(except free issue material), receipt, movement, handling and storage of all materials issued as free issue material from time to time. It also includes supply, transportation, fabrication, erection, alignment, welding, testing, painting and commissioning of all appurtenances and accessories and other instruments as specified in the tender documents, final cleaning, supplying and application of primers and paints as required.

5.1.2. The fabrication and erection works shall be carried out by HYDRAULIC JACKING METHOD including manual erection of first 2/3 shells and roof plates to facilitate installation of jacks for hoisting the steel tank in accordance with tender specifications and drawings to be prepared and

furnished by contractor for purchaser's approval before commencement of work.

5.1.3. Since construction of sand pad foundations is in contractor's scope of work, he shall himself check & satisfy the evenness of levels within acceptable tolerance and concave bed of the foundations before commencement of tank fabrication. Any defect in the tank found at a later date due to defective sand pad foundation shall be solely attributed to the fabricator.

5.1.4. Underside surface of bottom plates for tanks shall be sand blasted to SA 2 1/2 and painted with one coat of epoxy zinc phosphate primer of 75 microns and 2 coats of high build bitumen coating of 90-100 micron each, upto total DFT of 260 microns, before plates are laid on the sand pad foundation.

5.1.5. Painting shall be carried out as described in painting specification.

5.1.6. All roof structural members, stairways, hand railings etc. shall be blast cleaned and made free from rust and scale & painted as per enclosed specifications.

5.1.7. All machined surfaces of plate edges adjacent to welded joints, bolts and nuts shall be left unpainted and coated with an approved corrosion inhibitor in a petroleum base before dispatch.

5.1.8. The suitability and capacity of equipment used for erection shall be to the satisfaction of the purchaser.

5.1.9. All structural steel should be so stored & handled at the site that the members are not subjected to excessive stresses and damage.

5.1.10. During erection, the steel work shall be securely bolted or otherwise fastened and wherever necessary properly braced to provide for all loads to be carried by the structure during erection including load of equipments.

5.1.11. No permanent bolting or welding should be done until proper alignment is obtained.

5.2. MATERIAL AND TESTING

5.2.1. All materials used in fabrication of storage tanks shall be as per applicable codes. Material test certificates/documents shall be submitted to inspector for verification.

5.2.2. All material identification numbers shall be legibly stamped or stenciled preferably on the long edge of each component. When stamping is required on rolled surfaces, a 'low stress' stamp is to be used.

5.2.3. Before commencing the job all plates shall be visually examined squared, diagonally checked, stenciled and stacked in order of execution of work. Plates shall be checked for splitting if any, particularly, Split plates or laminated plates shall be rejected.

5.2.4. Plates thus prepared shall be offered for inspection to the site engineer. Contractor shall arrange all equipment and labour necessary for inspecting and measuring all the plates. After the plates are approved they shall be stenciled and stacked properly. Plates shall be thoroughly checked for any damages, all dimensions and diagonality. Steel plates stored pending for erection shall be suitably protected against oxidation.

5.3. WELDING

5.3.1. General

I. Tanks and their structural attachments shall be welded by the Metal Arc process. Welding may be performed on manual/automatic or semi-automatic mode using suitable equipments.

II. All welding shall be in accordance with the applicable code and welding process shall be electric fusion shielded metal arc unless otherwise specified.

III. All parts that must be welded to the tank shall be installed before the hydrotest.

IV. Welding shall not be carried out when the surfaces of the parts to be welded are wet from any causes and during periods of rain and high winds unless the welder and work are properly shielded.

V. Welder performance qualification shall be carried out as per API-650 Section 9 'Welding Procedure and Welder Qualifications'. Welders shall be qualified in the approved procedure as per the code requirements. The qualification test shall be arranged by supplier at his cost and witnessed by Purchaser's authorized inspection agency. IS: 823 shall also be referred.

VI. The welding sequence for tack welding and final welding of the bottom, shell and roof plates shall be such so as to minimize the distortion due to welding shrinkage and it shall be as per standard drawing.

5.3.2. **Cleaning**

I. Tank shall be cleaned inside and outside of weld spatter, weld slag, flux deposits, burrs and splinters, loose mill scale and all other foreign matter.
II. The internal of all tank nozzles shall also be cleaned and inspected.

5.3.3. **Welding Consumables**

I. Electrodes shall conform to IS: 814 and E-60 & E-70 classification series in the latest addition of AWS A 5.1 (Carbon Steel Covered Arc Welding Electrodes) specifications wherever applicable for covered electrodes for metal arc welding of mild steel. Electrodes for SMAW shall be E-6010,E 6013, E 7018 and E7018-1. They shall be stored in a dry place in their original packets or cartons.

5.3.4. **Shell**

I. Shell plates shall be shaped by power operated rolling machine to exactly suit the curvature of the tank under fabrication. Rolled plates shall be either stacked vertically on longer edge or on properly designed stackers having radius equal to that of the tank for which the plates have been rolled, so as to avoid damage to plate curvature.
II. All shell plates to be flush inside.
III. Vertical joints in adjacent shell courses shall not be in alignment but shall be offset from each other by 1/3rd of the plate length but in no case less than a distance of 300mm.
IV. All vertical and horizontal shell joints shall be of full penetration, full fusion, double welded butt welds using any of the edge preparations profile permitted by the code.
V. Vertical and horizontal joints shall also clear the nozzle welds and reinforcement pad welds and minimum distance between welds shall be as per Code.
VI. The top shell course of all tanks shall have a top angle butt welded or double lap welded to the top shell course.

5.3.5. **Bottom**

I. Three plate laps shall not be closer than 300 mm from each other and also from the tank shell.
II. Bottom plates are thoroughly cleaned on the underside before being positioned.

5.3.6. **Annular Plate**

I. Annular plate joints shall be single sided butt joint with backing strip of 50mm. wide and 6mm thk.

5.3.7. **Nozzle**

I. Nozzles shall be attached to the tank by full penetration welds.
II. All nozzle reinforcing pads shall be provided with ¼" threaded tell tale hole for test purposes.

5.3.8. **External Attachments**

All external attachments like cleats, platforms, staircase shall be of same material as the tank.

5.3.9. **Nameplate**

The storage tank nameplate bracket shall be fabricated from the same material as shell and shall be visible and accessible at all times.

5.3.10. **Tolerances**

The dimensional tolerances shall be within the limits indicated on drawings and standards. Where tolerances are not specified, these shall be in accordance with the requirements of API code.

6. INSPECTION AND TESTING

6.1. GENERAL

All tanks shall be subject to inspection. All tanks shall be offered for inspection in stages as indicated in the quality assurance plan prepared by contractor and approved by Purchaser. Contractor shall provide all tools, equipment and labour to the inspector for proper inspection. Approval of Inspector shall in no way relieve the supplier of his responsibility for proper execution of work.

6.1.1. The inspection shall include but not limited to:

a. Examination of materials of construction
b. Welding Procedure and Welder's qualification tests
c. Various non-destructive test as per code
d. Dimensional Check
e. Pressure testing and certification etc.
f. Hardness testing

6.2. RADIOGRAPHIC INSPECTION PROCEDURE OF VERTICAL TANKS

6.2.1. RADIOGRAPHIC INSPECTION

Radiographic inspection of weld joints of vertical tanks shall be conducted as per API 650 (latest edition), as per following details:

I. JOINTS REQUIRING RADIOGRAPHY

a. Tank shell butt welds
b. Tank bottom annular plate butt welds
c. 100 % of butt weld around the periphery of an insert manhole or nozzle in the tank shell.
d. All 'T' joints in Shell irrespective of plate thickness. Each film shall clearly show not less than 50mm of weld length on each side of vertical intersection and 150 MM along the vertical weld.
e. Butt weld of bottom sump.
f. Shell joints covered by reinforcement pad plate.

II. JOINTS NOT REQUIRING RADIOGRAPHY

a. Welds of roof plates
b. Welds of bottom plates
c. Welds Joining roof plates to curb angle
d. Welds joining curb angle to shell plates
e. Welds joining bottom plates to shell plates
f. Welds joining appurtenances to tank

6.2.2. NUMBER AND LOCATIONS OF RADIOGRAPHS

I. VERTICAL JOINTS

a. TANKS HAVING PLATE THICKNESS UPTO 10mm OR LESS

- One spot radiograph shall be taken in the first 3 m of completed vertical joint of each type and thickness welded by each welder.
- Thereafter, without regard to number of welders, one additional spot radiograph shall be taken in each additional 30m and any remaining fraction of vertical joint of the same type and thickness.
- In addition to the above requirements, one random spot radiograph shall be taken in each vertical joint in the lowest course of the tank. The spot radiographs already taken on the lowest course may be used to meet this requirement.
- In addition, junctions of all vertical & horizontal joints (Tee Joints) shall be radiographed.

b. TANKS HAVING PLATE THICKNESS GREATER THAN 10mm AND UPTO AND INCLUDING 25mm

- Spot radiographs shall be taken as per 9.2.2 (a) above.
- In addition, two spot radiographs shall be taken in each vertical joint of lowest course of the tank. One of the radiograph will be as close to the bottom as practicable and other shall be taken at random.

II. HORIZONTAL JOINTS

- One spot radiograph shall be taken in the first 3m of completed horizontal butt joint of the same type and thickness without regard to number of welders.
- Thereafter, one radiograph shall be taken in each 60m and any remaining fraction of horizontal joint of the same type and thickness.
- No. of such radiographs should exclude junctions of vertical & horizontal seams.

6.2.3. **BOTTOM ANNULAR PLATE BUTT JOINT**

For single butt welded joint using backing up strip, one spot radiograph shall be taken on 50% of radial joints. Location of radiographs shall be preferably at the outer edge where shell plate joins the annular plate. The minimum length of the radiograph shall be 150mm. Extra care should be exercised to interpret such radiographs.

6.2.4. **PERIPHERY OF INSERT, MANHOLE OR NOZZLE**

a. 100 % radiography shall be carried out of the butt weld around the periphery of an insert manhole or nozzle in the tank shell i/c bottom sump.
b. 100% radiograph of gauge pipe and gauge well in FR tank.
c. 100% radiograph of vertical and horizontal joints, where pad plate fouls.

6.2.5. **REMARKS**

I. For the purpose of radiography, plates shall be considered of the same thickness when difference in specified or design thickness does not exceed 0.85 mm.

II. When two or more tanks are erected in the same terminal/depot, the number of spot radiographs to be taken should be based on meterage of the welds of the same type and thickness in each individual tank rather than aggregate meterage of welds of all tanks.

III. It is permissible to inspect the work of two welders with one spot radiograph, if they weld opposite sides of the same butt joint. In the event of rejection of a spot radiograph, further spot radiographs shall be used to determine whether one or both welders were at fault.

IV. As far as possible, an equal number of spot radiographs shall be taken from the work of each welder, except that this requirement does not apply where

length of joints welded by welder is much less than average in comparison with other welders.

V. Radiographs shall be taken as soon as practicable during process of welding. The number and locations of radiographs should be pre-determined as per guidelines mentioned above.

VI. Each radiograph shall clearly show a minimum of 150mm of weld length and 50mm on either side from the center line of the weld. Hence each film should show minimum radiograph of 150 x 100 mm of selected weld. The film shall be centered on the weld and shall be of sufficient width to permit adequate space for the location of identification works and a thickness gauge.

VII. **EXAMINATION OF RADIOGRAPHS**

a. The radiographic examination method employed shall be in accordance with the ASME Boiler and Pressure Vessel Code Section V "Non Destructive Examination" Article 2.

b. The requirements of Article 2, Section V of ASME code are to be used only as a guide. However, final acceptance of radiographs shall be based on the ability to see the prescribed penetrameter image and the specified hole. For final interpretation of radiographs Contractor shall get approval of Purchaser's authorized inspection agency.

c. The acceptability of welds examined by radiography shall be judged by the standards in Section VIII, Division 1, Paragraph UW-51 (b), of the ASME code.

6.2.6. **DETERMINATION OF LIMITS OF DEFECTIVE WELDING**

I. When a section of weld is shown by radiograph to be unacceptable under provisions given above or limits of the deficient welding are not defined by the radiograph, two adjacent spots shall be examined by radiography.

II. However, if the original radiograph shows at least 75mm of acceptable weld between the defect and any one edge of the film, an additional radiograph need not be taken of the weld on that side of the defect.

III. If the weld at either side of two adjacent sections fails to comply with the requirements of ASME Sec. VIII Div.1, additional nearby spots shall be examined until the limits of acceptable welding are determined or the fabricator may replace all the welding performed by the welder on that joint.

IV. If the welding is replaced as per ASME Sec. VIII Div.1, one radiograph should be taken at any selected location on any other joint on which the same welder has welded.

V. If any of these additional spots fails to comply with the requirements of ASME Sec. VIII Div.1, the limits of unacceptable welding shall be determined as specified for the initial section.

6.2.7. **REPAIR OF DEFECTIVE WELDS**

I. The defective weld shall be removed by chipping or melting out by thermal gouging process from both sides of joint and re welding. Only sufficient cutting out of the defective joints, as is necessary to correct the defect, is required.

II. All repaired weld in joints shall be checked by repeating the original inspection procedure and by repeating the hydrostatic testing / vacuum box testing method.

6.2.8. **RECORD OF RADIOGRAPHIC EXAMINATION**

I. The fabricator shall make a record consisting of all films with their identification marks on a developed shell - plate diagram.

II. After completion of tanks, the films shall be handed over to the Purchaser.

6.3. TESTING PROCEDURE OF VERTICAL CONE ROOF TANKS

6.3.1. **GENERAL**

I. Initial reduced levels of Sand Pad foundation top, bottom plate top at minimum 8 points on periphery @ 45 degree apart.

II. Plate thickness shall be checked for all plates at minimum 6 random points on each plate using ultrasonic gauge.

III. Initial levels of tank bottom before Hydrostatic testing of tank and after full erection of tank & transfer of load to SPF at above 8 points after every 1 mtr. Increase in water level.

IV. Verticality test for tanks @ 3 mtrs. c/c on tank periphery shall be carried out.

V. Reinforcement pads for shell manhole, nozzles shall be tested with pneumatic pressure of 1 kg./cm^2. through tell-tale holes. After testing, the tell-tale hole shall be plugged with threaded stud and shall not be sealed.

6.3.2. **TANK BOTTOM TESTING**

I. WATER DRAW OFF SUMP

a. Fabricate sump as per drawing.
b. Radiograph the butt weld of the sump.
c. Place the bottom plate on the ground. Invert the sump on the bottom plate and weld with it. (Carry out DP test of the fillet joint after root run)
d. Create pneumatic/ hydraulic pressure of 2 kg/cm^2 inside the sump after providing nozzles (two) on the bottom plate.
e. Repair the defective welds and repeat test till entire satisfaction.
f. Cut the bottom plate at the sump as per requirement.

g. Weld the bottom to sump collar and carry out root DYE PENETRATION (DP) Test.

II. ANNULAR PLATE BUTT WELDS

a. RADIOGRAPHY

Radiography as per details given in this tender schedule for single welded butt joints with back up bar, one spot radiograph shall be taken on 50% of radial joints as near to periphery as possible.

b. PNEUMATIC PRESSURE / VACCUM BOX TEST

BEFORE ERECTION OF FIRST STRAKE OF SHELL

I. Complete all annular plates radial butt welds for at least 800 mm length from outer edge of tank bottom towards tank center.
II. For tanks without annular plates, 800 mm length of sketch plates joints to be welded as described above.
III. Conduct vacuum box test of the above joints at 3 PSI vacuum.
IV. Repair the defective welds and repeat test till fully successful.

c. BOTTOM PLATE LAP WELDS

I. In case of erection by conventional method, complete welding of all bottom seams. Erect at least lowest (1st) course of shell plates and 2nd course of shell plates. In case of erection by jacking method complete welding of bottom seams after full erection and tack welding of the lowest course to bottom plate.
II. Testing of bottom plate lap welds should be done only by vacuum box method of testing by creating a vacuum of 3 PSI on the welds seams under test.
III. In addition, all bottom plates including weld joints shall have thorough visual inspection for pin holes, inadequate weld size, improper reinforcement, undercutting etc.

6.3.3. **SHELL TESTING**

I. FILLET WELD - 1st STRAKE PLATE TO BOTTOM PLATE

a. Complete shell to bottom fillet weld from inside periphery of tank bottom.
b. Visual check shall be carried out for craters cracks or other surface cracks. The undercutting of base metal shall not exceed 0.4 mm
c. CHALK-KEROSENE test shall be conducted by injecting kerosene from outer periphery un welded joint and applying chalk on inside fillet weld.
d. The defective weld shall be rectified and the test shall be repeated till entire satisfaction.
e. Outer periphery fillet weld shall be completed and visually checked as per API-650.

II. **SHELL APPURTENANCE - REINFORCEMENT PLATES TO SHELL PLATES WELDS**

a. Make 6 mm dia. screw threaded TELL TALE hole in the reinforcement pads before its welding to shell and shell appurtenances.
b. The reinforcement pads shall be tested by applying up to 15 PSI gauge pneumatic pressure between the tank shell & the reinforcement plates on each opening using TELL TALE hole.
c. Soap suds shall be used on welds between reinforcement plate to shell, reinforcement plate to appurtenances and appurtenances to shell plate welds.
d. Defective weld shall be repaired and the test shall be repeated till entire satisfaction.
e. The tell-tale hole shall be closed with a bolt or screw.

III. **SHELL PLATE BUTT JOINTS**

RADIOGRAPHY

a. Shell plate development diagram shall be prepared.
b. Locations for spot radiographs shall be marked as per guide lines detailed in this tender schedule.
c. Spot radiography shall be conducted.
d. Radiographs shall get interpreted and the defective welds shall be repaired.
e. Radiography of repaired welds shall be conducted.
f. The procedure shall be repeated till satisfactory results are obtained.

SPOT RADIOGRAPHY SHOULD BE CONDUCTED CONCURRENTLY DURING ERECTION AND WELDING OF SHELL PLATES.

6.3.4. **HYDROSTATIC TESTING**

I. Weld the permanent "BENCH MARKS" on the tank shell approximately 300 mm above the bottom plate at minimum eight places @ 45 degree apart along periphery.
II. Take initial levels on these bench marks.
III. Commence filling water @ 1 m water column per day in the tank for a height upto 4 mtrs.
IV. In case differential settlement between two consecutive points is less than 5 mm then increase water filling rate @ 2 m water column per day.
V. Fill water upto maximum filling height.
VI. Hammer the shell joints. Sweating from any joints will be an evidence for leak.

VII. Repair the defective weld & repeat test till satisfaction.
VIII. Upon satisfactory completion of hydrostatic test, dewatering process may be commenced @ the rate of 2 m to 3 m water column per day.
IX. Note down the settlements of the points on concentric circles already marked in bottom plates.Contractor shall forward value of expected total settlement post hydrotest of tank for deciding stiffness of spring for pipe support to Owner / Consultant.
X. Roof should be floated up to the maximum filling height.
XI. Minimum two tanks shall be hydro tested simultaneously.

6.3.5. **TESTING OF CONE ROOF**

a. Testing of roof shall be carried out in accordance with any of API-650 recommendations i.e apply internal pneumatic pressure not exceeding weight of roof plates and check for leakage by soap solution. Alternatively, roof seams may also be tested by vacuum box test.
b. Internal pneumatic pressure, not exceeding weight of roof plates, works out to be 40 mm of water gauge. Hence testing roof should be done at 40 mm of water gauge only.
c. Commence dewatering of tank.
d. Clean the tank from inside.
e. Record levels of points on bottom plates and levels of tank periphery.
f. Compare the final levels with the original levels & analyze the findings in view of the Third Party Inspector's recommendations.
g. In case of variation in final levels and original levels is more than anticipated, report matter to Competent Authority for further guidance.

6.3.6. **ANNULAR SPACE AROUND GAUGE WELL**

I. While roof is subjected to floatation test, note down the annular space between outer dia. of gauge well and inner dia. of gauge well sleeve in roof at minimum four points 90 degree apart and at every 1 m ascend of roof during its floatation test up to the maximum filling height. Before taking such readings, tank roof should be made concentric with tank shell with the help of wooden blocks in the rim space at each observation point.
II. Repeat the same observations while emptying out water from the tank.
III. In no case, gauge well should rub against gauge well sleeve.
IV. Reason for excessively low annular gap should be analyzed and carry out necessary correction.

6.4. QUALITY ASSURANCE PLAN

I. Raw material control/identification.
II. Approval /review of welding procedure qualification record.
III. Review of WPS.
IV. Bottom plate layout.
V. Vacuum box test.
VI. Fit-up/set-up of shells.
VII. Individual shell plumb.
VIII. Basis of shell plumb, peaking and bending.
IX. Circularity and dimension of pair of shell.
X. Back chip DP.
XI. NDT including radiography as per contract.
XII. Overall visual and dimensional check.
XIII. Roof visual and dimensional check.
XIV. Pontoon puncture test
XV. PAD pneumatic test.
XVI. Surface profile for blasted surface check
XVII. Stagewise Painting thickness check
XVIII. Checking of leaks; Hydrostatic testing of tank.
XIX. Overall plumb.
XX. Roof pneumatic test.

6.5. Documentation

6.5.1. The supplier shall prepare drawings, manufacturing welding inspection plans and obtain purchaser's approval before manufacture. No fabrication will start without the approval of Purchaser. These shall include, as a minimum, detailed fabrication drawings, welding procedure specifications (WPS), welder performance qualification (WPQ), procedure qualification records (PQR), welding plans, material inspection plan (MIP), quality control plan (QCP), repair procedures.

6.5.2. The following documents shall be submitted :

I. As built drawings of the tank foundation
II. As built drawings of the tank.
III. Settlements results of tank bottom.
IV. Bottom layout with respect to earth north and test results of the bottom.
V. Shell development drawings indicating the location of radiography and test result of the radiograph.
VI. Wind girder drawings.

VII. Roof layout and test results.
VIII. Test certificate for steel structure used.
IX. Certificate of tank mountings i.e. PR valves, Seal etc.
X. General arrangement drawings and material specification.
XI. Stairway details with orientation.
XII. Certificate of earthing of tank.
XIII. Calibration charts.
XIV. Radiography films (separately)

6.5.3. The supplier shall be responsible for preparation and issue of all reports, certificates and documents which shall be certified by Purchaser's authorised inspection agency. Such certified final documents shall be supplied in bound volumes with proper identification. Three (3) sets shall be submitted to purchaser. The supplier shall keep the above records with him for a period of at least five years.

7. CALIBRATION OF TANK

7.1. Coordination with Weights & Measure dept. or any other approved authority shall be done including payment of calibration fee and other expenses.

7.2. Calibration of tanks shall be carried out as per IS 2007 and IS 2008 in presence of W&M or their authorized representative and Purchaser's authorized inspection agency.

7.3. Temporary scaffolding, only using steel structural of safe design, shall be erected around the tank to ensure safety of the workers during strapping of the tank.

7.4. Tested water meters and hoses shall be arranged for physical calibration of tank bottom up to datum plate level. All the scaffolding necessary for holding the tape shall be arranged by the contractor at his own cost.

7.5. Required water, labour & equipment for calibration shall be arranged by the contractor at their own cost.

7.6. After calibration is carried out, scaffolding materials shall be dismantled and removed from site immediately and damages caused to the sand pad foundations shall be repaired at no extra cost to the Purchaser.

7.7. After calibration, the water shall be drained out and the bottom, shell from inside, steel structures underside of roof shall be cleaned properly and manhole covers to be fixed properly including replacing the gaskets etc., wherever necessary as directed by Site Engineer.

7.8. Calibration charts shall be prepared and submitted in triplicate duly approved by W&M / calibrating authorities. One set of charts shall be submitted duly laminated and balance two in file covers.

8. SPECIFICATION FOR CONSTRUCTION OF RCC RINGWALL SAND PAD FOUNDATION FOR VERTICAL STORAGE TANKS

Refer Technical Specification for Civil Works

9. INFORMATION AND DRAWINGS TO BE FURNISHED ALONG WITH THE OFFER

The following drawings / documents and information shall be furnished along with the offer.

I. Details of similar installations constructed.
II. Details of manufacturing / fabrication / erection / testing facilities available with the tenderer. manpower available, deployment details and jobs on hand.
III. Detailed bar chart showing different stages of procurement, fabrication, testing and commissioning duration.
IV. Overall general arrangement and cross sectional drawings of storage tanks, showing dimensional details, drainage arrangement, appurtenances provided, primary and secondary seal arrangement.
V. Specifications, makes, sizes and thickness of plates and other structural members used for each tank fabrication.
VI. List of appurtenances included for each tank.
VII. Deviations from specifications if any, to be listed out.
VIII. Confirmation regarding the codes and standards specified for different works.
IX. Welding methods adopted, makes and specifications of welding electrodes.
X. Unpriced bid showing quantities and weights.
XI. Guarantee for performance, workmanship and materials of construction.

10. SCAFFOLDING, PLATFORMS AND LADDERS SPECIFICATION

10.1. Normally only metal is to be used as material of construction for scaffolding, platforms and ladders. Scaffold shall conform to provisions given in IS : 2750 – Specification for Steel Scaffoldings.

10.2. A scaffold should be provided and maintained where work cannot safely be done on or from the ground or from part of a building or other permanent structure.

10.3. Scaffolds should be provided with safe means of access. Ladders should be secured against inadvertent movement.

10.4. Every scaffold should be constructed, erected and maintained so as to prevent collapse or accidental displacement when in use.

10.5. Every scaffold and part thereof should be constructed such as not to cause hazards for workers during erection and dismantling

10.6. Scaffold should be of suitable type and adequate for the job

10.7. Every scaffold should be maintained in good and proper condition, and every part should be kept fixed or secured so that no part can be displaced in consequence of normal use.

10.8. LIFTING APPLIANCES ON SCAFFOLDS

When a lifting appliance is to be used on a scaffold the parts of the scaffold should be carefully inspected to determine the additional strengthening and other safety measures required.

10.9. Prefabricated scaffolds

- In the case of prefabricated scaffold systems, the instructions provided by the manufacturers or suppliers should be strictly adhered to. Prefabricated scaffolds should have adequate arrangements for fixing bracing.
- Frames of different types should not be intermingled in a single scaffold.
- Scaffolding shall be erected on firm and level ground.

10.10. Suspended scaffolds/boatswain's chair

10.10.1. In addition to the requirements for scaffolds in general as regards soundness, stability and protection against the risk of falls, suspended scaffolds should meet the following specific requirements.

10.10.2. Platforms should be designed and built with dimensions that are compatible with the stability of the structure as a whole, especially the length;

10.10.3. The number or anchorage should be compatible with the dimensions of the platform;

10.10.4. The safety of workers should be safeguarded by an extra rope having a point of attachment independent of the anchorage arrangements of the scaffold;

10.10.5. The anchorage and other elements of support of the scaffold should be designed and built in such a way as to ensure sufficient strength;

10.10.6. The ropes, winches, pulleys or pulley blocks should be designed, assembled, used and maintained according to the requirements established for lifting gear adapted to the lifting of persons according to national laws and regulations;

10.10.7. Before use, the whole structure should be checked by a competent person.

10.11. BAMBOO SCAFFOLDING

Bamboo scaffolding is not permitted.

11. REFERENCES

11.1. APPLICABLE CODES, STANDARDS AND REGULATIONS

The following Standards, Codes and Regulations whichever applicable in their latest edition including their addenda at the time of bidding shall form the basis for design, fabrication, inspection, testing and acceptance of storage tanks.

I. Design & Fabrication Codes and Standards:

a.	API 650	:	Welded Tanks for Oil Storage
b.	IS 10987	:	Code of practice for design, fabrication, testing and installation of underground/above ground

horizontal cylindrical storage tanks for petroleum products

c. API 2000 : Venting Atmospheric and Low Pressure Storage Tanks

d. IS 808 : Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections

e. ASME Section IX : Qualification Standard for Welding

f. ASME B16.9 : Standard for butt welded fittings

II. Material Codes:

a. IS 2062 : Steel for General Structural Purposes

b. IS 800 : Code of Practice for General Construction of steel

III. Inspection and Testing Codes:

a. ASME Section V : Nondestructive Examination

b. ASTM : Standard of Materials of Construction and Testing

c. IS 2007 : Method for calibration of Vertical Oil Storage Tanks

d. IS 2008 : Method for computation of capacity tables for Vertical Oil Storage Tanks

e. ASME Sec. VIII, Div.1 : ASME Boiler and Pressure Vessel Code

IV. Safety Codes:

a. OISD 235 (Latest Edition) : Storage, Handling, Refueling and Fire Fighting At Aviation Fueling Stations

V. Regulations

National laws and Regulations together with local by-laws for the country or state where equipment is to be erected shall be complied with.

11.2. Refer LIST OF ENCLOSURES (VOLUME 1) for all drawings and documents

14. PAYMENT SCHEDULE

PAYMENT SCHEDULE

S. No.	DESCRIPTION	% PAYMENT
1	**PLATE WORK**	-
a	After fabrication & erection of plates.	30%
b	After welding of plates.	40%
c	After radiographic inspection & its acceptance.	10%
d	After hydrostatic testing and calibration.	10%
e	On completion of all works and in final bill.	10%
2	**APPURTENANCES**	-
a	After supply of materials at site incl. submission of test certificates as per requirement.	50%
b	After Installation of steel structural incl. erection & welding.	30%
c	After hydrostatic testing.	10%
d	On completion of all works	10%
3	**STEEL STRUCTURALS**	-
a	After supply of materials at site incl. submission of Test certificates as per requirement	60%
b	After fabrication, erection and completion of all welding	30%
c	On completion of all works.	10%
4	**GRIT BLASTING AND PAINTING**	-
a	After cleaning, surface preparation and application of first coat of primer.	50%
b	After application of further coats and of finish coats.	40%
c	On completion of all works and in final bill.	10%

STANDARD SPECIFICATION

FOR

WELDING (STORAGE TANKS)

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12. WELDING REQUIREMENTS

12.1. WELDING

Welding of steel plates, other structures and related accessories shall be carried out conforming to the requirements of various paragraphs in this chapter.

12.2. WELDING RESPONSIBILITY

The contractor is responsible for the welding done by welders employed by him. Purchaser's authorized inspection agency shall conduct the tests required to qualify welding procedures, and to qualify the welders and if, necessary re-qualify welders and welding operators.

12.3. WELDING QUALIFICATIONS

12.3.1. QUALIFICATION REQUIREMENTS

Qualification of the welding procedures to be used and of the performance of welders and welding operators shall conform to the requirements of the ASME Section IX.

12.3.2. PROCEDURE QUALIFICATION BY OTHERS

Purchaser or Purchaser's authorized inspection agency is responsible for qualifying any welding procedure that will be used. Welding procedures qualified by others may be used, subject to the specific approval of the Purchaser provided that the following conditions are met.

a. The proposed Welding Procedure Specification (WPS) has been prepared, qualified and executed by responsible, recognized organization with expertise in the field of welding

b. The Contractor has not made any change in the welding procedure.

12.3.3. The impact testing is generally not required.

12.3.4. The materials to be welded are in the thickness range between 5 mm to 22 mm. Therefore Post weld heat treatment is not required.

12.3.5. The design pressure is atmospheric and the design temperature is in the range -2° C to 65 ° C.

12.3.6. The welding process is SMAW or GTAW or a combination thereof.

12.3.7. Welding electrodes for the SMAW process shall be E60 and E 70 classification series (E-6010, E 6013, 7018 and E 7018-1 in AWS A 5.1).

12.3.8. The contractor shall accept written responsibility for both i.e. the Welding Procedure Specifications (WPS) and the Procedure Qualification Record (PQR).

12.3.9. The contractor has at least currently employed welder or welding operator, who have met with the following requirements

a. While in employment, the welder has satisfactorily passed a performance qualification test using the procedure and the P-Number material specified in the WPS.
b. The performance bend test required by ASME Section IX QW-302 shall be used for this purpose.

12.4. PERFORMANCE QUALIFICATION BY OTHERS

12.4.1. Site Engineer may accept a performance qualification made by certified agencies subject to specific approval.

12.4.2. The Contractor shall obtain a copy from the certified agencies of the performance qualification test record & submit the same for purchaser's approval with specific recommendation & approval of Inspector with the following details.

a. The name of the agency.
b. The name of the welder or welding operator.
c. The procedure identification.
d. The date of successful qualification.
e. The data that Individual last used the procedure on tank fabrication.

12.5. QUALIFICATION RECORD

The Contractor shall maintain a self-certified record, available to site engineer and inspector. The records will have the following details:

a. The procedure used.
b. The welders and welding operators employed showing the date and results of procedure and performance qualifications
c. The identification symbol assigned to each welder and welding operator.

12.6. WELDING MATERIALS

12.6.1. FILLER METAL

Filler metal shall conform to the requirements of ASME Section IX.

12.7. PREPARATION FOR WELDING

12.7.1. CLEANING

a. Internal and external surfaces to be thermally cut or welded shall be clean.

b. They will be free from paint oil rust scale and other material that would be detrimental to either the weld or the base metal when heat is applied.

12.7.2. END PREPARATION

a. End preparation is acceptable only if the surface is reasonably smooth and true, and slag from oxygen or arc cutting is cleaned from thermally cut surfaces.
b. Discolouration remaining on a thermally cut surface is not considered detrimental oxidation.
c. End preparation, for groove welds specified in ASME or as specified, which meets the WPS is acceptable.
d. Edge preparation of plates shall be done using Pug Cutting machine only.

12.7.3. ALIGNMENT

CIRCUMFERENTIAL WELDS

a. Inside surface of steel plate ends to be joined shall be aligned within the dimensional limits in the WPS and the engineering design.
b. If the external surfaces of the steel plates are not aligned, the weld shall be tapered between them.

12.7.4. WELDING REQUIREMENTS

WELDS : Welds including addition of weld metal for alignment shall be made in accordance with a qualified procedure and by qualified welders or welding operators.

12.7.5. WELDER'S IDENTIFICATION SYMBOL

Each qualified welder and welding operator shall be assigned an identification symbol.

a. Unless otherwise specified in the engineering design, each weld or adjacent area shall be marked with the identification symbol of the welder or welding operator.
b. In addition of marking the weld, appropriate records shall be maintained.

12.7.6. TACK WELDS

a. Tack welds at the root of the joint shall be made with filler equivalent to that to be used in the root pass.
b. Tack welds shall be made by a qualified welder or welding operator.
c. Tack welds shall be fused with the root pass weld, except that those which have cracked shall be removed. Bridge tacks (above the weld) shall be removed.

12.7.7. PEENING

Peening is prohibited on the root pass and final pass of a weld.

12.7.8. CLIMATIC CONDITIONS

No welding shall be done if there is impingement on the weld area, of rain, snow, sleet or excessive wind or if the weld area is frosted or wet.

12.7.9. FILLET AND SOCKET WELDS

Fillet welds, including socket welds, may vary from convex to concave. The size of a fillet weld shall be as per engineering design.

12.7.10. SEAL WELDS

Seal welding shall be done by a qualified welder. Seal welds shall cover all exposed threads.

12.7.11. WELDING SPECIFICATION FORMATS

Following formats shall be used welding specifications:

FORMAT FOR WELDING PROCEDURE SPECIFICATIONS (WPS)

1. Contractor's Name _____
2. By _____
3. WPS No.(s) _____Date_____
4. Supporting PQR No. (s) _____
5. Revision No. _____Date_____

6. Types of Welding _____
   Process (es) (Automatic, Manual, Machine or Semi Automatic)

Notes :

1) Tenderers to sign Pg. Nos. ___ to ____ in token of acceptance of formats.
2) Details have to be filled in by the successful tenderer at the time of acceptance of W.O.

_____

WA. JOINT

1. Joint Design _____
2. Backing (Yes)_____(No)_____
3 Type of Backing Material _____

Notes:

a)The general arrangement of the parts to be welded should be shown by sketches, drawings, weld symbols or written detailed description. The root spacing and the details of weld groove should be specified.\

b) The contractor should attach the sketches to illustrate joint design, weld layers and bead sequence e.g. for notch toughness procedures, for multiple process procedures etc.

WC1. POSITIONS

1. Position(s) of Groove _____
2. Welding Progression: Up _____
   Down_____

3. Position(s) of Fillet _____

_____

WC2. PREHEAT

1. Preheat Temp. Minimum _____
2 Interpass Temp. Max _____
3 Preheat Maintenance _____
Note: Continuous or special heating where applicable should be recorded

_____

WC3. GAS

1 Shielding Gas(es) _____

2 Percent Composition _____
(mixtures)
3 Flow Rate _____
4 Gas Backing _____
5 Trailing Shielding Gas _____

WC4. ELECTRICAL CHARACTERISTICS

1 Current AC or DC _____ Polarity_____

2. Amps.(Range) _____ Volt~ (Range) _____

3 Tungsten Electrode _____
Size & Type (Pure Tungsten~2% Thoriated etc.)
4 Mode of Metal Transfer _____
For GNAW (Spray arc, short circuiting arc etc.)
5. Electrode Wire feed _____
speed range

Notes:

a. Amps. and volts range should be recorded for each electrode size, position and thickness etc.

b This information may be listed in a tabular form similar to that shown above

---

WC5. TECHNIQUE

1. String or Weave Bead _____
2. Orifice or Gas Cup Size _____
3. Initial and Interpass Cleaning _____
   (Brushing, Grinding etc.)
4. Method of Back Gouging _____
5. Oscillation _____
6. Contact Tube to Work Distance _____
7. Multiple or Single Pass (per side)_____
8. Multiple or Single Electrodes _____
9. Travel Speed (Range) _____
10. Peening _____
11. Other _____

WB. STEEL PLATES MATERIAL (BASE METAL)

1. P.No._____Group No. _____ To P. No._____ Group No._____

OR

2. Specification _____ Specification _____

to

type and grade _____ type and grade _____

OR

3 Chem. Analysis Chem Anlysis _____
and Mech. Prop. _____ and Mech. Prop. _____

4. Thickness Range :

5- Base Metal : Groove _____ Fillet_____

6. Deposited : Groove _____ Fillet_____
   Weld Metal
7. Plate thickness Groove _____ Fillet_____+ range
8. Other _____

_____

WC. ELECTRODES

1. F.No. _____ Other_____

2. A.No. _____ Other _____

3. Spec. No. (SFA) _____

4. AWS No. (Class) _____

5. Size of filler metals _____
(Electrode, Cold Wire, Hot Wire etc.)

6. Electrode Flux (Class)_____

7. Flux Trade Name _____

Notes: Each base metal filler metal combination should be recorded individually.

WELD LAYERS	PROCESS	FILLER METAL		CURRENT		VOLT RANGE	TRAVEL SPEED RANGE	OTHER
		CLASS	DIA	TYPE POLAR	AMP. RANGE			
								eg. Remarks, Coment Hotwire, Addition Technique, Torch Angle, Etc.

FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)

1. Contractor's Name _____
2 PQR No. _____
3. Date _____
4. WPS No. _____
5. Welding Process(es) _____
(Type - Manual, Automatic, Semi-Auto)

PA. JOINTS

GROOVE DESIGN OF TEST COUPON

Note :

For combination qualifications the deposited weld metal thickness shall be recorded for each filler metal or process weld.

PB. STEEL PLATES MATERIAL (BASE METAL)

1 Material Spec. _____

2. Type of Grade _____

3. P.No. _____To P.No._____

4. Thickness of Test Coupon _____

5. Size Test Coupon _____

6. Other _____

PC. WELDING ELECTRODES (FILLER METALS)

1. Weld Metal Analysis A-No._____

2. Size of Filler Metal _____

3. Filler Metal E-No. _____

4. SPA Specification _____

5. AWS Classification _____

6. Other _____

PC1. POSITION

1. Position of Groove _____

2. Weld Progression (Up, Down) _____

3. Other _____

PC2. PREHEAT

1. Preheat Temp. _____

2. Interpass Temp. _____

3. Other _____

PC3. GAS

1. Types of Gas of Gases _____

2. Composition of Gas Mixture _____

3. Other _____

PC4. ELECTRICAL CHARACTERISTICS

1. Current _____
2. Polarity _____
3. Amps. _____
4. Volts _____
5. Tungsten Electrode Size _____
6. Other _____

PC5. TECHNIQUE

1. Travel Speed _____
2. String or Weave Bead _____
3. Oscillation _____
4. Multipass or Single Pass (per side) _____
5. Single or Multiple Electrodes _____
6. Other _____

SPECIMEN NO.	WIDTH	THICKNESS	AREA	ULTIMATE TOTAL LOAD Kgs.	ULTIMATE UNIT STRESS Mpa	TYPE OF FAILURE AND LOCATION

GUIDED BEND TEST

TYPE AND FIGURE NO.	RESULT

TOUGHNESS TEST

SPECIMEN NO.	NOTCH LOCATION	NOTCH TYPE	TEST TEMP.	IMPACT VALUES	LATERAL EXP.		DROP WEIGHT	
					% SHEAR	MILES	BREA	NO BREAK

FILLET WELD TEST

1. RESULT
   Satisfactory:
   Yes _____
   No _____
2. PENETRATION INTO PARENT METAL:
   Yes _____
   No _____
3. MACRO –RESULTS _____

OTHER TESTS

1. TYPE OF TEST _____
2. DEPOSIT ANALYSIS_____
3. OTHERS _____

---

1. WELDER's NAME _____
2. CLOCK NO. _____STAMP NO._____
3. TEST CONDUCTED BY_____
4. LABORATORY TEST NO._____

This is to certify that the statements in this record are correct. We also certify that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer _____

Date _____ By _____

Details of record of tests are illustrative only and may be moulded to conform to the type and number of tests required by the Code.

CONTRACTORS RECORD OF WELDER QUALIFICATION TESTS

Welder Name_____

Check No _____ Stamp No _____

Using WPS No _____ Revision _____

The above welder is qualified for the following ranges

SN.	DESCRIPTION	RECORD ACTUAL VALUES USED IN QUALIFICATION	QUALIFICATION
1	Process		
2	Process Type		
3	Backing (Metal, weld, flux etc)		
4	Material Specs		
a.	Plate thickness		
b.	Groove		
c.	Fillet		
5	Filler Metal		
a.	Spec No		
b.	Class		
c.	F. No		
6	Position		
7	Weld Progression		
8	Gas Type		
9	Elec. Charac		
a.	Current		
b.	Polarity		

GUIDED BEND TEST RESULTS

TYPE & FIGURE NO. RESULT

RADIOGRAPHIC TEST RESULTS

For alternative qualification of groove welds by radiography Radiographic Results_____

FILLET WELD TEST RESULTS

Fracture Test _____

(Describe the location, nature & size of any crack of tearing of the specimen)
Length and Percent of Defects_____ INCHES_____%
Macro Test – Fusion _____
Appearance - Fillet Size(ing) _____in. X_____ in.
Convexity _____in. or Concavity _____
Test Conducted by _____
Laboratory - Test No._____

This is to certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Organization

_____

Date _____ by _____

Details of record [1]tests are illustrative only and may be modified to conform to the type & number of tests required by the Code.

Note : Any essential variables in addition to those above shall be recorded.

ELECTRODE QUALIFICATION TEST RECORD

Date_____

Test started on_____

Test completed on_____

A. DETAILS _____

1. Tested at_____
2. Work order no._____
3. Sponsoring Agency _____
4. Manufacturer's Name_____
5. Brand Name _____
6. Welding Positions_____
7. In combination with (if any) _____
8. Reference Code & Classification_____
9. Special requirements (if any) _____
10. Batch No. with date & size _____

SN.	ELECTRODE SIZE	BATCH NO.	DATE OF MANUFACTURE	REMARKS

B. TESTS

1. All weld tests_____
2. Base material used _____
3. Buttering used _____ Yes/No
4. Preheat Temperature _____ Deg.C
5. Interpass Temperature _____ Deg.C
6. PWHT details soaking Tem./Time_____
7. Visual Examination _____

RADIOGRAPHIC PROCEDURE FOR TANK FABRICATION

1.	Location	-	
2.	Date of Testing		-
3.	Name of the Contractor		-
4.	Material	-	
	Carbon steel/Alloy Steel /Stainless Steel		-
5.	Plate thickness		-
6.	Type of Weld Joint	-	
7.	Radiation Source	-	
8.	Intensifying Screens/ Lead Screens		-
9.	Geometric Relationship		-
10.	Limit of Film Coverage		-
11.	Film Type and Make	-	
12.	Exposure Time		-
13.	Processing	-	
14.	Density		-
15.	Sensitivity	-	
16. *	Type of Penetrameter (Source side)		-
17. *	Type of Penetrameter (Film side)		-

Signature of Contractor with Seal

Approval of Owner's Inspector

WELDER'S IDENTIFICATION CARD

PHOTOGRAPH

1.	Name	-	
2.	Identification		-
3.	Date of Testing		-
4.	Valid until	-	
5.	Process		-
6.	Thickness	-	
7.	F. No.	-	
8.	Approval of welding	-	
9.	Position	-	

Approved by

Employee's Signature
with Seal

SPECIFICATION FOR PAINTING

OF

STORAGE TANKS

Table of Contents

13. PAINTING SPECIFICATIONS

13.1. GENERAL

13.1.1. This section defines basic requirements for painting of mild steel vertical cone roof storage tanks.

13.1.2. It is deemed that the work shall be carried out by the contractor with the best quality of specified material and workmanship at his own cost.

13.1.3. The blasted surface shall not be kept exposed to atmosphere for more than 24 hours (particularly at night time when humidity %age in atmosphere is more and might spoil the surface prepared).

13.1.4. The first coat of primer shall be applied soon after cleaning and before any visible rusting occurs.

13.1.5. The paint coat shall be smooth and even and shall not show any trace of brush mark. The bands, lettering, etc. shall be carried out as per drawing after the external painting is completed.

13.1.6. Adequate numbers of required tools, brushes, blast material, scaffolding, shot/Blasting equipment, air compressors etc. shall be arranged by the contractor at site.

13.1.7. During storage and application of paints, the paint manufacturer's instructions shall be strictly followed. Particular attention shall be paid to the following:

- Proper storage avoiding exposure and extreme temperature
- Specified surface preparation
- Mixing and thinning
- Application of paints and the recommended time intervals between consecutive paint coats
- Two pack paint system shall be mixed by mechanical means. The Purchaser may allow hand mixing of small quantities at his discretion
- Restrictions for number of batches per tank

13.2. SCOPE OF TANK PAINTING

Scope of Tank Painting covered in this includes :

a. External surface of tank, shell, roof and appurtenances.
b. Underside surface of roof and roof supporting structures for CR tanks.
c. Structural steel, ladder, staircase, platform, walkway, handrail, etc.
d. Inside of shell above liquid level.
e. Underside and upper side surface of tank bottom plates.
f. Inside surface of tank shell up to first strake height from bottom plate of CR tanks.

13.3. Material Specification

13.3.1. Aluminium

The particles used for Blasting shall be free from moisture.

13.3.2. BRUSHES

The brushes used in painting shall conform to IS : 384.

13.3.3. PRIMER COAT

The primer used must provide good protection against corrosion and shall leave a tough adherent film which will form a suitable base for the following coats. It shall conform to given specifications.

13.3.4. FINISH COAT

The finish coats shall conform to given specifications.

13.3.5. SKY BLUE PAINT

The sky blue paint shall be used for painting outer surface of water tank.

13.3.6. Paints used shall be of superior grade paints of approved make and quality and conform to given specification shall be used. Contractor shall obtain approval from Purchaser before procurement of primer/paint etc. and shall obtain approval from site in sealed and unopened condition for inspection and approval of Purchaser for use of paints at site.

13.4. SURFACE PREPARATION

Before Blasting surface shall be cleaned thoroughly leaving it free of all scales, dust, grease, oil coating, moisture and other impurities with the help of brass wire brushes, sand paper, emery paper etc. Wherever required any weld metal etc. shall be ground off by grinding machine to get smooth polished surface. Heavy deposits of grease of oily matter if any shall be removed by suitable solvent wash before Blasting is undertaken.

13.5. BLASTING

13.5.1. Shot blasting shall be carried out to a surface finish of SA 2½ standard as per Swedish Standard SIS 055900-1967 or equivalent i.e., Blast cleaning to near white metal cleanliness, until 95% of each element of surface area is free of all visible residues.

13.5.2. Before Blasting, the surfaces shall be cleaned thoroughly i.e. free from all scales, dust, grease, oil coating, moisture and other impurities. Any weld metal etc. shall be ground by grinding machine to get a smooth surface. Heavy deposit of greases of oily matter if any shall be removed by solvent wash.

13.5.3. Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

13.5.4. AIR BLASTING CLEANING

a. The blast cleaning of the surfaces shall be done using abrasive media like Al_2O_3 particles, copper slag, or other standard media at a pressure of 7 kg/cm^2 at appropriate distance and angle depending on nozzle size maintaining constant velocity and pressure.
b. Compressed air shall be free from moisture and oil. The blasting nozzles should be venturi style with tungsten carbide or boron carbide as the materials for liners. Nozzles orifice may vary from 3/16" to ¾".
c. Maximum air supply pressure shall be maintained at the delivery nozzle is 7 kg/cm^2 (100 psi) during blasting operation.
d. On completion of blasting operation, the blasted surface shall be clean and free from any scale or rust and must show a gray white metallic luster. Primer shall be applied within 4 hours of surface preparation.
e. Blast cleaning shall not be done outdoors in bad weather without adequate protection or when there is dew on the metal which is to be cleaned. Surface profile shall be uniform to provide good key to the paint adhesion (i.e. 35 to 50 micron). If possible vacuum collector shall be installed for collecting the abrasives and recycling.

13.5.5. After blasting, the surface need to be cleaned by dry brush or by dry compressed air (free from moisture and oil) to remove dust deposits.
After surface preparation, the first coat of primer must be applied on dry surface by airless/conventional spray and as directed by Site Engineer. Delaying the primer application is not advisable beyond 2 hours if weather is dry and humidity level is less than 80% and if primer is applied within 4 hours, there is no need to provide inhibitor wash over the blasted surfaces if it is not possible to apply primer within 4 hours, then application of inhibitor is a must. It is essential to preplan the activities to start the primer application immediately after blasting.

13.5.6. Blast cleaned surface should be inspected by using magnifier glass or surface profile for anchor patterns. Surface profile in blast cleaning should ideally be 50 to 70 microns (generally 1/3 of the total DFT).

13.5.7. Arrangements for inspection at various stages of work should be made available so that entire blasted area is accessible for inspection.

13.5.8. The thickness of plates used for tank shell is not uniform. This factor should be kept in mind blast cleaning to prevent damage for thinner plates. When carrying out blast cleaning on the shell and roof, the work shall always be done in such a manner with respect to the wind direction that the abrasive practices are blown away clear of the tank surface.

13.6. CLEANING

Abrasives or dirt particles and the other metals shall be removed from the shot blasted surface by means of clean soft brush or vacuum or compressed air (free from oil and moisture).

13.7. PAINTING RECOMMENDATIONS

a. Painting of CR Tanks for Fire Water

Surface to be painted	EXTERNAL PAINTING External side of shell and roof, structural and other non galvanized steel works like spiral stair case, hand rail, mid and top landing platforms, top railing etc.	
Surface Preparation	Blast clean to SA 2½	Blast clean to SA 2½
Paint system Recommended	One coats of P1 (75-80μm) + One coat of U1 (120-125 μm) + Two coats of F1 (40-45 μm) each	One coats of P1 (75-80μm) + Two coats of epoxy coal tar coating each to a DFT of 125 – 175 μ.
Thickness of paint system	275 μ	Total DFT (min): 375μm

b. Table – 5 : Painting of Steel Structure

Surface to be painted	Steel Structurals (External)
Surface Preparation	Blast clean to SA 2½
Paint system Recommended	One coats of P1 (75-80μm) + One coat of U1 (120-125 μm) + Two coats of F4 (25 μm) each
Thickness of paint system	Total DFT (min.) - 235 μm

c. Table – 5 : Painting of Pipelines and Fittings

Surface to be painted	Mild steel Pipelines and fittings
Surface Preparation	Blast clean to SA 2½
Paint system Recommended	One coats of P1 (75-80μm) + One coat of U1 (120-125 μm) + Two coats of F1 (40-45 μm) each
Thickness of paint system	Total DFT (min.) - 275 μm

13.8. SPECIFICATIONS FOR PAINTS

13.8.1. Primers

a. ZINC ETHYL SILICATE PRIMER – (P1)

The zinc ethyl silicate consists of two packs. One pack contains the ethyl silicate binder with suitable solvents. The other pack contains zinc dust with additives. They have to be mixed in suitable proportions before application as recommended by manufacturer.

Colour	:	Gray
Application	:	Spray (airless/air)
Dry film thickness per coat	:	75 microns
Theoretical coverage	:	8 m^2/litre
Drying time	:	4 hours
Re-coating time	:	10 hours (min.)
% of total metallic zinc in dryfilm	:	85 – 90% by wt.
As per the ASTM D520 – Spherical size Storage life	:	4 months under sealed conditions

b. TWO PACK EPOXY POLYAMIDE ZINC PHOSPHATE PRIMER (P2)

These coatings are corrosion resistant inhibitive primers based on cold cured epoxy polyamide two pack system, over which subsequent coatings can be applied.

Type of Epoxy	:	Condensation product of bisphenol A & epichlorohydrin with terminal epoxides groups.
Epoxide Equivalent	:	400 – 500
Curing agent	:	Polyamide
Volume Solids	:	45 – 50%
Pigment	:	The main pigment shall be mixture of iron oxide with zinc phosphate. Out of total pigmentation, the minimum quantity of zinc phosphate should be 9% W / W
Pigment volume concentration	:	40 – 45%
Application	:	Spray
Dry film thickness per coat	:	75 microns
Spreading rate	:	6 – 7 m^2/ lt.

Drying time	:	Surface dry in 4 hours
Overcoating time	:	24-48 hours. This should be very strictly adhered to in order to avoid peeling of subsequent coat.
Storage life	:	12 months under sealed conditions.

c. ZINC PHOSPHATE PRIMER (P3)

This primer is based on single pack modified alkyd medium pigmented with a mixture of zinc phosphate and red oxide.

Volume solids	:	40 ± 2%
Main Pigment	:	A mixture of zinc phosphate and Red oxide. Out of the total pigmentation, the minimum quantity of zinc phosphate should be 10%
Colour	:	Brown
Pigment Volume concentration	:	30 – 35%
Application	:	Brush or spray
Dry film thickness per coat	:	30 – 35 mm
Theoretical coverage	:	11 – 13 m^2 litre
Drying time	:	Touch dry – 1 hour
Over coating time	:	Minimum – over night
Storage life	:	6 months under sealed conditions

13.8.2. Finish Paints

a. TWO PACK ALIPHATIC POLYURETHANE FINISH PAINT : (F1)

Part A & Part B are to b mixed together to form a pigmented polyurethane paint in suitable proportions as recommended by manufacturer.

Part A consists of polyacrylate polyol with appropriate pigments, extenders, solvents and additives.

Part B consists of an aliphatic polyisocyanate with appropriate solvents and additives

Volume solids	:	45%
Main pigment	:	Rutile TiO2 (min 80 % w/w on total pigment weight) and extenders with other suitable pigment to get the desired colour
Colour	:	As desired
Pigment Volume Concentration	:	15 – 20%

Application	:	Brush or spray
Dry film thickness per coat	:	40 – 45 um
Theoretical coverage	:	11 – 13 m^2/litre
Drying time	:	Surface dry/1hr.
		Full cure 7 days
Storage life	:	3 months under sealed conditions

b. COAL TAR EPOXY : (F3)

A high build two component epoxy coal tar product meant for excellent performance under total / partial / intermittent immersion conditions in salt or fresh water. It is a blend of epoxy and coal tar pitch in suitable ratios.

Type of epoxy	:	Condensation product of bisphenol A and epichlorohydrin with terminal epoxides groups
Curing Agent	:	Polyamide
Volume solids	:	80-85%
Application	:	Brush or airless spray
Dry film thickness per coat	:	150 – 200 um
Theoretical coverage	:	4-5 m^2/litre
Drying time	:	Touch dry/overnight dependant on ambient temperature and ventilation.
		Hard Dry – 48 Hours
Over coating time	:	24-48 hours. This should be strictly adhered to in order to avoid peeling of subsequent coat

Storage life	:	Up to 9 months under sealed conditions

c. SYNTHETIC ENAMEL (F4)

A high quality enamel based on synthetic resin vehicle stable weather - resistant pigment designed for both protection and decoration.

Volume solids	:	38 - 40%
Application	:	By brush or conventional spray
Dry film thickness/coat	:	25 microns
Spreading rate (Theoretical)	:	15 m^2/litre.
Drying time	:	Surface dry - 4 hrs.
		Hard dry - in 18 hours
Storage life	:	12 months under sealed conditions

13.8.3. TWO PACK EPOXY BASED TANK LINER (L1)

These coatings are high build paints based on epoxies and cured with polyamines or modified epoxy-phenolic and cured with amine adduct. They are specially meant as liners to interiors of petroleum tanks formulated to permit application at a DFT of 125 microns per coat.

Volume solids	:	50 - 60%
Pigment volume concentration	:	35 - 40%
Dry film thickness um/coat	:	125 microns
Spreading rate	:	4-5 m2/litre
Storage life	:	12 months under sealed conditions

13.8.4. TWO PACK EPOXY -POLYAMIDE MIO UNDERCOAT (U1)

These coatings are high build paints based on cold cured epoxy polyamide system pigmented with chemically inert pigments and extenders formulated to permit application at a DFT higher than 100 microns per coat.

Type of epoxy	:	Condensation product of bisphenol A and epichlorohydrin with terminal epoxides groups
Curing Agent	:	Polyamide
Epoxide equivalent	:	450-500
Volume solids	:	55-60%
Pigment	:	The main pigment shall be micaceous iron oxide (MIO- Lamellar) constituting

		a minimum of about 65 % of w/w of total pigments
Pigment volume concentration	:	40-45 %
Application	:	Brush or airless spray
Dry film thickness per coat	:	110 – 120 um
Theoretical coverage	:	5-5.5 m^2/litre
Drying time	:	Touch dry – 2 hours
		Hard Dry – 48 Hours
Over coating time	:	24-48 hours. This should be strictly adhered to in order to avoid peeling of subsequent coat
Storage life	:	12 months under sealed conditions

13.9. PRECAUTIONS TO BE TAKEN DURING PAINTING

13.9.1. Precautions to be taken during application of epoxy and polyurethane paints.

- Paint shall not be applied when temperature falls below 10°C or rises above 50°C and when relative humidity rises above 90%. Do not apply during rain, fog or mist.
- Use all the mixed paints within the stipulated pot life period indicated by the manufacturer.

13.9.2. Precautions to be taken during application of Inorganic Zinc Ethyl Silicate Primer

- The coating must be fully cured and free from residual solvents before over coating, which normally takes 24 hours but time may be extended if relative humidity is below 80%. While over coating, it is desirable to apply a mist coat first to avoid bubbing problem which appears due to air entrapment.

13.10. MARKET EQUIVALENT OF DIFFERENT PAINTS

Name of Paint	**Berger**	**Bombay Paints**	**CDC**	**Grand Polycoats**	**Jenson & Nicolson**	**Asian Paints**	**Shalimar**	**Corromandel Prodorite**
Zince ethyl silicate - P1	Zinc Anode 304	Hempel Galvosil 1570	CDC Zince 11	GP Prime 402		APCOSIL 605 ZS		
Epoxy zinc Phosphat	Epliux 13 HB	Pentadur 8530	-	GP Prime 201 HB	Epilac Zinc Phosph	APCODUR HB	Epiguard 4	COROCRETIN - ZNP

e primer P2					ate Primer			
Zinc phosphate Primer P3	Bizon HB zinc Phosphate primer	Kangaroo HB Phosphate Primer	-	GP TRUPRIME 301	J & N High build Zinc phosphate primer	APCOMIN HB	Tuffkote HB zinc phosphate primer grey	
High build Epoxy MIO (U1)	Epliux - 4 HB Mi0	Pentadur HB Mi0 5567	-	GP Guard MIO 233	Epilac HB Mi0 1 - 23	APCODUR EPOXY MIO	Epigard - 5	
Aliphatic polyurethane Finish Paint F1)	Bergerthane enamel	Pentathene 4510	CDC 134 Finish	GP Bond 141	J & N 993 HB	APCOTHANE CF 673	Shalithane Finish	COROLAC - UP
Coal tar Epoxy (F3)	Epilux 555 Coal Tar Epoxy High Build	PENTADUR 6518	CDC MASTIC 14	GP Guard CE - 232	Eplilac solvent Less coal tar epoxy coating	APCODUR CF 655	Bipigard 580 H.B. Black	COROCRETIN-TE
Synthetic enamel (F4)	Bison Chemical Resisting Enamel	Synthetic enamel to IS 2932		GP TRUCOAT 331	J 7 N Chemical resisting enamel	APCOMIN SYN ENAMEL	Tuffkote chemical resisting enamel (9609-49)	
Epoxy - based tank liner (L1)	Epilux 78 HB TL	Pentadur FP 4535	CDC 187	GP Guard 234 A	Eplac 976	APCODUR CF 699	Epigard - TL-BH 533	COROCRETIN--UBS

13.11. INSPECTION FORMAT DURING PAINT APPLICATION

Surface preparation adopted	
Type of primer used	
Method of application	
Date and time of application	
Whether condition prevailing on the day of application (temp., humidity, rainy, sunshine)	
DFT measured (24 hour later)	
Method of application	
Date of time of application	
Whether condition on the day of application	
DFT measured	
Type of subsequent paint	
Method of application	
Date and time of application	
Whether condition on the day providing and fixing application	

13.12. Joint Warranty period with paint manufacturer for painting systems:

a. External Polyurethane based systems: 5 Years
b. Internal Tank Liner based systems: 5 years
c. Internal coal tar based systems for water tanks: 5 years

VENDOR LIST

FOR

MECHANICAL ITEMS

CONTENTS

1. C S PIPES IS 1239 (BLACK & GI)

1. AMBICA TUBES CO
2. ANIL METAL CORPORATION
3. CHETAN STEELS (UPTO 6")
4. DADU PIPES (P) LIMITED (1/2" TO 6")
5. GOOD LUCK STEEL TUBES LTD (15 MM TO 150 MM DIA)
6. GUJRAT STEEL TUBES LTD.
7. HI-TECH PIPES LTD. (ERW MS / GL PIPES: 1/2" NB TO 6" NB,(THICKNESS 2.2 MM TO 6.0 MM)
8. INDIAN TUBE CO. (TATA DIV. OF TUBES & PIPES) (FOR >200M)
9. INDUS TUBES LIMITED (1/2" TO 6")
10. JAY LAKSHMI STEEL & ENGINEERING CO
11. JINDAL PIPES LTD. (1/2" TO 4")
12. JOTINDRA STEELS TUBES LTD. (1/2" TO 6'}
13. KALPESH TUBE (INDIA). (TRADER) (UPTO A MAX ORDER VALUE RS 25.0 LAKH)
14. MUKAT PIPES LTD
15. NAVRATAN PIPE AND PROFILE LTD (UPTO 6")
16. P.K.FORGE & FITTING INDUSTRIES
17. SAGAR STEEL CORPORATION (TRADER)
18. SANGHVI METALS (TRADER)
19. SURINDRA ENGINEERING CO PVT. LTD.
20. SURYA ROSHNI LTD. (15MM TO 150MM)
21. THE BENGAL MILL STORES SUPPLY CO.(TRADER)
22. WELSPUNGUJARAT STAHL ROHREN LIMITED (ANJAR) (UPTO 6")
23. ZENITH LIMITED

2. C S WELDED PIPES IS- 3589

1. ANIL METAL CORPORATION
2. DADU PIPES (P) LIMITED (6" to 12" (Thickness up to 9.5 mm))
3. EVERGREEN HARDWARE STORES
4. GOOO LUCK STEEL TUBES LTD (Upto 150mm dia . 8 mm thick)
5. GUJRAT STEEL TUBES LTD.
6. HEAVY METAL & TUBES
7. HI-TECH PIPES LTD (ERW MS / Gl Pipes: 6"NB OD to 12" (Thickness 2.6 mm to 8.0mm)
8. INDUS TUBES LIMITED (6" to 12")
9. JAY LAKSHMl STEEL & ENGINEERING CO.
10. JINDAL PIPES LTD. (8" to 14")
11. JOTINDRA STEEL & TUBES LTD. (6" lo 14")
12. KALPESH TUBE (INDIA). (TRADER)
13. LALIT PIPES & PIPES IIMITED (16" to 64", thickness upto 20mm)
14. MUKAT PIPES LTD
15. NAVRATAN PIPE AND Profile LTD (Upto 10")
16. P K FORGE & FITTING INDUSTRIES
17. PRATIBHA IHNDUSTRIES LTD. (16"NB to 24" NB. Wall Thickness. 6 mm to 20 mm)
18. RATNAMANI METALS & TUBES LIMITED
19. SAGAR STEEL CORPORATION (TRADER)
20. SANGHVI METALS (TRADER)
21. SAW PIPES
22. SHRI RAM METALS
23. STEEL AUTHORITY OF INDIA LTD
24. SURINDRA ENGINEERING CO. PVT LTD
25. SURYA ROSHHI LTD (6" to 16", (150mm to 400mm))
26. THE BENGAL MILL STORES SUPPLY CO.(TRADER)
27. WELSPUN GUJARAT STAHL ROHREN LIMITED (DAHEJ) (Upto 72" (50 mm thk)
28. WELSPUN GUJARAT STAHL ROHREN LIMITED (ANJAR) (Upto 100" (30 mm thk)

3. CS / AS / LT SEAMLESS PIPES

1. BHEL (VALVES DIVISION)
2. CHETAN STEELS (Upto 12" SCH 80)
3. HEAVY METAL & TUBES (Upto 8" (thickness upto 18.26 mrn))

4. HEAVY METAL PIPE CENTRE (Upto 24" (Upto SCHXXS) (PDIL approved Manufacture's Make only))
5. INDIAN TUBE CO (TATA DIV Of TUBES & PIPES)
6. ISMT LIMITED
7. JAY LAKSHMI STEEL & ENGINEERING CO.
8. JINDAL SAW LIMITED
9. MAHARASHTRA SEAMLESS LTD.
10. P K FORGE & FITTING INDUSTRIES
11. RATNADEEP METAL & TUBES PVT LTD. (<=168.3mm OD)
12. SAINEST TUBES PVT LTD. (1/2" NB to 3" Upto Sch 160 (ASTM A106 Gr. B. A333Gr.1 & 6 A335 Gr. P11))

4. FITTINGS: CS/AS/SS SLAMLESS & FORGED

1. AMFORGE INDUSTRIES
2. ANIL METAL CORPORATION
3. CHETAN STEELS (Upto 6" SCH 80)
4. COMMERCIAL SUPPLYING AGENCY
5. CSA FITTINGS (Forged: ½" to 2" (Upto 9000#) & Seamless: 2" to 8"(Upto SCH XXS))
6. EBY FASTNERS
7. EBY INDUSTRIES
8. FIT-TECH INDUSTRIES (CS (Forged) Elbow and Tee ½" NB 1 ½" NB, Rating 3000#, 6000#, 9000# as per ASME B16.11, CS (Seamless) Elbow 1/2" NB to 8" NB. Sch 5 to Sch XXS as per ASME B16.9, CS (Seamless) Tee 2" NB to 8" NB. Sch 5 to Sch XXS
9. FLASH FORGE (P) LTD. (Forged: Upto 4" (Upto 9000#) & Seamless: Upto 42")
10. GUJARAT INFRAPIPES PVT. LTD.
11. JAY LAKSHMI STEEL & ENGINEERING CO
12. KALPESH TUBE (INDIA). (TRADER) (upto a max order value Rs.25.0Jakh)
13. M.S. FITTINGS MANUFACTURING CO.PVT.LTD.
14. MARDALE PIPES PLUS LTD
15. NAVKAR FORGINGS & FITTINGS PVT. LTD. (Forged 3" (Upto 6000#) & Seamless: Upto 16" (Sch XXS))
16. NL HAZRA (up to SCH 80)
17. P K TUBES & FITTINGS PVT LTD (Forged upto 11/2" Seamless upto 24" (SCH 160))
18. PK FORGE & FITTING INDUSTRCS
19. PARAS FITTINGS PVT LTD (Forged CS: ½" to 2" & CS Seamless: 2" lo 8" (Upto Sch XXS))

20. PARMAR TECHNO FORGE (Elbow-1/2” to 12”. Tees-1/2” to 8". Reducer (conc & eccn)-1/2” to 12”. CAPS- 1/2" to 18"(CS & SS))
21. PERFECT MARKETING (P) LTD,
22. PETROCHEM INDUSTRIES (Seamless: upto 16” (all Fittings) & upto 36" (Only Caps) SchXXS/80S. Forged: Upto 3" 6000#)
23. RAJENDRA FORGE INDUSTRIES (CS: Upto 12" Sch 40 & SS: 6” Sch 40S)
24. S & G ENGINEERS (P) LTD
25. SAGAR STEEL CORPORATION (TRADER)
26. SANGHVI METALS (TRADER)
27. SAWAN ENGINEERS PVT LIMITED (Upto 36" (SCH160))
28. SHIVANANDA PIPE FITTINGS LTD
29. STEWARTS AND LLOYDS OF INDIA LIMITED
30. TEEKAY TUBES PRIVATE LIMITED
31. THE BENGAL MILL STORES SUPPLY CO (TRADER)
32. TOPAZ PIPING INDUSTRIES (Upto 36” (Sch 160))
33. TUBE BEND (CALCUTTA) PVT LTD (CS FITTINGS ONLY)
34. TUBE PRODUCTS INCORPORATE
35. ZOLOTO INDUSTRIES (15mm to 150mm (only CS-Gal))

5. FORGED FLANGE

1. AJAY FORGINGS PVT. LTD.
2. AMFORGE INDUSTRIES
3. ANANDMAYEE FORGINGS PVT LTD
4. C D ENGINEERING
5. CHAUDHARY HAMMER WORKS (P) LTD
6. CHETAN STEELS (Upto 6" (150#))
7. ECHJAY INDUSTRIES LIMITED
8. FEEROUS ALLOYS FORGINING PVT.LTD..
9. GOLDEN IRON & STEEL WORKS
10. GOOD LUCK ENGINEERING CO (1/2”-12" (Upto 2500#), 14"-16” (Upto 900#), 18"-32" (Upto 600#), 34"-48"(Uplo 300#))
11. J K FORGINGS (1/2” to 60".ANSI B16.5, Class 150# to 2500#)
12. KUNJ FORGINGS PVT. LTD. (Upto 60"(upto 300#) & Upto 12” upto 2500#))
13. MAHESH INDUSTRIES (Upto 8” (150#. Material: ASTM A105 only))
14. P K TUBES & FITTINGS PVT LTD (Upto24” (upto 1500#) & Upto 12" (upto 2500#) (Spectacle blinds and Spacer a Blind only).)

15. PARAMOUNT FORGE (CS, AS & SS: ½" to 42" (Uplo 600#). 1/2" to 24" (Upto 900#). ½" to "16" (Upto 1500#), 1/2" lo 12"(Upto 2500#))
16. PERFECT MARKETING (P) LTD.
17. PUNJAB STEEL
18. R D FORGE (A UNIT OF R D CHEMICALS PVT LTD) (Upto 54" (150#). 42"(upt0 600#). 20"(upto 1500#) & 12" (2500#))
19. RAJENDRA FORGE INDUSTRIES (CS & SS : Upto 12". 300#)
20. S & G ENGINEERS (P) LTD
21. SANGHVI FORGINGS & ENGINEERING LTD. (Up to 42" (upto 300#), 36" (600#), 24" (upto 1500#) & 12"(2500#))
22. SANGHVI METALS (TRADER)
23. SAWAN ENGINEERS PVT. LIMITED
24. TECHNO FORGE LTD (Up to 42" (Up to 300#). Up to 24" (600#), Up to 20" (900#), Up to 16" (1500#), Up to 12" (2500#))
25. TUBE BEND (CALCUTTA) PVT LTD

6. COMPRESSED FIBRE ASBESTOS FREE / RUBBER GASKETS

1. FERROLITE JOINTINGS (P) LTD (ASBESTOS.CAF ONLY)
2. GASKETS (INDIA) PVT LTD (ASBESTOS, CAF ONLY)
3. GOODRICH GASKET PVT. LTD (UP TO 24")
4. HINDUSTAN ASBESTOS & ALLIED PROOUCTS
5. HINDUSTAN COMPOSITES LIMITED
6. HINDUSTAN FERREDO LTD
7. IGP ENGINEERS LIMITED
8. MADRAS INDUSTRIAL PROOUCTS (UPTO 48")
9. MECHANICAL PACKING INDUSTRIESLTD..
10. PACKINGS & JOINTINGS (P) LTD.
11. PERFECT MARKETING (P) LTD,
12. PRASHANT ENGG STORES
13. REINZ TALBROS PRIVATE LIMITED
14. SPIRASEAL GASKETS PVT. LTD (CAF & TEFLON)
15. STARFLEX SEALING INDIA PVT LTD.
16. THE BENGAL MILL STORES SUPPLY CO (TRADER)
17. UNIQUE INDUSTRIAL PACKINGS PVT. LTD

7. FASTENERS

1. AEP COMPANY
2. CAPITAL INDUSTRIES
3. CONSOLE ENGG. & FASTNERS INDUSTRIES
4. EBY FASTNERS
5. FIT TIGHT NUTS & BOLTS LTD.
6. FIX FIT FASTENERS MFG PVT. LTD
7. INDUSTRIAL ENGINEERING CORPORATION (Size Up To 4" (M100)
8. MEGA ENGINEERING PRIVATE LIMITED (1/2" to 3" Material: CS/AS/SS)
9. METRO MECHANICAL PVTLTD.
10. NAGBHUSHANAM INDUSTRIES
11. NIREKA ENGG. CO. PVT. LTD.
12. PACIFIC FORGING & FASTENERS PVT LTD (M 10 to M 125)
13. PERFECT MARKETING (P) LTD.
14. PIONEER NUTS & BOLTS PVT LTD
15. PRECISION AUTO ENGINEERS
16. PRECISION ENGINEERING INDUSTRIES
17. PTD FASTNERS PVT. LTD
18. SANGHVI METALS (TRADER)
19. SUNDARAM FASTENERS LIMITED
20. UDHERA FASTENERS

8. CS PLATES

1. TISCO
2. SAIL
3. JINDAL STEEL
4. ESSAR STEEL

9. ELECTRODES

1. M/S. ESAB INDIA LTD.
2. M/S. ADVANI ORLEKON
3. M/S. D & H SECHRON ELECTRODES LTD.
4. M/S.D & H WELDING
5. M/S. FUSION ENGINEERING PRODUCTS LTD.
6. M/S. HONAVAR ELECTRODES LTD.

7. M/S. MODI ARC ELECTRODES
8. M/S. GEE LIMITED
9. M/S. KOBE STEELS

10. PAINTS

1. Asians Paints (I) Ltd.
2. Berger Paints Ltd.
3. Nerolac Paints Ltd.
4. Akzo Nobel Paints
5. Jenson and Nicholson Paints Ltd.
6. Shalimar Paints Ltd.
7. Sigma Coatings
8. Grand Polycoats
9. Bombay Paints Ltd.

SPECIFICATIONS FOR CIVIL & STRUCTURAL WORKS

SL.NO. DESCRIPTION

1. General
2. Scope of work
3. Earthwork
4. Reinforced Cement Concrete & Allied Work
5. Formwork
6. Steel Reinforcement
7. Brick Masonry Work
8. Plastering Work
9. Sand Pad Foundation for vertical Storage Tanks

SPECIFICATIONS

1.0 GENERAL:

1.1. The detailed specifications given hereafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards.

1.2. It may also be noted that the specification are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.

1.3. The work also includes all minor details of construction which are obviously and fairly intended and which may not have been referred to in these documents but are essential for the entire completion in accordance with standard engineering practice.

1.4. In case any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities shall take precedence.

1.5. In case any difference or discrepancy between the specifications and the drawing, the drawing shall take precedence.

1.6. Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.

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SCOPE OF WORK

1.0) INTRODUCTION

DAFFFL – fire water tanks

This document defines the minimum requirements for scope of work of General Civil Contractor and guidelines to the Contractor for the complete general civil works pertaining to the job of providing foundations for tanks and allied works at Doimukh petroleum Storage Terminal.

2.0) SCOPE OF WORKS

The scope of work for GENERAL CIVIL WORKS is divided into the following categories:

2.1) Ring Wall Sand Pad Foundation for Vertical Storage Tanks

2.1) SAND PAD FOUNDATION FOR VERTICAL STORAGE TANKS

The broad scope of work involved is Earthwork in Excavation in All Types of Soils, Earthwork in Filling with Good Quality Earth and Clean River Sand, Anti-Corrosive Layer, LDPE Film, Murrum Filling, Concreting, Filters. Work includes supply of all labours, supply of all related material, tools, tackles, equipment, machinery etc. all complete, as per design basis, specifications, standards, drawings, documents and direction of Engineer-In-Charge. During construction and on completion of construction (inclusive of all internal and external finish) clearing all the debris and waste materials scattered around the site and disposal of the same as per direction of the Engineer-in-Charge, shall be in the scope of the Contractor.

The scope of work consists of carrying out at site by the Contractor, the Supply, execution / construction and erection of civil complete civil work for tank foundation etc. The followings are the different types of tanks, involved in this project. The main job should consist of, but not limited to the following:

DIA OF TANKS	HEIGHT(H) LENGTH (L)	NOS	TYPE OF TANK	REMARKS
18 M	20 (H)	2	CRVT(FWT)	ON RING WALL

3.0) CONTRACTOR'S SCOPE OF SUPPLY

All materials and consumables required for satisfactory completion of the job shall be supplied by contractor. Contractor's scope shall also include arranging of all tools, tackles, equipments, machinery and labour required for satisfactory completion of the job.

4.0) POWER, WATER & OTHER FACILITIES

The CONTRACTOR shall be responsible to provide within the scope of work all facilities, consumables and utilities necessary for performance of the work including (but not limited to) water, power, transportation, labour, tools, construction and testing equipment, machinery and land at or about the job site(s) for the CONTRACTOR's field offices, stores; residential accommodation for CONTRACTOR's staff; quarry rights and borrow areas and making access roads to or about the job site(s) and CONTRACTOR's offices, stores, accommodation, borrow areas.

The OWNER does not warranty or undertake the provision of any facility, consumable or utility whatsoever to the CONTRACTOR.

Any assistance which the OWNER renders to the CONTRACTOR in terms hereof or otherwise relative to the work by provision of any facility, utility, consumables for the performance of any of' his obligations under the Contract, shall not be a ground for extension of time for completion or other claim whatsoever.

5.0) CONSTRUCTION POWER

The contractor has to arrange construction power connection with his own DG sets at no extra cost. Alternatively, contractor may directly arrange construction power from the existing sub-station/ LT line of State Electricity Board and make necessary arrangement (supply , laying of cables, etc.) for distribution to his job site/s by his own effort and cost.

All the works will be done as per IEA regulations and passed by the Engineer-In-Charge. The temporary lines will be removed forthwith after the completion of the

work or if there is any hindrance caused to the other works due to the alignment of these lines, the contractor will reroute or remove the temporary lines at his own cost. The cost of power supply shall be payable to SEB directly. The owner shall not, however, guarantee the supply of electricity and no compensation for failure or short supply of electricity will be entertained.

6.0) CONSTRUCTION WATER

Contractor will have to make his own arrangements for supply of water to his labour camps, residential accommodation of staff and for the works. All pumping installation, pipe net wok and distribution system will have to be carried by the contractor at his own cost.

The owner shall not take any guarantee for the supply of water and will not relieve the contractor of his responsibility in making his own arrangement and for the timely completion of the various works as stipulated.

7.0) LAND

The OWNER may at his discretion and convenience, if it has sufficient available land at its disposal, provide land to the CONTRACTOR near or about the job site, for the construction of the CONTRACTOR's field office(s), stores and Yard required for or in connection with the execution of the work(s). Such land shall be utilized by the CONTRACTOR only for the purpose of the contract and for the duration of the contract.

The CONTRACTOR shall at his own cost and initiative construct temporary buildings or other accommodation necessary for the purpose and make suitable arrangements for water and power supply thereto and for provisions of sanitary, drainage and dewatering arrangements thereof in accordance with plans / designs / layouts previously approved by the Site Engineer in this behalf.

8.0) ACCESS TO SITE

The CONTRACTOR shall construct, if necessary at his own cost and initiative, temporary access road to the site from the main public feeder road(s) and from borrow areas and shall so align such roads or ways so as not to interfere with the

construction of the site or hamper construction of pavement roads by or on behalf of the OWNER or other CONTRACTORS operating at or about the job site.

The CONTRACTOR shall, if so required or relative to the performance of any other work at the site or construction of permanent roads, suspend, discontinue use of and / or re-route any access road constructed by him. No suspension, discontinuance or re-routing as aforesaid shall form the basis of any claims by the CONTRACTOR against the OWNER for compensation of damages or ground for extension of time for completion or other claim whatsoever.

9.0) SPECIAL INFORMATION

The tenderer shall before tendering and shall be deemed before tendering to have undertaken a thorough study of the proposed work, the job site(s) involved, the site conditions, soil conditions, the terrain, the climatic conditions, the labour, power, material and equipment availability and transport and communication facilities, the availability and transport suitability or borrow areas, the availability of land for right of way and temporary office and accommodations, quarters, and all other facts and facilities necessary or relevant for the formulation of the tender, supply of materials and the performance of the work. Without prejudice to the foregoing, the tenderers may be allowed access to any information regarding the site of the work, the investigations conducted relative thereto, such as soil investigation etc. But, these shall be only indicative in nature and the tenderers are expected to collect their own data for preparation and submission of their tender. Any claim at a later date based on either incorrectness or inadequacy of the information/data made available by the OWNER/consultant to a tenderer shall not be entertained. The OWNER/Consultant shall be fully absolved of any and all liabilities in this regard.

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SPECIFICATION FOR EARTHWORK

1.0 SCOPE:

1.1. This specification covers the general requirements of earth work in excavation in different materials, site grading, filling in areas as shown in drawing, filling back around foundations and disposal of surplus spoils or stacking them properly as shown on the drawings and as directed by Engineer-In-charge and all operations covered within the intent and purpose of this specification.

1.2. For carrying out earth work excavation in different material, conveyance and disposal of surplus spoils or stacking them properly, contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, labour, materials, and any temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with specification requirements.

1.3. 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 grading, basement, foundations, plinth fillings, roads, drains cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to the established reference/grid lines at a 6 metres intervals or nearer as determined by the Engineer-In-charge based on ground profile. These shall be checked by the Engineer-In-charge and therein after properly recorded.

1.4. The excavation shall be done to correct lines and levels. This hall also include, wherever required, proper shoring to maintain excavation and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety.

1.5. The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, and riprap with regular slope as directed by the Engineer-In-charge within the lead specified and leveling the same so as to provide natural drainage. Rock/ soil excavated shall be stacked properly as directed by the Engineer-In-charge. As a rule, all softer material shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

2.0 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.

IS 965	Equivalent metric units for scale, dimensions and quantities in general construction work.
IS 1200 (Part 1)	Methods of measurement of building and civil engineering works: Part 1 Earthwork.
IS 2720 (Part 2)	Methods of test for soils: Part 2 Determination of water content.
IS 2720 (Part 7)	Method of test for determination of moisture (Part-7) content dry density relation using light compaction.
IS 2720 (Part 8)	Method of test for determination of moisture (Part-8) content dry density relation using heavy compaction.
IS 2720 (Part 25)	Method of test for determination of consolidation (Part-25) properties.
IS 2720 (Part 28)	Method of test for determination of dry density of (Part-28) soils by the sand replacement method.
IS 2720 (Part 29)	Method of test for determination of dry density of (Part-29) soils by the sand replacement method.
IS 3764	Excavation work - Code of Safety.
IS 4082	Recommendations of stacking and storage of construction materials at site.

3.0 SITE CLEARANCE:

The area to be excavated/ filled shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush, etc. and other objectionable matter. If any roots or stumps of trees are met during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by the Engineer-In-charge. Where earth fills is intended, the area shall be stripped of all loose/ soft patches, top soil containing objectionable matter/materials before fill commence.

4.0 PRECIOUS OBJECTS, RELICS, OBJECTS OF ANTIQUITY, ETC.:

All gold, silver oil, minerals, archaeological and other findings of importance, trees cut or other materials of any description and 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 the department and the contractor shall duly preserve the same to the satisfaction of the department and from time to time deliver the same to such person or persons as the department may from time to time authorize or appoint to receive the same.

5.0 CLASSIFICATION OF EARTH WORK:

5.1 GENERAL

All materials to be excavated shall be classified by the Engineer-In-charge, into one of the following classes and shall be paid for at the rate tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of the Engineer-In-charge regarding the classification of the material shall be final and binding on contractor and not be a subject matter of appeal or arbitration.

5.2 The earth work will be classified under any of the following categories:

5.2.1 Ordinary & Hard Soils:

These shall include all kinds of soils containing kankar, sand, silt, murrum and/ or shingle, gravel, clay, loam, peat, ash, shale, etc., which can generally be excavated by spade, pick axes 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 longer than one metre in any direction and not more than 200 mm in any one of the other two directions.

5.2.2 Soft and Decomposed Rock:

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite and all other materials which in the opinion of the Engineer-In-charge is rock, but does not need blasting and could be removed with picks, hammer, crow bars, wedges and pneumatic breaking equipment. The more fact that contractor resorts to blasting for reasons of his own shall not qualify for classification under ‘hard rock’.

This shall also include excavation in macadam and tarred roads, pavements and rock boulders not longer than one metre in any direction and not more than 500 mm in any one of the other two directions. Masonry to be dismantled will also be measured under this item.

5.2.3 Hard Rock:

This shall include all rock occurring in large continuous masses, which cannot be removed except by blasting/pneumatic hammering for loosening it. Harder varieties of rock with or without veins and secondary minerals, which in the opinion of the Engineer-In-charge required blasting, shall be considered as hard rock. Boulders of rock occurring in such sizes and not classified under 6.2.1 and 6.2.2 above shall also be classified as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item, unless a separate provision is made in the schedule of quantities.

6.0 EXCAVATION:

6.1 All excavation work shall be carried out by mechanical equipments unless in the opinion of the Engineer-In-charge the work involved and time schedule permit manual work.

6.2 Excavation for permanent work shall be carried out strictly to the dimensions given in the drawing or as specified by the Engineer-In-charge. Rough excavation shall be carried out to a depth 300 to 150 mm above the final excavation level. The balance shall be excavated with special care. Soft pockets shall be removed even below the final level and extra excavation filled up as directed by the Engineer-In-charge. The final excavation if so instructed by the Engineer-In-charge should be carried out just prior to laying the mudmat.

6.3 The contractor may excavate outside the lines shown on the drawing or as directed by the Engineer-In-charge for facility of work or similar other reasons and also backfill later at his own cost if so approved by the Engineer-In-charge. Should any excavation be taken below the specified elevations, the contractor shall fill it up with concrete of the same grade as in the foundation resting thereon upto the required elevation. No extra shall be claimed by the contractor on this account.

6.4 All excavations shall be done to the minimum dimensions as required for safety and working facility. Prior approval of Engineer-In-charge shall be obtained by the contractor in each individual case for the method he proposes to adopt for the excavation, including dimensions, side slopes, dewatering, disposal, etc. However, this approval shall not in any way relieve the contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for if the slips are due to the negligence of the contractor.

6.5 Excavation shall be carried out with such tools, tackles and equipments as described herein before. Pneumatic hammering or other methods may be resorted to in the case of hard rock, however not without the specific permission of the Engineer-In-charge.

6.6 The Engineer-In-charge may also direct that in some extreme cases the rock may be excavated by heating and sudden quenching for splitting the rock. Firewood shall be used for burning and payment shall be made for such work as called for in the schedule of quantities.

6.7 Stripping Loose Rock:

All loose boulders, semi detached rocks (along with earthy stuff which might move therewith) not directly in the excavation but so close to the area to be excavated as to be liable in the opinion of the Engineer-In-charge to fall or otherwise endanger the workmen, equipment, or the work, etc. shall be stripped off and removed away from the area of the excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion which was originally sound and safe.

6.8 Excavation in Hard Rock:

6.8.1 Unless otherwise stated herein, IS specification "IS 4031 (Safety Code for Blasting and Related Drilling Operations)" shall be followed. After removal of overburden, 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 the Engineer-In-charge. At all stages of excavation precautions shall be taken to preserve the rock below and beyond the lines specified for the excavation in the soundest possible condition. In case of damage to permanent or temporary structures the contractor shall repair the same to the satisfaction of the Engineer-In-charge at his cost. No blasting can be allowed for excavation of hard rock without prior permission of Engineer-in-charge.

6.8.2 Specific written permission of the Engineer-In-charge will have to be taken by the contractor for blasting rock. The contractor shall also obtain a valid blasting license from the authorities concerned. If permission for blasting is refused by the Engineer-In-charge the rock shall be removed by wedging, pick, barring, heating and quenching or other approved means. All loose or loosened rock in the sides shall be removed by barring, wedging, etc. The unit rates for excavation in hard rock shall include the cost of all these operations.

6.8.3 The contractor shall also obtain necessary license for storage and use of explosives for the work from the authorities dealing with explosives if permission for blasting is granted. The fees, if any, required for obtaining such license shall be borne by the contractor. The contractor shall have to make necessary storage facilities for the explosives as per rules of local, state and central government authorities and statutory bodies/ regulations. 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 should be built as far as possible from the area to be blasted. The Engineer-In-charge's prior approval shall be taken for the location proposed for the magazine.

6.8.4 In no case blasting shall be allowed closer than 30 metres 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.

6.8.5 If blasting operation carried out under permission the following points shall be observed :

6.8.5.1 The contractor shall employ competent and experienced supervisor an licensed Blaster-In charge of each set of operation who shall be held personally responsible to ensure that all safety regulations are carried out.

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

6.8.5.3 The contractor shall ensure that all workmen and the personnel at site are excluded from an area within radius of 200 metres from the firing point at least 15 minutes before firing time by sounding warning siren. The area shall be encircled by red flags. Clearance signal shall also be sounding a distinguishing siren.

6.8.5.4 The blasting of rock near any existing buildings, equipment or any other property shall be done under cover and the contractor has to make all such necessary muffling arrangements as stated hereinafter under "Controlled Blasting". Blasting shall be done with small charges only and where directed by the Engineer-In-charge. A trench shall have to be cut by chiseling prior to the blasting operation separating the area under blasting from the existing structures.

6.8.5.5 The firing shall be supervised by a supervisor. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, the same shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.

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

6.8.5.7 The contractor shall preferably fire the explosives electrically.

6.8.5.8 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.

6.8.5.9 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 225 mm shall be filled up as instructed by the Engineer-In-charge with concrete of mix 1:3:6. The cost of filling such excess depth shall be borne by the 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.

6.8.5.10 The contractor shall be responsible for any accident to workmen, public or department's property due to blasting operations. Contractor shall also be responsible for strict observance of rules laid down by Inspector of Explosives or any other Authority duly constituted under the state and/ or central government.

6.8.6 Controlled Blasting Instructions:

- Rock blasting shall be carefully controlled so that rock pieces do not fly out of the pits and thus endanger the installations around. Contractor shall follow the detailed procedure as given below and carefully watch the blasting operations. Based on observations he should set his norms for quantities of charge, depth of holes etc. in consultation with the Engineer-In-charge within the limits specified below.

- Material for the charge shall be either gun powder or gelatin. The ingredients of the gun powder shall be of best available quality. The composition shall be as per manufacturer's specification meant specifically for rock blasting. The same shall be best make and approved by the Engineer-In-charge before actual use.

6.8.7 Quantity of charge: Initially 75 to 80 mm of charge fill shall be used and observations made whether blasting is under full control. If necessary charge may be gradually increased to 150 mm.

Depth of hole	1500 to 1650 mm.
Diameter of hole	30 to 40 mm.
Embedment of fuse Inside charge	Fuse end shall be embedded to a depth of ½ to 2/3 of the depth of the charge.
Distance of firing end of the fuse from the charge	15 to 30 metres.
Time of the blast after firing the fuse	120 to 150 seconds.
Disposition of hole	1.20 to 1.80 metre apart both ways.
Inclination	Inclination of the hole to be pointed towards the non-developed side of the site.
Number of holes to be taken up per blast	Minimum 8 Numbers and Maximum 20 Numbers.

6.8.8 Protective Measures:

- The holes are to be covered with 3.0 mm thick square steel plate of minimum area from 0.60 m2 to 1.00 m2.
- A steel mesh made out of reinforcement rods of not less than 20 mm diameter @ 150 mm centers both ways shall be placed over the steel plates.
- Six to eight layers of sand filled bags shall be placed over the mesh suitably covering the whole region under blasting operations.
- The steel mesh shall be inspected after every operation and all twist shall be removed before reuse to the satisfaction of the Engineer-In-charge.

6.8.9 Feeding the Charge:

- At the bottom of the hole 50 to 75 mm depth shall be filled with dry powder.
- Then the gun powder shall be fed into the hole to the desired length and lightly tamped with a rod.
- The fuse wire shall then be inserted to a depth of ½ to 2/3 of the charge.
- The rest of the hole shall then be filled with dry brick powder or dry murrum.

6.8.10 Precautions to be taken when the water table is encountered:

- When the drilled hole encounters water, the charge shall be fed into a steel tube or a plastic tube and inserted to the bottom of the hole.
- In case the contractor prefers to use gelatin for blasting wherever water table is encountered, the method of blasting , the quantity of charge shall be got approved from the Engineer-In-charge before proceeding with the work.

6.8.11 Particular care should be taken to preserve rock below and beyond excavation limits in soundest possible manner. Rough excavation should be carried out 150 to 300 mm above the final excavation level. The excavation shall then be done to the specified level with special care. Over break in the hard rock at bottom beyond 225 mm shall not be permitted and if it is exceeded the same shall have to be made good by the contractor at his own cost by filling the same with cement concrete of grade not less than 1:3:6.

6.8.12 After removal of overburden and thereafter excavation of soft rock if excavation is required to be continued in rock to such width, lengths, depths and profiles as shown on the drawing or such other lines and grades as may be specified by the Engineer-In-charge, the excavation in hard rock shall be done by chiseling if in the opinion of Engineer-In-charge blasting cannot be permitted.

6.8.13 The contractor shall also at his own expenses and without any extra charges make provision of pumping, bailing and draining water at the ground level to the safe distance so as not to cause any flooding at site. He shall also keep all foundation pits free of water while the concreting work is in progress and till the Engineer-in-charge considers it necessary.

6.8.14 The rate quoted by the contractor for item of excavation in foundation / excavation over areas includes removing and disposing of vegetation, grass, cut plantation, shrubs, bushes, plants, trees of whose girth is not more than 600mm diameter when measured at 1.0 meter height above ground level. No extra payment / measurement on account of this made.

7.0 FILL AND BACK FILLING:

7.1 All fill material will be subjected to the approval of Engineer-In-charge. If any material is rejected by the Engineer-In-charge the contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be deposited /disposed off as directed by the Engineer-In-charge after the fill work is complete.

7.2 No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by the Engineer-In-charge.

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

7.4 If any selected fill material is required to be borrowed, contractor shall make arrangements for bringing such material from outside borrow pits. The material and source shall be subject to prior approval of the Engineer-In-charge. The approved borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc. Top soil containing salts/ sulphates and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed

by the Engineer-In-charge. The contractor shall make necessary access roads to borrow areas and maintain the same at his own cost if such access road does not exist.

7.5 As soon as the work in foundations has been accepted and measured the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with selected/ approved earth in layers not exceeding 150 mm each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the full satisfaction of the Engineer-In-charge. Filled earth shall be rammed with approved compaction method. Usually no manual compaction shall be allowed unless the Engineer-In-charge is satisfied that in some cases manual compaction by tampers cannot be avoided. The final back-fill surfaces shall be trimmed and leveled to proper profile as directed by the Engineer-In-charge of indicated on the drawings.

7.6 Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and approved by the Engineer-In-charge. The backfilling material shall be properly consolidated by watering and ramming taking due care that no damage is caused to the pipes.

7.7 Where the trenches are excavated in soil the filling from the bottom of the trench to the level of the centre line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 80 mm. Backfilling above the level of the centre line of the pipe shall be done with selected earth by hand compaction of other approved means in layers not exceeding 150 mm.

7.8 In case of excavation of trenches in rock the filling upto a level 300 mm above the top of the pipe shall be done with fine materials such as earth, murrum etc. The filling upto the level of the centre line of the pipe shall be done by hand compaction in layers not exceeding 80 mm whereas the filling above the centre line of the pipe shall be done by hand compaction or approved means in layers not exceeding 150 mm. The filling from a level 300 mm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 150 mm mixed with fine material as available to fill up the voids.

7.9 The filling in the trenches shall be carried out simultaneously on the sides of the pipe to avoid unequal pressure on the pipes.

7.10 Plinth filling shall be carried out with approved material as described herein before, in layers not exceeding 150 mm watered and compacted mechanically. The Engineer-In-charge may however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level the surface shall be flooded with water for at least 24 hours unless otherwise directed by the Engineer-In-charge. The surfaces shall then be allowed to dry and again compacted as specified above to avoid settlements at the later stage. The finished level of the filling shall be trimmed to the specified the level, slope etc.

7.11 Site grading shall be carried out as indicated in the drawings and as directed by the Engineer-In-charge. Any excavation/ filling for site grading shall be carried out as specified in the specifications given above unless otherwise indicated below:

- 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 using vibratory as indicated in the specifications given above before the next layer is deposited.

- To ensure that the fill has been compacted as specified, if required field and laboratory tests shall be carried out by owner.

- Field compaction 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 embankment as well.

- The contractor shall protect the earth fill from being washed away by rain or damaged in any other way. If any slip occurs the contractor shall remove the affected material and make good the slip at his own cost.

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

- If specifically permitted by the Engineer-In-charge compaction can be obtained by allowing loaded trucks conveying fill or other material to ply over the fill

area. Even if such a method is permitted, it will be for contractor to demonstrate that the desired/ specified compaction has been obtained. In order that the fill may be reasonably uniform throughout the material should be dumped in place in approximately uniform layers. Traffic over the fill shall then be so routed to compact the area uniformly throughout.

- If so specified the rock as obtained from excavation may be used for filling and leveling to the indicated grades without further breaking. In such event filling shall be done in layers not exceeding 500 mm approximately. After rock filling to the approximate required level the void in the rocks shall be filled with finer material such as earth, broken stone etc. and area flooded so that be taken to ensure that the finer fill material does not get washed out. Over the layer so filled a 100 mm thick mixed layer of broken material and earth shall be laid and consolidated to the full satisfaction the Engineer-In-charge.

8.0 SAND FILLING:

At some of the places backfilling may have to be carried with local sand if directed by the Engineer-In-charge. The sand used shall be clean, medium grained and free from impurities. The filled in sand 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 the contractor's account. The surface of the consolidated sand shall be dressed to required level or slope.

Construction of floors or other structures on sand fill shall not be started until the Engineer-In-charge has instructed and approved the fill.

9.0 FILL DENSITY:

The compaction, only where so called for, in the schedule of quantities/ items shall comply with the specified (proctor/ modified proctor) density at moisture content differing not more than 4 percent from the optimum moisture content. Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.

10.0 MODE OF MEASUREMENT:

10.1 Excavation in all strata's in different components of the schedule of quantities shall be measured net and by levels. Dimensions for the purpose of payment shall be reckoned on the horizontal area of the concrete at the base for foundations of the walls, column, footings, tanks, rafts, or other foundations/ structures to be built multiplied by the mean depth measured from the surface of the original ground level in accordance with drawings or as per actual whichever is minimum.

10.2 In case of excavation exceeding 1.0 meter depth then 3V: 1H in side slopes or as specified in the drawing shall be paid to the contractor. The contractor may make such allowance in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety of excavation. Safety of the excavation work shall be the responsibility of the contractor.

10.3 No extra payment shall be paid to the contractor for providing approach ramps to facilitate carrying out the excavation work and transporting the excavated earth at the various levels.

10.4 Reasonable working space not exceeding 600 mm beyond the line of PCC or actual excavation carried out whichever is less for waterproofing of basement structure wherever considered necessary in the opinion of the Engineer-In-charge will be allowed in excavation and considered for payment. However, if concentrating is proposed against the sides of excavation to place the water proofing treatment earlier to casting of foundation member over break in rock up to 225 mm beyond the theoretical fine of water proofing treatment only will be permitted and paid for.

10.5 Over break in hard rock at bottom to the extent of 225 mm in depth or actual whichever is less will be measured and paid for. If, however, the excavation in hard rock at bottom is done more than the required limits the same will have to be made good by filling with concrete of mix 1:3:6 at the contractor's cost. For the rock excavation beyond the required profile over break in rock only will be limited to 225 mm beyond the theoretical line or actual whichever is less.

10.6 In case of rock strata intermixed with soil the excavated rock will be properly stacked as directed by the Engineer-In-charge and the volume of rock calculated on the basis of stack measurement after deducting voids @ 50% of the volume.

10.7 Unless otherwise specified the unit rates quoted for excavation in different types of materials shall also account for the basic class as specified in the item of the work. Only leads beyond the basic lead as specified will be considered as extra lead and paid for at rates quoted in the schedule after deducting the voids as specified in the items.

10.8 The rates for excavation in soft and hard rock shall include carting away the excavated rock to the required lead as indicated in the items of work and properly stacking the same as directed by the Engineer-In-charge.

10.9

10.10 The rate to the quoted in hard rock excavation shall also be inclusive of all explosive and additional cost, if any, involved in protective measures as stipulated above in the specifications.

10.11 Backfilling as per specifications in the sides of foundations, columns, footings, structures, walls, tanks, rafts, trenches etc. with selected excavated material will not be paid for separately. It shall be clearly understood that the rate quoted for excavation shall include stacking of excavated material as directed and carting it back and backfilling around the foundations as specified above. Generally the material to be backfilled may be stacked temporarily up to basic lead of 50 meters unless otherwise directed by the Engineer-In-charge.

10.12 Payment for fill inside trenches, plinth or similar filling with selected excavated material will be made only after compaction as specified /directed. Cost of all other operations shall be deemed to have been covered in the rate quoted for excavation. Payment for this work will be made based on the measurement of plinth/ trench dimensions filled. If no compaction is specified/ desired, such filling will not be separately paid for. In such an event the fill shall be leveled/ finished to the profiles as directed at no extra cost.

10.13 Filling under floors with approved murrum which may have to be brought from outside sources shall be paid for at rates quoted. The quoted rate shall include all operations such as clearing, excavation, lead and transportation, fill, compaction etc. as specified. Actual quantity of consolidated filling limited to the dimension

considered for payment for excavation only shall be measured and paid for in cubic metres.

10.14 Actual quantity of consolidated sand filling shall be measured and paid in cubic metres.

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SPECIFICATION FOR REINFORCED CONCRETE AND ALLIED WORKS

1.0 GENERAL

The quality of materials, method, control of manufacture and transportation of all concrete work in respect of mix whether reinforced or otherwise shall confirm to the applicable portion of these specification.

The Engineer-In-Charge shall have the right to inspect the source of materials, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipments and the quality control system. Such an inspection shall be arranged by the contractor and the Engineer-In-Charge's approval shall be obtained prior to starting of concrete work.

2.0 SCOPE

This specification covers the general requirements for concrete to be used on jobs using on-site production facilities including requirements in regard to the quality, quantity, handling, storage of ingredients, proportioning, batching, mixing, and testing of concrete and also requirements in regard to the quality, storage, cutting, bending and fixing of reinforcement in position. This also covers the transportation of concrete from mixer to the place of final deposit and placing, curing, protecting, repairing and finishing of concrete.

3.0 APPLICABLE CODES & SPECIFICATION:

The following specifications, standards and codes 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, revisions and additional publications. In case of discrepancy between this specification and those referred to herein this specification shall govern.

269	Specification for ordinary, rapid hardening and low heat Portland cement.
IS 383	Specification for coarse & fine aggregate from natural source or concentrate.
IS 456	Code of practice for plain and reinforced concrete.
IS 457	Code of practice for plain and reinforced concrete for dams and other massive structures.
IS 515	Specification for natural and manufactured aggregate for use in mass concrete.
IS 516	Method of test for strength of concrete.
IS 650	Specifications for standard sand for testing of cement.
IS 1199	Method of sampling and analysis of concrete.
IS 1200	Method of measurement of building works.
IS 1791	Specification for batch type concrete mixers.
IS 2386 (Part-I)	Method of test for aggregates for concrete: Particle size and shape.
IS 2386 (Part-II)	Method of test for aggregates for concrete: Estimation of deleterious materials and organic impurities.
IS 2386 (Part-III)	Method of test for aggregates for concrete : Specific gravity, density, voids, absorption and bulking.
IS 2386 (Part-IV)	Method of test for aggregates for concrete: Mechanical properties.
IS 2386 (Part-V)	Method of test for aggregates for concrete: Soundness.
IS 2386 (Part-VI)	Measuring mortar making properties of fine aggregates.
I.S. 2386 (Part-VII)	Method of test for Alkali aggregates reactivity.
IS 2386 (Part-VIII)	Petro graphic examination of aggregates.
IS 2438	Specification for roller pan mixer.
IS 2505	Specification for immersion type concrete vibrators.
IS 2506	Specification for screed board concrete vibrators.
IS 2514	Specification for concrete vibrating table.
IS 2645	Specification for integral cement water proofing compound.
IS 2722	Specification for portable swing weigh batcher for concrete.
IS 3025	Methods of sampling and test (physical and chemical) for water used in industry.
IS 3366	Specification for pan vibrator.
IS 3370	Code of practice for concrete structures for the storage of liquids: General.

IS 3370	Code of practice for concrete structures for the storage of liquids: Reinforced concrete structure.
IS 3385	Code of practice for measurement of Civil Engineering works.
IS 3414	Code of practice for design and installation of joints in buildings.
IS 3558	Code of practice for use of immersion vibrators for consolidating concrete.
IS 3935	Code of practice for composite construction.
IS 4031	Method of physical test for hydraulic cement.
IS 4656	Specification for form vibrator.
IS 7861	Code of practice for extreme weather concreting (for hot weather concreting).
IS 8112	Specifications for high strength ordinary Portland cement (Grade 43).
IS 10262	Code of practice for design mix.
IS 12269	Specifications for high strength ordinary Portland cement (Grade 53).
IS 13311 (Part-I)	Non-destructive testing of concrete: Method of test for ultrasonic pulse velocity.
IS 13311 (Part-II)	Non-destructive testing of concrete: Method of testing by rebound hammer.

4.0 MATERIALS FOR STANDARD CONCRETE

The ingredients to be used in the manufacture of standard concrete shall consist solely of a standard type Portland cement; clean sand, natural coarse aggregate, clean water, ice, an admixture, if specifically called for on drawings or schedule of quantities.

4.1 Cement:

4.1.1 Unless otherwise specified or called for by the Engineer-In-Charge cement shall be ordinary Portland cement / Portland Pozzolana cement in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-In-Charge. Changing of brand or type of cement within the same structure will not be permitted. In case it is required to change the brand of cement in the same structure, prior permission shall be obtained from the Engineer-In-Charge.

4.1.2 If demanded a certified report attesting to the conformity of the cement to I.S. specifications by the cement manufacturer's chemist shall be furnished to the Engineer-In-Charge.

4.1.3 The contractor will have to make his own arrangements for the storage of adequate quantity of cement. Cement in bulk may be stored in bins or silos, which will provide complete protection from dampness, contamination and minimize cracking and false set. Cement bags shall be stored in 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 use and shall be removed from 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 the Engineer-In-Charge. Consignment of cement shall be stored as received and shall be consumed in the order of their delivery.

4.1.4 Cement held storage for a period of Ninety (90) days or longer shall be tested before use in work. Should at any time the Engineer-In-Charge have reason to consider that any cement is defective, then irrespective of its origin and / or manufacturer's test certificate, such a cement shall be tested immediately at a National Test Laboratory / Departmental Laboratory or such approved laboratory

and until the result of such test are found satisfactory, it shall not be used in any work.

4.2 Aggregates:

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

- All fine and coarse aggregate proposed for use in the work shall be subjected to Engineer- In-Charge's approval and after specific materials have been accepted the source of supply of such materials shall not be changed without prior approval of the Engineer-In-Charge.

- Aggregates shall consist of natural sand, crushed stone and gravel from source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, and 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 aggregate 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 "mixed design" and preliminary test on concrete specified herein after.

4.2.1 Sampling and Testing:

- Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer- In-Charge and delivered to the laboratory, well in advance of the scheduled placing of concrete.

- Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates, shall be furnished to the Engineer- In-Charge in advance of the work for use in determining the aggregate suitability.

4.2.2 Storage of Aggregates:

All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with the foreign materials and earth during storage and while heaping the materials, shall be avoided. The aggregate must be specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rakers shall be used for lifting the coarse aggregates from the bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.20 metres 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. Rejected material after re-mixing may be accepted, if subsequent tests demonstrate conformity with required gradation.

4.2.3 Specific Gravity:

Aggregate having a specific gravity below 2.60 (saturated surface dry basis) shall not be used without special permission of the Engineer- In-Charge.

4.2.4 Fine Aggregate:

4.2.4.1 Fine aggregate except as noted above and for other than lightweight concrete shall consist of natural river sand, crushed stone sand or crushed gravel sand stone dust confirming to I.S. 383. The sand shall be clean, sharp, hard, durable, chemically inert and free from dust, vegetable substances, adherent coating, clay, organic matter, alkalis, mica, salt or other deleterious substances which can be injurious to the setting qualities/ strength/ durability of concrete. No creek / sea sand shall be allowed.

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

4.2.4.3 Sand shall be prepared for use by such screening or washing or both as necessary to remove all objectionable foreign matter while separating the sand grains to the required size fractions. Sand with silt content more than 3 % will not be permitted for use unless the same is washed and silt content is brought within 3% by weight.

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

Sl. No.	Substances	Percent by weight Uncrushed : Crushed
1.	Material finer than 75 micron I.S. sieve	3.00% : 15.00%
2.	Shale	1.00% ---
3.	Coal and Lignite	1.00% : 1.00%
4.	Clay lumps	1.00% : 1.00%
5.	Total of all above substances including items 1 to 4 for uncrushed sand and items 3 & 4 for crushed sand.	5.00% : 2.00%

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

Sl. No.	I.S.Sieve Designation	Percentage passing for			
		Zone - I	Zone - II	Zone - III	Zone - IV
1.	10 mm	100	100	100	100
2.	4.75 mm	90-100	90-100	90-100	95-100
3.	2.36 mm	60-95	75-100	85-100	95-100
4.	1.18 mm	30-70	55-90	75-100	90-100
5.	600 micron	15-34	35-59	60-79	80-100
6.	300 micron	5-20	8-30	12-40	15-50
7.	150 micron	0-10	0-10	0-10	0-15

4.2.4.6 Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron I.S. sieve by total amount not exceeding 5% (five percent), it shall be regarded as falling within the grading zone. This tolerance shall not be applied to percentage passing the 600-micron I.S. sieve or to percentage passing any other sieve size on the coarser limit of Grading Zone-I or the finer limit of Grading Zone-IV. Fine aggregates confirming to Grading Zone-IV shall not be used unless mix designs and preliminary tests have shown its suitability for producing concrete of specified strength and workability.

4.2.4.7 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 percentage retained on the I.S. sieve (4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron and 150 micron) and dividing the sum by 100.

4.2.5 Coarse Aggregate:

4.2.5.1 Coarse aggregate for concrete except as noted above and for other than lightweight concrete shall confirm to I.S. 383. This shall consist of natural or crushed stone and gravel, and shall be free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkalis, mica, organic matter or other deleterious matter.

4.2.5.2 The coarse aggregate and fine aggregate shall be tested from time to time as required by the Engineer- In-Charge to ascertain its suitability or use in construction and the charges for testing aggregate shall be born by the contractor as specified herein after.

4.2.5.3 Crushed rock shall be screened and/or washed for the removal of dirt or dust coating if so demanded by the Engineering- In-Charge.

4.2.5.4 Coarse aggregates shall be either in single size or graded. In both cases grading shall be within the following limits:

(a) "Table – I"

Sl. No.	**I.S. Sieve Designation**	**Percentage passing for single sized aggregate of nominal size**				
		40 mm	**20 mm**	**16 mm**	**12.5 mm**	**10 mm**
1.	63 mm	100	--	--	--	--
2.	40 mm	85-100	100	--	--	--
3.	20 mm	0-20	85-100	100	--	--
4.	16 mm	--	--	85-100	100	--
5.	12.5 mm	--	--	--	85-100	100
6.	10 mm	0-5	0-20	0-30	0-45	85-100

7.	4.75 mm	--	0-5	0-5	0-10	0-20
8.	2.36 mm	--	--	--	--	0-5

(b) "Table – II"

Sl. No.	I.S. Sieve Designation	Percentage passing for single sized aggregate of nominal size			
		40 mm	20 mm	16 mm	12.5 mm
1.	63 mm	100	--	--	--
2.	40 mm	95-100	100	--	--
3.	20 mm	30-70	95-100	100	100
4.	16 mm	--	--	95-100	--
5.	12.5 mm	--	--	--	90-100
6.	10 mm	10-35	25-55	30-70	40-85
7.	4.75 mm	0-5	0-10	0-10	0-10
8.	2.36 mm	--	--	--	--

4.2.5.5 The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale if present shall be only in such quantities that will not in the opinion of Engineer-In-Charge affect adversely the strength and / or durability of concrete. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than ¼ 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 form. Plums above 160 mm and up to any reasonable size can be used in plain mass concrete work of large dimensions up to a maximum limit of 20% by volume of concrete when specially approved by the Engineer-In-Charge. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the main reinforcing bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per I.S. 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 I.S. 2386.

4.2.5.6 The percentage of deleterious substances in the coarse aggregate delivered to the mixer shall not exceed the following:

Sl. No.	Substances	Percentage by weight of aggregates Uncrushed : Crushed	
1.	Material finer than 75 micron I.S. sieve	3.00	3.00
2.	Coal and lignite.	1.00	1.00
3.	Clay lumps.	1.00	1.00
4.	Sift fragments.	3.00	--
5.	Total of all above substances.	5.00	5.00

4.3 Water:

4.3.1 Water used for both mixing and curing shall be free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally satisfactory for mixing and curing of concrete. 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 I.S. 456. The sample of water taken for testing shall be typical for the water proposed to be used for concrete, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

4.3.2 Average 28 days compressive strength of at least three 150 mm size concrete cubes prepared with water to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. The cubes shall be prepared, cured and tested in accordance with the requirements of IS: 516.

4.3.3 The initial setting time of test block made with the appropriate test cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than + 30 minutes from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The block shall be prepared and tested in accordance with the requirements of IS: 4031 (Part 5).

4.3.4 Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-In-Charge may refuse to permit its use. As a guide the following concentration represent the maximum permissible values:

- To neutralize 100 ml sample of water, using Phenolphthalein as an indicator, it should not require more than 5 ml of 0.02 normal NaOH. The details of test shall be as given in 8.1 of IS: 3025 (Part 22).

- To neutralize 100 ml sample of water, using Methyl Orange as an indicator, it should not require more than 25 ml of 0.02 normal H2 SO4 . The details of test shall be as given in 8 of IS: 3025 (Part 23).

4.3.5 The percentage of solids, when tested in accordance with the IS: 3025 shall not exceed the following:

Sl. No.	Substances	Tested as per	Permissible percentage
1.	Organic	IS: 3025 (Part 18)	0.02% (200 mg/litre)
2.	Inorganic	IS: 3025 (Part 18)	0.30% (3000 mg/litre)
3.	Sulphates (as SO3)	IS: 3025 (Part 24)	0.04% (400 mg/litre)
4.	Chlorides (as Cl)	IS: 3025 (Part 32)	0.20% (2000 mg/litre) for concrete not containing embedded steel and 0.05% (500 mg/litre) for reinforced concrete works.
5.	Suspended matter	IS: 3025 (Part 17)	0.20% (2000 mg/litre)

4.3.6 P.H. value of water shall generally be not less than 6.

5.0 DESIGN MIX CONCRETE:

All reinforced concrete in the work shall be “Design Mix Concrete” as defined in IS: 456 considering as ‘severe’ environment and cost of design mix shall be included in the item rate and no separate payment shall be made on account of this. All “Design Mix Concrete” work to be carried out under these specifications shall be in grades designated as per table below.

Use of mineral admixtures like fly ash, GGBFS, etc. shall not be permitted in the design mix unless otherwise special permission is given by the Engineer-in-Charge. Cement shall be Ordinary Portland Cement – 43 grade or Portland Pozzolana Cement (Fly ash based meeting the 28 day strength requirement of OPC 43 grade cement) only.

Group	Grade Designation	Specified Characteristic Compressive Strength of 150 mm Cube at 28 days in N/mm2
Ordinary Concrete	M - 10	10
	M – 15	15
	M – 20	20
Standard Concrete	M – 25	25
	M – 30	30
	M – 35	35
	M - 40	40
	M – 45	45
	M – 50	50
	M – 55	55
High Strength Concrete	M – 60	60
	M – 65	65
	M – 70	70
	M – 75	75
	M – 80	80

Notes:

1) The Characteristic strength is defined as the strength of material below which not more than 5% of the test results are expected to fall.

2) In the designation of a concrete mix, letter 'M' refers to the mix and the number to the specified characteristic compressive strength of 150 mm size cube at 28 days in N/mm2.

3) The mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than appropriate value given in the table above.

5.1 Mix Design:

5.1.1 This is to investigate the grading of aggregates, water cement ratio, workability and the quantity of cement required to give works cubes of the characteristic strength specified. The proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to the ACI standard designation 'ACI-613' or Design of concrete mixes - Road Research Note No.4, Department of Scientific and Industrial Research U.K. or I.S. 10262.

5.1.2 Since different cements and aggregates of different maximum size, grading, surface texture, shape and other characteristics may produce concretes of different compressive strength for the same free water cement ratio, the relationship between strength and free water cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free water cement ratio (by mass) corresponding to the target strength at 28 days may be selected from the relationship shown in Fig.1 of I.S. 10262 at page 7.

5.1.3 Alternately, the preliminary free water cement ratio (by mass) corresponding to the target average strength may be selected from the relationship in Fig. 2 of I.S. 10262 page at 8, using the curve corresponding to the 28 days cement strength to be used for the purpose. Other relevant items to the used with design of mix should strictly confirm to the relevant clauses and appendices of I.S. 10262. The calculated mix proportions shall be checked by means of trial batches. The contractor should refer to the item No.4 at page 12 and the Appendix 'D' (clause No. 4.1) of I.S. 10262 for neat illustration. The contractor may refer Appendix 'C' (clause 3.8) at page 16 of I.S. 10262 for an example illustrating the mix design of M-20. The free water cement ratio selected as above should be checked against the limiting water cement ratio for the requirement of durability and the lower of the two values should be adopted.

5.1.4 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 fresh tests shall be carried out to determine the revised proportion of the mix to suit the altered conditions. While designing mix proportions over wet mixes shall always be avoided.

5.1.5 While fixing the value for water cement ratio for 'Design Mix' assistance may be derived from the standard graph showing the relationship between the 28 days compressive strength of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with I.S. 269 and I.S. 8112.

5.1.6 It will be contractor's sole responsibility to establish the concrete mix designs for different grades of concrete specified in the work consistent with the workability required for nature of work an also taking into consideration the assumed standard deviation which will be expected at site or by establishing the standard deviation based on 30 test results at site for each grade of concrete so as to produce concrete of required strength, durability and surface finish. The materials and proportions used in making the tests to be carried out either at site or under laboratory, conditions 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 the concrete of the required consistency to give such specified strength.

5.2 Standard Deviation:

5.2.1 Standard deviation of concrete of each grade shall be determined separately. When results of sufficient number of tests (at least 30) are not available, then the value of standard deviation given in the table below may be assumed for design mix in the first instance. As soon as the results of the samples are available, actual calculated standard deviation shall be used and the mix designed properly.

5.2.2 Assumed Standard Deviation:

No.	Grade of Concrete	Assumed Standard Deviation in N/mm2
1.	M - 10	3.5
2.	M – 15	
3.	M – 20	4.0
4.	M – 25	
5.	M – 30	5.0
6.	M – 35	
7.	M - 40	

8.	M – 45	
9.	M – 50	

Note: - the above values correspond to the site control having proper storage of cement; weigh batching of all materials; controlled addition of water; regular checking of all materials; aggregate grading and moisture content; and periodical checking of workability and strength. Where there is deviation from the above, the values given in the above table shall be increased by 1 N/mm2.

5.2.3 Standard Deviation Based On Test Results:

- The total number of test results required to constitute and acceptable record for calculation of standard deviation shall be not less than 30. Attempts should be made to obtain the 30 test results as early as possible when a mix is used for the first time.

- The calculation of the standard deviation shall be brought up to date after every change of mix design and at least once in a month.

5.2.4 Determination Of Standard Deviation :

- Concrete of each grade shall be analyzed separately to determine its standard deviation.

- The standard deviation of concrete of given grade shall be calculated using the following formula from the results of individual tests of concrete of that grade obtained as specified for test strength of sample :

  Estimated Standard Deviation (S) = $V\ X^2 / (n-1)$

  Where X = Deviation of the individual test strength from the average strength of a sample and
  n = Number of sample test results.

- When significant changes are made in the proportion of concrete (for example changes in materials used, mix design, equipments or technical control), the standard deviation value shall be separately calculated for such batches of concrete.

5.4 Proportioning:

The proportions which shall be decided by conducting preliminary tests, shall be by weight. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete batching by means of weigh batchers confirming to I.S. 2722, capable of controlling the weights within one percent of the desired value. Except where it can be shown to the satisfaction of the Engineer-In-Charge that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stacked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible, as determined by the Engineer-In-Charge, to ensure maintaining of grading in accordance with samples used in preliminary mix design. The material shall be stock piles well in advance of use.

5.2.1 The cement shall be measured by weight for design mix. Every facility should be provided to the Engineer-In-Charge for sampling and inspection of stored cement at site of work.

5.2.2 Only such quantity of water shall be added to the cement and aggregate in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of materials or the collection of excessive free water on the surface of the concrete.

5.2.3 The water cement ratio (W/C) is defined as the weight of water in mix (including the surface moisture of the aggregate) divided by the weight 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-In-Charge.

5.2.4 The water cement ratio specified for use by the Engineer-In-Charge shall be maintained. The contractor shall determine the water content of the aggregate as frequently as directed by the Engineer-In-Charge as the work progresses and as specified in I.S. 2386 (Part-III) and the amount of mixing water added at the mixer shall be adjusted as directed by the Engineer-In-Charge so as to maintain the specified water cement ratio. To allow for the variation in their moisture content, suitable adjustments in the weights of aggregates shall also be made.

5.5 Consistency and Slump:

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined the consistency of mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor test etc. in accordance with I.S. 1199, shall be conducted from time to time to ensure the maintenance of such consistency.

Workability of Concrete:

The following tabulation gives a range of workability which shall generally be used for various types of construction unless otherwise instructed by the Engineer-In-Charge:

Placing Conditions	**Degree of workability**	**Value of workability**
Blinding concrete, shallow sections, pavements using pavers.	Very low	0.75 - 0.80 Compacting factor.
Mass concrete, lightly reinforced sections in slabs, beams, walls, columns, floors, hand placed pavements, canal lining, strip footings.	low	Slump of 25 – 75 mm.
Heavily reinforced sections in slabs, beams, walls, columns, Slip formwork, pumped concrete.	medium	Slump of 50–100 mm. Slump of 75 – 100 mm.
Trench fill, In-situ piling,Tremie concrete.	High Very high	Slump of 100 – 150 mm.

5.6 Batching and Mixing of Concrete:

5.6.1 The material and proportions of concrete ingredients as established by the preliminary tests for the mix design shall be rigidly followed for all concrete works on the project and shall not be changed except when specifically permitted by Engineer-In-Charge.

5.6.2 Concrete shall be produced only by weigh batching the ingredients. The mixer and weigh batcher shall be maintained in clean serviceable condition. The accuracy of weigh batcher shall be periodically checked. They shall be set up in level on a firm base and the hopper shall be loaded evenly. The needle shall be adjusted to zero

when the hopper is empty. Fine and coarse aggregates shall be weighed separately unless otherwise stated.

5.6.3 Volume batching will not be permitted. However Engineer-In-Charge may permit volume batching by subsequent conversion of weights of ingredients into their equivalent volumes in respect of their bulk densities only in the case of small and less important pours involving concrete of not more than 0.25 cubic metre on the day when other pours involving weigh batching are not likely to be taken up.

5.6.4 The concrete shall be of strength as stipulated in the respective items. All concrete shall be mixed in mechanically operated batch mixers complying with I.S. 1791 and of approved make with suitable provision for correctly controlling the water delivered to the drum.

5.6.5 The quantity of water actually entering the drum shall be checked with the reading of the gauge or valve setting when starting a job. The test should be made while the mixer is running.

5.6.6 The volume of the mixed material shall not exceed the manufacturer's rated mixer capacity. The batch shall be charged into the mixer so that some water will enter the drum in advance of cement and aggregate. All water shall be in the drum by the end of the first 15 seconds of the specified mixing time. Each batch shall be mixed until the concrete is uniform in colour for a minimum period of two minutes after all ingredients are in the drum.

5.6.7 The entire contents of the drum shall be discharged in one operation before the raw materials for the succeeding batches are fed into the drum.

5.6.8 Each time the work stops the mixer shall be cleaned out and when next commencing the mixing the first batch shall have 10% additional cement to allow for sticking in the drum.

6.0 SAMPLING AND TESTING OF CONCRETE:

If the Engineer-In-Charge desires facilities required for sampling materials and concrete in the field shall be provided by the contractor at no extra cost. The following equipments (in serviceable condition) with operator shall be made available at Engineer's request:

No.	Equipments	Requirement
1.	Cast Iron cube moulds of 150 mm size	As required
2.	Slump cone complete set with tamping rod	1 set
3.	Slump cone complete set with tamping rod 10 gm.	1 No.
4.	Laboratory balance of 2 kg. Capacity and sensitivity of 1 gm.	1 No.
5.	I.S. sieves for coarse and fine aggregates	1 set.
6.	A set of measure from 0.1 litre to 5 litres.	1 set.
7.	Electric oven with thermostat up to 120 degree centigrade.	1 No.
8.	Flakiness gauge	1 No.
9.	Elongation index gauge	1 No.
10.	Sedimentation pipette	1 No.
11.	Pyconometer	1 No.
12.	Calibrated glass jar of 1 litre capacity	2 Nos.
13.	Glass flasks and metal containers	As required.
14.	Chemical reagents like Sodium Hydroxide, Tannic Acid, Litmus papers etc.	As required.

The concrete test cubes will be tested at Department's or site laboratory. The contractor shall make all arrangements to cure, store of concrete cubes and transport the same to the laboratory at his own cost as directed by the Engineer-In-Charge.

6.1 Sampling and Strength Test of Concrete:

6.1.1 The samples from fresh concrete shall be taken as per I.S. 1199 and cubes shall be made, cured and tested at 28 days in accordance with I.S. 516.

6.1.2 In order to get a relatively quicker idea of the quality of concrete optional test on beams for modulus of rupture at 72 (+/-)2 hrs. or at 7 days or compressive strength tests at 7 days may be carried out in addition to 28 days compressive strength tests. For this purpose the value given in table below may be taken for general guidance in case of concrete made with ordinary Portland cement. In all cases, the 28 days compressive strength specified shall alone be the criterion for acceptance or rejection of the concrete. If however, from test carried out in particular job over a reasonably long period, it has been established to the satisfaction of the Engineer-In-Charge that a suitable ratio between 28 days compressive strength and the modulus of rupture at 72 (+/-)2 hrs. or 7 days or compressive strength at 7 days may be accepted. The Engineer-In-Charge may suitable relax the frequency of 28 days compressive strength, provided the expected strength values at the specified early age are consistently met.

6.1.3 Optional Test Requirement of Concrete:

No.	Grade of Concrete	Minimum Compressive Strength on 150 mm Cube	Min. Modulus of Rupture By Beam Test at	
			72 (+/-) 2 hrs.	7 days
1.	M - 10	7.00 N/m2	1.20 N/mm2	1.70 N/mm2
2.	M – 15	10.00 N/m2	1.50 N/mm2	2.10 N/mm2
3.	M – 20	13.50 N/m2	1.70 N/mm2	2.40 N/mm2
4.	M – 25	17.00 N/ m2	1.90 N/mm2	2.70 N/mm2
5.	M – 30	20.00 N/ m2	2.10 N/mm2	3.00 N/mm2
6.	M – 35	23.50 N/ m2	2.30 N/mm2	3.20 N/mm2
7.	M - 40	27.00 N/ m2	2.50 N/mm2	3.40 N/mm2

6.1.4 Frequency of Sampling:

- A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested, i.e. the sampling should be spread over the entire period of concreting and cover all mixing units.

- The minimum frequency of sampling of concrete of each grade shall be in accordance with the following:

No	(c) Quantity of concrete	(d) Number of Samples

.		
1.	1.00 to 5.00 m3	One
2.	6.00 to 15.00 m3	Two
3.	16.00 to 30.00 m3	Three
4.	31.00 to 50.00 m3	Four
5.	51.00 m3 and above	Four Plus one additional sample for each additional 50 m3 part thereof.

- At least one sample shall be taken from each shift. Where concrete is produced at continuous production unit, such as ready-mixed concrete plant, frequency of sampling may be agreed upon mutually by suppliers and purchasers.

- Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork or to determine the duration of curing or to check the testing error. Additional cubes may also be required for testing cubes cured by accelerated methods as described in I.S. 9013. The specimen shall be tested as described in I.S. 516.

6.1.5 The test strength of the samples shall be the average of the strength of three specimens. The individual variation should not be more than (+/-) 15 percent of the average.

6.1.6 Slump test shall be carried out as often as demanded by the Engineer-In-Charge and invariably from the same batch of concrete from which the test cubes are made. Slump test shall be done immediately after sampling.

6.1.7 Standard Deviation shall be vide clause '5.3' of this specification.

7.0 ACCEPTANCE CRITERIA:

7.1 The concrete shall be deemed to comply with the strength requirement if:

- The mean strength determined from any group of four consecutive test results complies with the appropriate limits in col. 2 of table below.

- Any individual test result complies with the appropriate limits in col. 3 of table below.

Specified Grade	Mean of the Group of 4 Non-overlapping consecutive test results in N/mm2	Individual Test Results in N/mm2
M 15	> fck + 0.825 x established standard deviation (rounded off to nearest 0.5 N/mm2) or, • fck + 3 N/ mm2 , whichever is greater	$\geq f_{ck}$ – 3 N/mm2
M20 or above	• > fck + 0.825 x established standard deviation (rounded off to nearest 0.5 N/mm2) or, • fck + 4 N/ mm2 , whichever is greater	$\geq f_{ck}$ – 3 N/mm2

7.2 If the concrete is deemed not to comply pursuant to 7.0 above, the structural adequacy of the part affected shall be investigated and any consequential action as needed shall be taken.

7.3 Concrete of each grade shall be assessed separately. Concrete shall be assessed daily for compliance.

7.4 Concrete of each grade shall be liable to be rejected if it is porous or honey-combed, its placing has been interrupted without providing a proper construction joints, the reinforcement has been displaced beyond the tolerances specified or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the Engineer-In-Charge.

8.0 ADMIXTURES:

Admixture may be used in concrete only with the approval of the Engineer-In-Charge 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 set 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 exceed 1.5 percent of the weight of the cement in each batch of 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-in-Charge. The cost of admixtures shall be included in the item rate and no extra amount shall be paid on this account.

Where specified and approved by Engineer-In-Charge neutralized vinsol resin or/ and other approved air entraining agent may be used to procedure the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6-260 air entraining admixture of concrete. The recommended total air content in the concrete is 4% + 1%. The method of measuring air content shall be as per I.S. 1199.

8.1 Retarding Admixtures:

Where specified and approved by the Engineer-In-Charge retarding agents shall be added to the concrete mix in quantities specified by Engineer- In-Charge.

8.2 Water Reducing Admixtures:

Where specified and approved by Engineer- In-Charge water reducing lignosulfonate mixture shall be added in quantities specified by Engineer- In-Charge. The admixtures shall be added in the form of a solution.

8.3 Water Proofing Agent:

Where specified and approved by Engineer-In-Charge chloride and sulphide free waterproofing agent shall be added in the quantities specified by Engineer-In-Charge.

8.4 Other Admixtures:

Engineer-In-Charge may at his discretion instruct contractor to use any other admixture in the concrete.

9.0 INSPECTION AND TESTING OF STRUCTURES:

Immediately after stripping the form work all concrete shall be carefully inspected and any defective work or small defects either removed or made good before the concrete has thoroughly hardened as instructed by the Engineer-In-Charge.

9.1 In case of doubt regarding the grade of concrete used either due to poor workmanship or based on results of cube strength tests the contractor may be asked to carry out compressive strength test of concrete on the basis of core test, ultrasonic test and/ or load test.

9.2 In case of results of cube strength are observed to be lower than the required designed strength at 28 days as per specifications, ultrasonic test shall be carried out by the digital ultrasonic concrete tester by an approved agency at the cost of the contractor.

9.3 In case the ultrasonic test do not satisfy the requirement as above the department will be at liberty to reject the concrete and the contractor has to dismantle and redo the same or carry out such remedial measures as approved by the department at the contractor's own cost.

9.4 The unit rate for concrete shall be all inclusive of making preliminary mix design and test cubes, works cubes, testing them as per specifications, slump test, optional tests etc. However, the department will test the same departmentally the contractor will have to make arrangement for transportation of the cubes to the departmental laboratory.

9.5 In case cube tests give unsatisfactory results the contractor should also conduct conclusive tests such as ultrasonic pulse test, core test etc. to prove the suitability of concrete. The cost of the conclusive tests shall have to be borne by the contractor.

9.6 If the results of ay test prove unsatisfactory or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove and rebuild the member(s) involved or carry out such other remedial measures as may be required by the Engineer-In-Charge. The contractor shall bear the cost of so doing unless the failure of the member(s) to fulfill the test conditions is approved to be solely due to faulty design. The cost of all tests shall be borne by the contractor.

10.0 PREPARATION PRIOR TO CONCRETE PLACEMENT, FINAL INSPECTION AND APPROVAL:

10.1 Before the concrete is actually placed in position the insides of formwork 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 wall forms to permit removal of saw dust, wood shavings, binding wire, rubbish, dirt etc. Such openings/ holes shall be later suitably plugged.

10.2 The various traders shall be permitted ample time to install drainage and plumbing lines, floor and trench drain, conduits, hangers, anchors, inserts, sleeves, bolts frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawing or as necessary for the proper execution of the work. All such embedment shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

10.3 Slots, openings, holes, pockets etc. shall be provided in concrete work in the positions indicated in the drawings or as directed by the Engineer-In-Charge.

10.4 Reinforcement and other items to be cast in concrete shall have clean surfaces that will not impair bond.

10.5 Prior to concrete placement all works shall be inspected and approved bythe Engineer-In-Charge and if found unsatisfactory concrete shall not be poured until all defects have been corrected at contractor's cost.

10.6 Approval of Engineer-In-Charge for any and all materials and work as required herein shall not relieve contractor from his obligations to produce finished concrete in accordance with the drawings and specifications.

10.7 Rain or Wash Water:

- No concrete shall be placed in wet weather or on a water covered surface. Any concrete that has been washed by heavy rains shall be entirely removed if there is any sign of cement and sand having been washed away from the concrete mixture.

- Before leaving unattended the work shall be covered with tarpaulins immediately after the concrete has been placed and compacted to safe guard against damages, which may be caused by rain.

- 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.

10.8 Bonding Mortar:

Immediately before concrete placement begins prepared surfaces except formwork which will come in contact with the concrete to be placed shall be covered with a bonding mortar of the same strength of concrete.

10.9 Transportation:

- All buckets, containers or conveyers used for transport the concrete shall be mortar tight. All means of conveyance shall be adopted to deliver the concrete of the required consistency and plasticity without segregation or loss of slump whatever method for transportation is employed.

- Chute shall not be used for transport of concrete without the written permission of the Engineer-In-Charge and concrete shall not be re-handled before placing.

10.10 Contaminated Concrete:

- Concrete must be placed in its final position before it become 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 and which has not been placed within half an hour of mixing water with cement shall be rejected and disposed off as directed by the Engineer-In-Charge.

- All equipments used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipe lines and other equipments shall be thoroughly cleaned after each period of placement.

11.0 PROCEDURE FOR PLACING OF CONCRETE:

11.1 Before any concrete is placed the entire placing programme consisting of equipment, layout, proposed procedures and methods shall be submitted to Engineer-In-Charge for approval if so demanded by the Engineer-In-Charge and no concrete shall be placed until Engineer-In-Charge's approval has been obtained. Equipment 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.

11.2 Concrete shall be placed in its final position before the cement reaches its initial set and concrete shall normally be compacted in its final position within 30 minutes of leaving the mixer and once compacted, it shall not be disturbed.

11.3 In all cases the concrete shall be deposited as nearly as practicable directly in its final position and shall not be re-handled or caused to flow in a manner which may cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible and in narrow forms contractor shall provide suitable drop and Elephant Trunks to confine the movement of concrete. Special care shall be taken where concrete is dropped from a height especially if reinforcement is in the way particularly in columns and thin walls.

11.4 Except when otherwise approved by Engineer-In-Charge concrete shall be placed in the shuttering by shovels or other approved implements and shall not be dropped from a height more than one metre or handle in a manner which will cause segregation.

11.5 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:

11.6 Concrete placed in restricted forms by borrows, buggies, cars, sort chutes or hand shoveling shall be subjected to the requirement for vertical delivery of limited height to avoid segregation and shall deposited as nearly as practicable in it's final position.

11.7 Concreting once started shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 150

mm to 900 mm as directed by the Engineer-In-Charge. These shall be placed as rapidly as practicable to prevent the formation of cold joints or planes of weakness between each succeeding layers 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 will 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 onto stones. Such a condition shall be corrected by redesign of mix or other means as directed by Engineer-In-Charge.

11.8 The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

12.0 COMPACTION:

12.1 Concrete shall be compacted during placing with 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 form faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution is to be exercised not to over vibrate the concrete to the point that segregation results.

12.2 When placing in layers, which are advancing horizontally as the work progresses great care shall be exercised to ensure adequate vibration, blending and melding of the concrete between the successive layers.

12.3 The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below while the under layers is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

12.4 Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come into contact with forms or finished surfaces.

12.5 Formation of stone pockets or mortar pondages in corners and against faces of forms shall not be permitted. Should these occur they shall be dug out, reform and refilled to a sufficient depth and shape for thorough bonding as directed by Engineer-In-Charge.

12.6 Bleeding or free water on top of concrete being deposited into the forms shall be caused to stop the concrete pour and the condition causing this defect corrected before any further concreting is resumed.

13.0 CONSTRUCTION JOINTS AND KEYS:

13.1 Concrete shall be placed without interruption until completion of the part of the work between predetermined construction joints as specified therein after. Time laps between the pouring of adjoining units shall be as specified in the drawings or as directed by the Engineer-In-Charge.

13.2 If stopping of concreting becomes unavoidable anywhere a properly formed construction joints shall be made where the work is stopped.

13.3 Joints shall be either vertical or horizontal unless otherwise shown on drawing. In case of an inclined or curved member the joints shall be at right angles to the axis of the member. Vertical joints in walls shall be kept to a minimum.

13.4 Vertical joints shall be formed against a stop board and horizontal joints shall be level and wherever possible arranged so that the joint lines coincide with the architectural features of the finished work.

13.5 Batten shall be nailed to the form work to ensure a horizontal line and if directed shall also be used to form a grooved joint. For tank walls and similar work joints shall be formed as per IS 3370.

13.6 Concrete that is in the process of setting shall not be disturbed or shaken by traffic either on the concrete itself or upon the shuttering.

13.7 Horizontal and vertical joints and shear keys shall be located and shall confirm in details to the requirements of the plans unless otherwise directed by the Engineer-In-Charge.

13.8 Column Joints:

Column joints shall be formed 75 mm below the lowest soffit of the beam including haunches if any. In flat slab construction the joint shall be 75 mm below the soffit of column capital. At least 2 hours shall elapse after depositing concrete in columns, piers or walls before depositing in beams, girders or slabs supported thereon.

13.9 Beam and Slab Joints:

Concrete in beam shall be placed throughout without a joint but if the joint is unavoidable the same shall be vertical and at the centre or within the middle third of the span unless otherwise shown on drawings. Where a beam intersects a girder the joints in the girder shall be offset a distance equal to twice the width of the beam and additional reinforcement provided for shear. The joint shall be vertical throughout the full thickness of the concrete member. A joint in a slab shall be vertical and parallel to the principal reinforcement. Where it is unavoidably at right angles to the principal reinforcement the joint shall be vertical and at the middle of the span.

13.10 Vertical construction joints in water tight construction will not be permitted unless indicated on the drawings. Where a horizontal construction joint is required to resist water pressure special care shall be taken in all phases of its construction to ensure maximum water tightness.

14.0 DOWELS:

Dowels for concrete works not likely to be taken up in the near future shall be wrapped in tar paper and burlap.

15.0 MASS FOUNDATIONS:

Mass foundation shall be poured in lifts not exceeding 1.5 m in height unless otherwise indicated on the drawings or approved by Engineer-In-Charge.

16.0 TREATMENT OF CONSTRUCTION JOINTS ON RESUMING CONCRETING:

A dryer mix shall be used for the top lift of horizontal pours to avoid laitance. All laitance and loose stones shall be thoroughly and carefully removed by wire brushing/ hacking and surface wash.

Just before concreting is resumed the roughened joint surface shall be thoroughly cleaned and loose matter removed and then treated with a thin layer of cement grout of proportion specified by Engineer-In-Charge and worked will into the surface. The new concrete shall be well worked against the prepared face before the grout mortar sets. Special care shall be taken to obtained thorough compaction and to avoid segregation of the concrete along the joint plane.

17.0 CURING, PROTECTING, REPAIRING AND FINISHING:

17.1 All concrete shall be cured by keeping it continuously damp for a period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or by ponding of water, continuously saturated coverings of sacking, canvas, hessian (especially on vertical structural members) 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 weather as outlined hereinafter.

17.2 Certain type of finish or preparation for overlaying concrete must be done at certain stages of the curing process and special treatment may be required for specific concrete surface finish.

17.3 Curing With Water:

17.3.1 Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete following a lapse of 10 to 12 hours after laying of concrete in normal weather and in hot weather not more than lapse of 4 hours. Date of casting shall have to be marked, as directed by Engineer-in-charge, on the exposed surfaces of the concrete so as to enable easy monitoring of the curing period.

17.3.2 The curing of horizontal surface exposed to the drying winds shall be however beginning immediately after the concrete has hardened. Water shall be applied to unformed concrete surfaces within one hour after concrete has set. Water shall be

applied to formed surface immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

17.3.3 The quality of curing water shall be the same as that used for mixing concrete.

17.3.4 Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliances of hose, sprinklers and spraying devices. Continuous fine moist spraying or sprinkling shall be used unless otherwise specified or approved by the Engineer-In-Charge.

17.3.5 For curing of concrete in pavements, side-walks, 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 the Engineer-In-Charge. Special attention shall be given to edges and corners of the slab to ensure proper protection to these areas. The ponded areas shall be kept continuously filled with water during the curing period.

17.3.6 All equipments and materials required for curing shall be on and ready for use before concrete is placed.

18.0 FINISHING OF CONCRETE:

18.1 This specification is intended to cover the treatment of concrete surface for all structures. Areas requiring special finish not covered by this specification shall be clearly indicated on the drawings and special specification shall be furnished.

18.2 When specified on the drawings an integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawings and as per I.S. 2571.

18.3 The surface shall be compacted and then floated with a wooden float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated.

18.4 Floating or trowelling of the finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the concrete finish to absorb moisture or to stiffen the mix.

18.5 A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings.

18.6 Upon removal of forms all fins and other projections on the surfaces shall be carefully removed, offsets leveled, voids and /or damaged sections immediately saturated with water and repaired by filling with concrete or mortar of the same composition as was used in the concrete.

18.7 The finished surfaces shall present a uniform and smooth appearance.

18.8 All concrete shall be protected against damage until final acceptance by the Engineer-In-Charge.

19.0 CONCRETE FINISHES:

19.1 Unless otherwise specified concrete finishes shall confirm to the following specifications:

- Finish F1, F2 and F3 shall describe formed surfaces.
- Finish U1, U2 and U3 shall describe unformed surfaces.
- Offsets or fins caused by disposed or misplaced from sheathing, lining or form sections or by defective form lumber shall be referred to as abrupt irregularities.
- All other irregularities shall be referred as gradual irregularities. Gradual irregularities shall be measured as deviation from a plane surface with a template 1500 mm long for formed surface and 3000 mm long for unformed surfaces.

19.2 Formed Surfaces:

- Finish F1 shall apply to all formed surfaces for which finish F2 and F3 or any other special finish is not specified and shall include filling up all form tie holes.
- Finish F2 shall apply to all formed surfaces as shown on the drawings or specified by the Engineer-In-Charge. This shall include filling all form tie holes, repair of gradual irregularities exceeding 6 mm removal of ridges and abrupt irregularities by grinding.

- Finish F3 shall apply to all formed surfaces exposed to view or where shown in the drawings or specified by the Engineer-In-Charge. Finish F3 shall include all measures specified for Finish F2 and in addition filling air holes with mortar and treatment of the entire surface with sack rubbed finish. It shall also include clean up of loose and adhering debris. Where a sack rubbed finish is specified the surfaces shall be prepared within two days after removal of the forms.

    - The surface shall be wetted and allowed to dry slightly before mortar is applied by sack rubbing. The mortar used shall consist of one part of cement to one and half parts of fine sand (minus No.16 mesh) by volume. Only sufficient mixing water to give the mortar a workable consistency shall be used.

    - The mortar shall then be rubbed over the surface with a fine burlap or linen cloth so as to fill all the surface voids.

    - The mortar rubbed in the voids shall be allowed to stiffen and solidify after which the whole surface shall be wiped clean so that the surface presents a uniform appearance without air holes, irregularities etc.

- Curing of the surface shall be continued for a period of ten days.

19.3 Unformed Surfaces:

- Finish U1 shall apply to all unformed surfaces for which the finish U2, U3 or any other special finish is not specified and shall include screeding the surface of the concrete to the required slope and grade.

    - Unless the drawing specifies a horizontal surface or shows required the slope the top of the narrow surfaces such as stairs, treads, walls, curbs and parapets shall be sloped approximately 10 mm per 300 mm width.

    - The surfaces to be covered by back fill or concrete sub floors to be covered with concrete topping, terrazzo and similar surfaces shall be smooth screeded and leveled to produce even surface, irregularities not exceeding 6 mm.

- Finish U2 shall apply to all unformed surfaces as shown in the drawing or specified by the Engineer-In-Charge and shall include screeding and applying a wood float finish to the surface of the concrete to the required slopes and grade.

    - Repair of abrupt irregularities unless a roughened texture is specified. Repair of gradual irregularities exceeding 6 mm.

- Finish U3 shall apply to unformed surfaces for which a high degree of surface smoothness is required where shown on the drawing or as specified by the Engineer-In-Charge. This shall include screeding, floating and applying a steel trowel finish to the surface of the concrete to the required slopes and grade.

    - Repair of abrupt irregularities and gradual irregularities exceeding 6 mm, finishing joints and edges of concrete with edging tools.

20.0 MODE OF MEASUREMENTS:

20.1 The concrete as actually done shall be measured for payment. Any work done excess over the specified dimensions for the section shown in the drawing or as required by the Engineer-In-Charge shall not be measured for payment.

20.2 Dimensions of length, breadth and thickness shall be measured correct to nearest centimeters except for the thickness of slab, which shall be measured to nearest 5 mm.

20.3 Areas shall be worked out to nearest 0.01 square metre and the cubic contents of consolidated concrete shall be worked out to nearest 0.001 cubic metres.

20.4 For the purpose of measurements and payments for all concrete works I.S. 1200 (Part-II) shall be referred.

21.0 CONTROL JOINT / DUMMY JOINT:

21.1 These joints shall be founded at 5 M to 6 M intervals. The width of the joint shall be 8 to 10 mm and the depth shall be 25 mm. The edges shall be rounded with an edging tool.

21.2 The joint shall be filled with the joint sealing compound of IS 1834-1961 for hot applied sealing compounds for joints in concrete.

21.3 The unit of measurement will be running metre including cost of sealing compound.

22.0 PLAIN CEMENT CONCERTE FOR GENERAL WORK:

22.1 For plain cement concrete work, the specifications for materials viz., cement, sand, fine and coarse aggregates and water shall be the same as that specified in reinforced work specification. But the proportion of mix will be nominal and the ratio of fine and coarse aggregate may be slightly adjusted within limits keeping the total volume of aggregates to a given volume cement constant, to suit the sieve analysis of the aggregates. Cement shall on no account be measured by volume, both it shall always be used directly from the bags (i.e., 50 Kg/bag).

22.2 The proportion of cement, sand, aggregate for concrete of proportion 1:4:8, 1:3:6, 1:2:4 by volumes shall generally consist of quantities as given below:

Proportions of ingredients	Quantity of materials used per bag of Cement			
	Cement	Sand	Coarse aggregate	Water
1:4:8	1	130 ltrs.	272 ltrs.	39 ltrs.
1:3:6	1	102 ltrs	204 ltrs.	34 ltrs.
1:2:4	1	68 ltrs.	136 ltrs.	30 ltrs.

22.3 The quantity of water used shall be such as to produce concrete of consistency required by the particular class or work and shall be decided by the use of slump cone. Sufficient care should be taken to see that no excess quantity of water is used. The final proportion of the aggregates and the quantity of water shall be decided by the Engineer on the basis of test in each case. The slum shall be specified for each class of work and shall in general be as follows:-

Type of Concrete	**Mix slump (Millimetres)**	Mass
Concrete	50	
Roads and pavements, hand finished	100	
Roads and pavements, machines finished	25	
Floor paving	50	

22.4 All plain concrete shall be preferably mixed in a drum type power driven machine with a loading hopper, which will permit the accurate measure of various ingredients. If hand mixing is authorized, it should be done on a watertight platform.

22.5 The mixing of each batch in the concrete mixer shall continue for not less than 2 minutes after the materials and water are in the mixer. The volume of mixed materials per batch shall not exceed the manufacturer's rated capacity of the mixer. The mixer shall rotate at a peripheral speed of about 60 metres per minute.

22.6 Concrete shall be poured and consolidated in its final position within half an hour of mixing. The re-tempering of concrete, which has partially hardened, that is remixing with or without additional cement, aggregate or water shall not be permitted. Concrete in c.c. 1:2:4 will be required to be vibrated if specified and directed by the Engineer. In case if the thickness of concrete is more than 150 mm in thickness, it may be vibrated if directed by the Engineer.

22.7 The concrete shall be cured for 10 days in ordinary weather and 15 days in cold weather. Measurements for the work done shall be exact length, breadth and depth shown or figured on the drawings or as instructed by the Engineer and after the concrete is consolidated. No extra shall be paid for excess quantity resulting from faulty workmanship.

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SPECIFICATION FOR FORM WORK

1.0 SCOPE

This specification covers type of form work, moulds and scaffolding required for this job.

1.1. General

The formwork shall consists of shores, bracings, side of beams and columns, bottom of slabs, etc. including ties, anchors, hangars, inserts, etc. complete which shall be properly designed and planned for the works.

The formwork shall be so constructed that up and down vertical adjustments can be made smoothly. Wedges may be used at top or bottom of shores, but not at both the ends to facilitate vertical adjustment for dismantling of the formwork.

2.0 APPLICABLE CODES AND SPECIFICATIONS:

The relevant IS specification, standards and codes given below are made a part of this specification. All standards, specifications, code of practices refer to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

IS 303	Plywood for general purpose
IS 1200 (Part V)	Method of Measurement of building and civil engineering work (Form work)
IS 2750	Specification for steel scaffolding
IS 3696	Safety code for scaffolds and ladders
IS 4014 (Part I)	Code of Practice for steel tubular scaffolding
IS 4014 (Part II)	Code of Practice for steel tubular scaffolding
IS 4990	Specification for plywood for concrete shuttering work
ACI 347	Guide to formwork for concrete (American Concrete Institute)

3.0 DESIGN OF FORMWORK:

3.1. The design and engineering of the formwork as well as its construction shall be the responsibility of the contractor. If so instructed, the drawings and calculations for the design of the formwork shall be submitted well in advance to the Engineer-in-charge for approval before proceeding with the work at no extra cost to the department. Engineer-In-charge's approval shall not relieve the contractor of the full responsibility for the design and construction of the formwork.

3.2. The design shall take into account all the loads vertical as well as lateral that the forms will be carrying including live load and vibration loads.

3.3. Depending upon the height of the staging, suitable vertical and horizontal cross bracings shall be provided.

3.4. The contractor shall note that no concrete work of floor, beam, slab including roof slab will be permitted unless the staging work is inspected and the approval in writing for its soundness is given to the Engineer-in-charge prior to commencement of concrete work.

4.0 TOLERANCES

Tolerance is a specified permissible variation from lines, grade or dimensions given in the drawings. No tolerance specified for horizontal and vertical building lines or footings shall be considered to permit encroachment beyond the legal boundaries. Unless otherwise specified, following tolerances shall be permitted –

4.1 Tolerance for R.C. Building

4.1.1 Variation from vertical:

No.	Building Members	Tolerances
1.	In the line and surface of columns, piers, walls and buttresses	5 mm per 2.50 M but not more than 25 mm
2.	For exposed corner columns and other conspicuous lines	In any bay or 5 M maximum: (+/-) 5 mm. In 10 M or more: (+/-) 10 mm

4.1.2 Variation from the level or frame the grade indicated in the drawings:

No.	Building Members	Tolerances
1.	In slab soffits, ceilings, beam soffits and staircases	In 2.50 M : (+/-) 5 mm In any bay or 5 M maximum: (+/-) 8 mm. In 10 M or more: (+/-) 15 mm
2.	For exposed lintels, parapets, horizontal grooves and other conspicuous lines	In any bay or 5 M maximum: (+/-) 5 mm. In 10 M or more: (+/-) 10 mm

4.1.3 Variation of the linear building lines from established position in plan and related position of columns, walls and partitions:

No.	Building Members	Tolerances
1.	In any bay or 5 M maximum	(+/-) 5 mm
2.	In 10 M or more	(+/-) 20 mm

4.1.4

No.	Building Members	Tolerances
1.	Variation in the sizes and locations of sleeves, openings in walls and floors except in the case of anchor bolts.	(+/-) 5 mm

No.	Building Members	Tolerances
1.	Variation in cross sectional dimensions of columns and beams and thickness of slabs and walls	(-) 5 mm and (+) 10 mm.

4.1.5 Variation in footings:

No.	Building Members	Tolerances
1.	Variation in dimension in plan	(-) 5 mm and (+) 50 mm.
2.	Misplacement or eccentricity in the direction of misplacement	0.02 times the width of the footing in the direction of the deviation but not more than 50 mm
3.	Reduction in thickness	(+/-) 0.05 times the specified thickness

4.1.6 Variation in steps:

No.	Building Members	Tolerances
1.	In a flight of stairs riser	(+/-) 3 mm
2.	In a flight of stairs tread	(+/-) 5 mm
3.	In consecutive steps riser	(+/-) 1.5 mm
4.	In consecutive steps tread	(+/-) 3 mm

4.2 Tolerances in other Concrete structures:

4.2.1 All structures:

No.	Building Members	Tolerances
1.	Variation of the constructed linear outline from established position in plan	(+/-) 10 mm in 5 M (+/-) 15 mm in 10 M or more
2.	Variation of dimensions to individual structure features from established positions in plan	(+/-) 25 mm in 20 M or more (+/-) 50 mm in buried construction
3.	Variation from plumb, specified batter or curved surfaces of all structures	(+/-) 10 mm in 2.50 M (+/-) 15 mm in 5 M (+/-) 25 mm in 10 M or more (+/-) Twice the above amounts in buried construction
4.	Variation from level or grade indicated on drawings in slabs and beams soffits, horizontal grooves and visible arises	(+/-) 5 mm in 2.50 M (+/-) 10 mm in 7.5 M or more (+/-) Twice the above amounts in buried construction
5.	Variation in cross sectional	(-) 5 mm and (+) 10 mm

	dimensions of columns, beams, buttresses, piers and similar members	
6.	Variation in the thickness of slabs, walls, arch sections and similar members	(-) 5 mm and (+) 10 mm

4.2.2 Footings for columns, piers, walls, buttresses and similar members:

No.	Building Members	Tolerances
1.	Variation in dimension in plan	(-) 10 mm and (+) 50 mm.
2.	Misplacement or eccentricity in the direction of misplacement	0.02 times the width of the footing in the direction of the deviation but not more than 50 mm
3.	Reduction in thickness	(+/-) 0.05 times the specified thickness

4.2.3 Tolerances in other types of structures shall generally conform to those given in clause 2.4 of recommended Practice for Concrete Formwork (ACI 347).

5.0 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-in-charge

6.0 FORMWORK REQUIREMENTS

6.1 Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, waler braces, ties, straps, shores, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete has set sufficiently to permit removal of forms. Form shall be strong enough to permit the use of immersion vibrators; in special case form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete shall be free from adhering grout, plaster, paint,

projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water and fine material from concrete.

6.2 Plywood shall be used for exposed concrete surface where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surface, which are to be rubbed finished shall be planed to remove irregularities or unevenness in the face. Formwork with lining will be permitted.

6.3 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 the Engineer-in-charge shall be removed from the site.

6.4 Shores supporting successive stories shall be placed directly over those below or be so designed and placed that the load will be transmitted directly on them. Trussed supports shall be provided for shores that can be secured on adequate foundation.

6.5 Form work during any stage of construction showing signs of distortion or disturbed to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings shall be re-positioned and strengthened. Poured concrete affected by faulty formwork shall be removed entirely and the formwork shall be corrected prior to placing new concrete.

6.6 Excessive construction camber to compensate for shrinkage settlement etc. that may impair the structural strength of the members will not be permitted.

6.7 Forms for substructure concrete may be omitted in the opinion of the Engineer-in-charge the open excavation is firm enough to act as the form. Such excavation shall be slightly larger than that required by drawings to compensate for irregularities in excavation and to ensure the design requirement.

6.8 Forms shall be designed and constructed that they can be stripped in order required and their removal do not damage the concrete. Face form work shall provide true vertical and horizontal joints conforming to the architectural features of the structure as to location of joints and be as directed by the Engineer-in-charge.

6.9 Where exposed smooth or rubbed concrete finishes are required, the forms shall be constructed with special care so that the desired concrete surfaces could be obtained which require a minimum finish.

7.0 BRACINGS, STRUTS AND PROPS

7.1 Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bracings.

7.2 The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slab can be removed without disturbing the beam bottoms.

7.3 Re-propping of the beams shall not be done except when the props have to be reinstalled to take care of construction loads anticipated being 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.

7.4 If the shuttering for a column is erected for the full height of the column, one side shall be left open and built upon sections as placing of concrete proceeds or windows may be left for pouring concrete from sides to limit the drop of concrete to one meter or as directed by the engineer-in-charge.

8.0 FORM OIL

8.1 Use of the form oil shall not be permitted on the surface that requires painting. If the contractor desires to use form oil on the inside of form work of the other concrete surfaces, a non staining mineral oil or other approved oil ‘CEMOL-35’ of M/s Hindustan Petroleum Co. Ltd. or equivalent may be used provided it is applied before placing of reinforcing steel and embedded parts.

8.2 All excess oil on the form surfaces and any oil on metal or other parts to be embedded in the concrete shall be carefully removed. Before treatment with oil forms shall be thoroughly cleared of dried splatter of concrete from placement of previous lift.

9.0 CHAMFERS AND FILLETS:

9.1 All corners and angles in the finished structure shall be formed with mouldings to form chamfers or fillets on the finished concrete. The standard dimensions of chamfers and fillets unless otherwise specified shall be 20 mm x 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the moulding shall be planed or surface to the same texture as the forms to which it is attached.

9.2 Vertical construction joints on faces which will be exposed at the completion of the work shall be chamfered as above except where not permitted by Engineer-in-charge for structural or hydraulic reasons.

10.0 WALL TIES:

Wall ties passing through the walls shall not be allowed. Also through bolts shall not be permitted. For fixing of formwork alternate arrangements such as coil nuts shall be adopted at the contractor's cost.

11.0 REUSE OF FORMS:

Before reuse all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary repaired and the inside retreated to prevent adhesion to the satisfaction of Engineer-in-charge. Warped timber shall be resized. Contractor shall equip himself with enough shuttering to complete the job in the stipulated time.

12.0 REMOVAL OF FORMS:

12.1 Contractor shall record in the drawings or 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 there from.

12.2 In no circumstances shall form struck until the concrete reaches a strength of at least twice the stress due to self weight and any construction/erection loading to which the concrete may be subjected at the time of striking of formwork. The strength referred to shall be that of concrete using the same cement and aggregates and admixture, if any, with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work.

12.3 In normal circumstances where the ambient temperature does not fall below 15o C and where Ordinary Portland Cement is used and adequate curing is done the stripping time is to be followed as specified in IS: 456-2000 (clause 11.3).

12.4 Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration by gentling easing the wedges. If after removing the formwork it is founds that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

12.5 Reinforced temporary openings shall be provided as directed by the Engineer-in-charge to facilitate removal of formwork which otherwise may be inaccessible.

12.6 Tie rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structure shall be loosened not sooner than 16 hours not later than 24 hours (in case the conditions in 12.3 are satisfied) after the concrete has been deposited. Ties except those required to hold the 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 forms and grade beams will not be permitted. Work damaged due to premature or careless removal of forms, any undulation in exposed concrete surface due to sag / settlement or movement of supports found after removal of shuttering shall be reconstructed or rectified to the satisfaction of the Engineer-in-charge by the contractor at his own risk and cost. Abrupt changes in surface of concrete, mortar fins at formwork joints shall be made even by chipping, grinding and finishing with cement mortar, curing, etc. as directed by Engineer-in-charge at his own cost.

13.0 MODE OF MEASUREMENT:

13.1 The net area of exposed surfaces of concrete members as shown in the drawings coming in contact with form work shall be measured under item of form work in square meter.

13.2 The dimensions of the formwork shall be measured correct to a centimeter.

13.3 No deductions shall be made from the shuttering for openings/obstructions up to an area of 0.10 m2 and nothing extra shall be paid of forming such opening.

13.4 For the purpose of measurements for formwork IS: 1200 (Part V) shall be referred.

14.0 SPECIFICATION FOR STAGING WORK:

The contractor shall note that only steel tubular staging (acrow type or equivalent) shall be used for all RCC beams, slabs, etc. at all floor levels and the same shall be designed by him and the detailed drawings and the design calculations shall be submitted for the approval of Engineer-in-charge at least two months in advance of the scheduled date of its erection at site. Depending upon the height of the staging, suitable vertical and horizontal cross bracings shall be provided. The contractor shall note that no concreting of floor beams, stairs and slabs including roof slab will be permitted unless the staging work is inspected and approval in writing for its soundness by the Engineer-in-charge is given prior to the commencement of concreting.

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SPECIFICATIONS FOR STEEL REINFORCEMENT

1.0 GENERAL:

1.1 Steel reinforcement bars, if supplied or arranged by the contractor, shall be either plain round mild steel bars grade – I or medium tensile steel bars as per IS: 432 or hot rolled mild steel and medium tensile deformed as per IS: 1139 or Thermo-mechanically treated (TMT) bars - high yield strength deformed bars as per IS: 1786 as shown and specified on the drawings and shall be manufactured by M/s SAIL or TISCO or RINL only and shall be rolled from their own plants and from virgin material. Materials manufactured by their authorized conversion agents and re-rollers shall not be accepted. Documentary evidence of purchasing steel produced from these manufacturers and their manufacturing test certificate shall be submitted. The third party test shall be carried out as directed in line with the relevant Indian standards and cost of which shall be included in the item rate and no separate payment shall be made on account of this.

1.2 Wire mesh or fabric shall be in accordance with IS: 1566.

1.3 Substitution of reinforcement will not be permitted except upon written approval from Engineer-In-Charge.

2.0 SCOPE:

This specification covers the general requirements for quality, storage, bending and fixing of reinforcement.

APPLICABLE CODES AND SPECIFICATIONS:

The relevant IS specification, standards and codes given below are made a part of this specification. All standards, specifications, code of practices refer to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

IS 226	Specification for steel standard quality
IS 228	Methods for chemical analysis of steels
IS 280	Specifications for mild steel wire for general engineering purpose.
IS 432 (Part 1)	Specification for mild steel and medium tensile steel burn and hard drawn steel wires for concrete requirement. Mild steel and Medium tensile steel bars.
IS 432 (Part 2)	Specification for mild steel and medium tensile steel burn and hard drawn steel wires for concrete requirement. Hard drawn steel wire.
IS 456	Code of practice for construction and design of reinforced concrete.
IS 816	Code of practice for use of metal arc welding for general construction in mild steel
IS 961	Specification for structural steel: high tensile steel Bars.
IS 1566	Hard drawn steel wire fabric for concrete reinforcement
IS 1599	Method of Bend test
IS 1642	General requirements for fire protection.
IS 1785	Cold drawn stress relieved wire (part J)
IS 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS 2751	Code of practice for welding of MS bars.
IS 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
IS 2751	Code of practice for welding of Bars.
IS 3696	Safety Code of scaffolds and ladders: Part 1 Scaffolds Part 2 Ladders
IS 4014	Code of practice for steel (Part 1 & 2) tubular scaffolding.
IS 4082	Recommendation on stacking and storage of construction materials at site
IS 5525	Recommendation for detailing of reinforcement in RCC work.
IS 9417	Recommendation for welding cold worked steel bars for reinforced concrete construction
IS 10790	Method of sampling of steel for prestressed and reinforced concrete

4.0 STORAGE:

The reinforcement shall not be kept in direct contact with the ground but stacked on top of an arrangement of timber slippers or the like. The reinforcement shall be coated with cement wash before stacking to prevent scale and rust. Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion and deterioration.

5.0 QUALITY:

5.1 All steel shall be of grade-I quality unless specifically permitted by the Engineer-In-Charge. No re-rolled material will be accepted. Contractor shall submit the manufacturer's test certificate for steel.

5.2 Random test on steel supplied by the contractor may be performed by owner as per relevant IS. All cost incidentals to such tests shall be at the contractor's expenses. Steel not conforming to the specifications shall be rejected.

5.3 All reinforcement shall be clean, free from grease, oil, paint, dirt, loose mill scale, loose rust, dust, bituminous material or any other substance that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated.

5.4 Pitted and defective rods shall not be used. All bars shall be rigidly held in position before concreting. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer-in-charge. If welding is approved the work shall be carried out as per IS: 2751, according to best modern practices and as directed by the Engineer-in-charge.

5.5 In all cases of important connections, test shall be made to prove that the joints are of the full strength of the bar welded. Special precaution as specified by the Engineer-in-charge shall be taken in the welding of cold work reinforcing bars and bars other tan mild steel.

6.0 LAPS:

Laps and splices for reinforcement shall be as shown on the drawings. Splices and adjacent bars shall be staggered and the location of all splices except those specified on the drawings shall be approved by the Engineer-in charge. The bars shall not be

lapped unless the length required exceeds the maximum available length required of bars at site.

7.0 BENDING:

7.1 All bars shall be accurately bent according to the size and shape shown on the detail working drawing / bar bending schedule. They shall be gradually bent by machine or approved means.

7.2 Reinforcing bars shall not be straightened and re-bend in the manner that will injure the material. Bars containing cracks and splits shall be rejected. They shall be bent cold except bars above 25 mm in diameter which may be bent hot, if specifically approved by Engineer-in-charge.

7.3 Bars which depend for their strength on cold working shall not be bent hot. Bars bent hot shall not be heated beyond cherry-red color (not exceeding 645° C) and after bending shall be allowed to cool slowly without quenching.

7.4 Bars incorrectly bent shall be used only if the means used for straightening and re-bending is such as shall not in the opinion of the Engineer-in-charge injure the material.

7.5 No reinforcement bars 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 the design shall not be used.

8.0 FIXING:

8.1 The reinforcement shall accurately be fixed by any approved means and maintained in the correct position as shown in the drawing by use of blocks, spacers and chairs as per IS: 2502 to prevent displacement during placing and compaction of concrete.

8.2 Bars intended to be in contact at crossing point shall be securely bound together at all such points with 1.6 mm diameter annealed soft iron wire.

8.3 The vertical distance required between successive layers of bars in beams or similar members shall be maintained by provision of mild steel spacer bars at such intervals that the main bar do not perpetually sag between adjacent spacer bars.

9.0 COVER TO REINFORCEMENT:

Unless indicated otherwise on the drawing, clear concrete cover for reinforcement (exclusive of plaster or decorative finish) shall be as per the provisions of IS: 456.

10.0 INSPECTION:

Erected and secured reinforcement shall be inspected and approved by the Engineer-in-charge prior to placement of concrete.

11.0 MODE OF MEASUREMENT:

11.1 The actual quantity of reinforcement bars embedded in concrete as specified in the drawing and as approved by the Engineer-in-charge irrespective of the level or height at which the reinforcement bars are placed shall be measured for payment.

11.2 The reinforcement bars shall be measured in length nearest to a centimeter for different diameters and their weight shall be calculated based on the standard weights as per Indian Standard.

11.3 Wastage, unauthorized overlap and annealed steel binding wires shall not be measured for payment.

11.4 Pins, chairs and spacers wherever required shall be provided As directed by the Engineer-in-charge and measured separately and paid for.

11.5 The rate for reinforcement item shall include the cost of labour and materials required for all operations described above including transportation, cleaning, straightening, cutting, bending, placing in position and binding of reinforcement bars and wastage, etc.

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SPECIFICATION FOR BRICKWORK

1.0 SCOPE

These specifications cover the use of Brick Masonry for the structural purposes.

1.1 GENERAL

1.1.1 Brick shall be table moulded of uniform size, shape and colour must be well burnt so as to give a clear ringing sound when struck. They shall be clean, whole and free from flaws, cracks, stones or lumps of any kind, especially lime. They shall have sharp edges, shapes and even surface and shall be sound & hard to resist compression. They shall be from a source to be approved by the Engineer-in-charge and the quality of the brick should be such that they shall not absorb more than 20% of water by weight after immersion in water for 24 hours and shall have a compressive strength of 3.5 N/mm2 as per IS: 1077-1992.

1.1.2 All bricks shall be thoroughly saturated with water before use. They should be soaked for about 12 hours for this purpose. No broken bricks shall be used except as closers. The course shall be laid flush in mortar and every course shall be thoroughly grouted, joints shall be broken vertically and they shall not exceed 10 mm in thickness. The horizontal joints shall not be more than 10 mm in thickness. The work shall not be raised more than 12 courses per day. It shall be kept constantly wet for at least 10 days and twice a day for a month. Date of laying the brickwork shall have to be marked, as directed by the Engineer-in-charge, on the wall so as to ensure easy monitoring of the curing period.

1.1.3 Before starting the brick masonry, the concrete surfaces e.g., plinth beams, columns, slabs, chajjas, etc. shall be thoroughly hacked and washed to remove all mud, dirt, loose particles, etc. No holes for supporting scaffolding arrangement shall be allowed especially at the junction of concrete surfaces and the brickwork. However, these holes may be allowed elsewhere and are to be made good after the scaffolding is removed in such a manner so as to ensure complete water tightness. When the fresh brickwork to be started on the old brick masonry the surface should be thoroughly cleaned and washed to remove all moss deposit, loose mortar, mud and dirt, etc.

1.1.4 String courses and mouldings shall be set straight and true by projecting brickwork with properly cut and shaped bricks wherever necessary with as fine joints as possible.

1.1.5 The walls shall be carried up regularly in all cases when the nature of the work will admit of it, not leaving any part 1.0 M lower than another, when circumstances render it necessary to carry out on the same section of a building in uneven course. The brick shall be raked back so as to maintain uniform and effectual bond.

1.1.6 In brick arched and other circular work, the brick shall be shaped to have joints indicating correctly to the center from the front to back of walls with thickness not meter than 10 mm. The face brick shall be of uniform colour and with sharp surfaces.

1.1.7 Where pointing or plastering is specified the joints in all brickwork shall be raked out on both the faces of the wall as the work proceeds.

1.1.8 The size of the brick shall be 230 (9") x 115 (4-1/2") x 75 mm (3") (or 190 x 90 x 90 mm). 230 mm (9") and 115 mm (4-1/2") thick walls will be built fair on one side only. All walls of greater thickness shall be built without exception with fair face to both sides.

1.1.9 Half brick or 115 mm thick brickwork shall be carried out in panels and with horizontal stiffeners of 115 x 75 mm with two bars of 10 mm diameter and spacers of 6 mm diameter at 900 mm center to center and vertical stiffeners of 115 x 75 mm with two bars of 10 mm diameter and spacers of 6 mm diameter at 2M center to center laid in 1:2:4 concrete properly filled including formwork, consolidation, curing, etc. The RCC work shall not be measured separately but will be included in the brickwork. The MS reinforcement however will be measured separately.

1.1.10 The contractor shall provide all necessary openings doors, windows or such other services and shall embed electrical fittings and fixtures; sleeves supplied by the other agency if required at no extra cost. Also shaping of the bricks for the exhaust fan, circular openings shall also be carried at no extra cost. All these openings shall be closed and gaps to be filled and finished neatly after the installation of all these services at no extra cost.

1.1.11 The rate for brickwork for both 230 mm and 115 mm thick walls shall include all single or double scaffolding, tools and plants, quoins and jambs, hacking, cutting and

wastage of bricks for splayed joints, watering, etc. deductions shall be made for all the openings, lintels, sills, columns, etc. The unit for measurement of 230 mm brick masonry and above will be in cubic meter and for 115 mm thick masonry in square meter. The rates for brickwork shall also include the cost of the following –

- Making good all holes (also ensuring the water tightness of the holes left out in external walls for supporting the scaffoldings), chases to any depth due to conduit pipes, holdfast, switches, plug box, exhaust fan openings and other openings, etc.

2.0 INDIAN STANDARDS

The provision of the latest Indian Standards listed below form part of these specifications:

IS 1077	Specifications for common burnt clay building bricks
IS 1200	Measurement for Building works
IS 1725	Specifications for solid cement blocks used in general building construction.
IS 1905	Code of practice for structural safety of buildings Masonry walls.
IS 2116	Sand for masonry mortars.
IS 2180	Specification for heavy duty burnt clay building bricks
IS 2185	Specification for concrete masonry units: Hollow and solid concrete blocks.
IS 2212	Code of practice for brick work.
IS 2222	Specification for burnt clay perforated building bricks.
IS 2250	Code of practice for preparation and use of masonry mortar.
IS 2645	Specification for integral waterproofing compound.
IS 2691	Specification for burnt clay facing bricks.
IS 3115	Specification for lime based blocks.
IS 3414	Code of practice for design and installation of joints in buildings.
IS 3466	Specification for masonry cement.
IS 3861	Method of measurement of plinth, carpet and rent able areas of buildings.
IS 3952	Specification for burnt clay hollow blocks for walls and partitions.
IS 4098	Specification for lime-puzzolona mixture
IS 4139	Specification for sand lime bricks
IS 4441	Code of practice for use of silicate type chemical resistant mortars.
IS 4442	Code of practice for use of sulphur type chemical resistant mortars.
IS 5495	Size & shape for fire bricks
IS 8112	Specification for high strength ordinary portland cement
IS 9103	Specification for admixtures for concrete.

Other Indian standards not specifically mentioned here, but pertaining to the use of bricks for structural purposes forms part of these specifications.

3.0 MATERIALS

3.1 Bricks

3.1.1 General

Bricks shall be of regular and uniform size, shape and colour, uniformly well burnt throughout but not over burnt. They shall have plane rectangular faces with parallel sides and sharp straight and right angled edges. They shall be free from cracks or other flaws. They shall have a frog of 10 mm. depth on one of their flat faces.

They shall give a clear metallic ringing sound when struck. They shall show a fine grained, uniform homogeneous and dense texture on fracture and be free from lumps of lime, laminations, cracks, air holes, soluble salts causing efflorescence or other defects which may in any way impair their strength, durability, appearance or usefulness for the purpose intended. They shall not have any parts under-burnt. They shall not break when thrown on the ground on their flat face in a saturated condition from a height of 60 cm.

3.1.2 Size of bricks

First class bricks shall be well & truly moulded of uniform shape, size , colour and must be well burnt so as to give a clear ringing sound when struck. They shall not break when thrown on the ground or against other bricks. They shall be clean, whole & free from flaw cracks, stones or un-burnt particles and shall measure 230mm by 112mm by 83mm.

Second class bricks shall be similar to those described above, but may vary more in colour. Twisted or irregular bricks shall not be accepted as second class.

When metric bricks are used they shall comply with I. S: 1077 - 1976.

3.1.3 Absorption

After immersion in water, absorption by weight shall not exceed 20% of the dry weight of the brick when tested according to IS: 1077-1976.

3.1.4 Crushing Strength

The load to crush the brick when dry shall not be less than 50 Kg/sq.cm. and when thoroughly soaked shall not be less than 35 Kg/sq.cm.

3.2 Cement, Fine Aggregate and Water

Refer relevant clauses of these specifications.

3.3 Mortars

Cement and sand shall be mixed in specified proportions given on the drawings. Cement shall be proportioned only by weight, by taking its unit weight as 1440 kg per cubic metre and the sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

The mixing shall be done intimately in a mechanical mixer unless hand-mixing is specifically permitted by the Engineer. If hand mixing is done, the operation shall be carried out on a clean watertight platform and cement and sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes. The mortar remaining unused after that period or mortar, which has partially hardened or is otherwise damaged shall not be re-tempered or re-mixed. It shall be destroyed or thrown away.

In case of cement mortar that has stiffened because of evaporation of water the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency, but this re-tempering shall be permitted only within thirty minutes from the time of addition of water at the time of initial mixing.

Necessary tests to determine compressive strength of the mortar, for consistency of the mortar and its water retentively shall be carried out in accordance with IS-2250. The frequency of testing shall be one cube for every 2 cubic metre of mortar prepared subject to a minimum of 3 cubes for a day's work.

4.0 CONSTRUCTION

4.1 Soaking of Bricks

Bricks shall be soaked in water for a minimum period of one hour before use so that they will be saturated and will not absorb water from the mortar. When bricks are soaked they shall be removed from the tank sufficiently in advance so that at the time of lying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not spoil by dirt, earth, etc,

4.2 Laying of Bricks

All brick work shall be laid in English bond, even and true to line, plumb, level and all joints accurately kept. The bricks used on the face shall be selected whole ones of uniform size and with true rectangular face. Brick shall be laid with frogs up, if any, on a full bed of mortar. When laying, bricks shall be slightly pressed so that the mortar gets into all the surface pores of bricks to ensure proper adhesion. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left.

Before laying bricks in foundation, a layer of not less than 12 mm of mortar shall be spread to make the surface on which the brickwork will be laid even. Immediately thereafter, the first course of bricks shall he laid.

The brickwork shall be built in uniform layers, corners and other advanced work shall be raked back. Brickwork shall be done true to plumb or in specified batter. No part of it, during construction, shall rise more than one meter above the general construction level, to avoid unequal settlement and improper joining. The height of brick works constructed shall not exceed one metre in a day.

Toothing may be done where future extension is contemplated but shall be used as an alternative to raking back.

4.3 Joints

The thickness of joints shall not exceed 10mm and this thickness shall be uniform throughout.

4.4 Joining with existing structure

When fresh masonry is to be placed against existing surfaces of structures, these shall be cleaned of all loose material, roughened and wetted as directed by the Engineer so as to affect a good bond with the new work.

4.5 Curing

Green work shall be protected from rain by suitable covering. Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. The top of the masonry work shall be left flooded with water at the close of the day. During hot weather all finished or partly completed work shall be covered or wetted in such manner as will prevent rapid drying of the brick work.

4.6 Scaffolding

The scaffolding shall be sound and strong to withstand all loads likely to come upon it and will be double or single as is warranted for the particular work. The holes, which provide resting space for horizontal members, shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled and made good with 1:4:8 cement concrete.

4.7 Condition of Equipment

All equipment used for mixing or transporting mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

4.8 Finishing of Surfaces

For a surface which is to be subsequently plastered or pointed the joints shall be squarely raked out to a depth of 15mm while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

4.9 Weep Holes

In case of abutment retaining walls and wing walls, weep holes as shown on the drawings or directed by the Engineer shall be provided in the masonry to drain moisture from the backfilling Weep holes shall be 8 cm wide, 15 cm high and shall extend through the full width of the masonry with slope of about 1 vertical to 20 horizontal towards the draining face.

The spacing of weep holes shall be as shown on the drawings with the lowest one at about 15cm above the low water level or ground level whichever is higher or as directed by the Engineer.

4.10 Fixtures to be built into Work

All fixtures of whatever nature must be built into the work as it proceeds in the position shown on the plan, specifications or as directed by the Executive Engineer from time to time. All metal fixtures must be embedded in cement mortar great care being taken to see that no lime mortar is in contact with them.

4.11 Arches

All arches are to be formed on properly framed centres. Bricks in arches should be set with a wooden mallet. The joints which must not exceed 6mm in thickness must radiate truly from the centre. In new work relieving arches shall be turned over all flat arches and lintels of doors, windows and other openings unless otherwise specified.

4.12 Uneven Foundation

In foundations or where due to any other insurmountable cause, part of the masonry starts from a lower level great care must be taken to keep mortar joints as thin as possible and to proceed slowly with the work paying particular attention to the bonding over offsets.

4.13 Bond

Unless otherwise specified the bond used shall be English Bond.

4.14 Excess of bats not to be used

Not bats or cut bricks shall be used in excess of the minimum number required for obtaining the required bond or for obtaining the actual dimensions required.

4.15 Threading

Threading shall be provided on the underside of all string courses, cornices and moulding.

4.16 Recess for beams, joists etc

The ends of beams, girders and roof trusses shall be seated as shown in the drawings, detailed in the specifications or as directed by the Executive Engineer from time to time and the brick work shall be recessed at all such places so as to leave a clear space 0f 38mm round the steel, iron or timber. No deduction shall be made in the brick work measurements for such recesses to compensate for the layout in making them.

4.17 Wooden plugs to be built in as work proceeds

Where shown on the plans or as directed by the Executive Engineer wooden plugs or wooden bricks shall be built in as the work proceeds and no extra rate granted for such work.

5.0 MEASUREMENT FOR PAYMENT

5.1 All brick work for 230mm thick or above shall be measured in cubic metres and 115mm thick and below shall be measured in sq. metres. The work of plastering and pointing shall be measured in square metres of the surface treated.

5.2 All plain brick work in walls, arches, square columns, bricks on edge and flat floors and flagging in roofs will be measured net.

5.3 Rate :- The contract unit rate for brick work shall include the cost of all labour, materials, tools and plant, scaffolding and other expenses incidental to the satisfactory completion of the work as described herein above and as shown on the drawings. The rate for work shall also include:

- Dewatering required for completing this item and till the mortar of masonry pointing & plastering is properly set,
- Watering the masonry, and
- Cleaning the site around the brickwork to restore the area to its original condition.

5.4 The rate for work shall also include full compensation for using specially moulded bricks on the face of walls with batter and provision of weep holes.

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SPECIFICATIONS FOR PLASTERING WORK

1.0 SCOPE

The work covered under this specification consist of supplying all materials and rendering all types of plaster /pointing finishes strictly in accordance with these specifications and applicable drawings etc.

2.0 INDIAN STANDARDS

Indian Standards to be followed are:

All relevant standards as specified elsewhere in this volume are applicable.

IS 383	Specification for coarse and fine aggregates for natural, sources for concrete.
IS 412	Specifications for expanded metal steel sheets for general purposes
IS 1542	Specifications for sand or plaster
IS 1661	Code of practice for application of cement and cement lime plaster finishes
IS 2402	Code of practice for external rendered finishes
IS 2645	Specifications for integral cement water proofing compound
IS 8112	Specification for 43 grade OPC
SP 27	Handbook of method of measurement of building works.

3.0 MATERIALS

3.1. Cement shall be ordinary Portland cement conforming to IS and of grade 43.

3.2. Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalis, acids, salts so as not to weaken mortar.

3.3. Water tested shall be in accordance with IS 3025. Maximum permissible limits of deleterious materials in water as given in IS 456 are reproduced for ready reference in table 1 of IS 456.

3.4. Sand shall conform to IS 1542 specification for sand for plaster. For white or coloured renderings, only quartz or silica sand shall be used. For textured finishes produced by treatment of freshly applied final or finishing coat with a tool coarser, particles used shall be screened through 3.35 mm IS sieve or 2.36 mm IS sieve. For torn texture a slightly larger portion of material coarser than 4.75 mm lS sieve shall be used.

3.5. Aggregate shall conform to IS 383.

3.6. Integral water proofing compound shall conform to IS 2645 (specification for integral water proofing compound).

3.7. GI Chicken mesh of 20 gauge as approved shall be used over junctions of concrete and masonry or two dissimilar materials about 150 mm wide fixed with GI wire nails etc. as directed by the ENGINEER-IN-CHARGE.

4.0 MORTARS

Mortars shall be prepared by mixing fine graded aggregate with cement, the lime or a combination of these in the proportion specified for respective items of 'work as detailed in the BOQ. Mixing of mortars shall be done by mechanical mixers only. Hand mixing may be permitted in specified cases on the written permission of the ENGINEER-IN-CHARGE.

Mortars shall be specified by proportion only and not by strength. Volumetric mixing shall be based on dry volumes of each ingredient. For convenience, measurement shall correspond to volume of one cement bag Le. 0.035 cu m. ; Boxes shall be of size 40 x 35 x 25 cm. These shall be marked as mortar mixing boxes by red paint and shall be used throughout the contract. Hand mixing or mechanical mixing' proportions shall be done with the use of these boxes.

4.1 Cement mortar

Cement mortar shall be prepared by mixing cement and sand in specified proportions. Proportioning shall be carried out as detailed above. Sand shall be added suitably to allow for bulkage if required. Bulkage shall/be determined as specified in IS 2386 Part III. Cement and sand added to mixer - shall be thoroughly mixed and water shall

be added to it gradually; After addition of water the mixer shall run for a minimum of 3 minutes. The mortar mixed shall be consumed within 30 minutes of its mixing.

5.0 WORKMANSHIP

Work shall be carried out as per recommendations of code of practices IS 1661 and IS2402.

5.1 Preparation of mortar mix

The material used in preparation of plastering mixes shall be measured by volume using gauge-boxes or by weight. When cement is measured by weight, 1440 kg of material shall be taken equivalent to one cubic meter.

5.2 Mixing

Mixing shall be done mechanically. Each mortar batch shall be used within half an hour. Hand mixing if permitted as special case shall be carried out on a clean, watertight platform. The mixing operation shall be continued with addition of necessary quantity of water until a uniform appearance and consistency of mortar is obtained.

Cement and sand shall be mixed dry in required proportion to obtain a uniform colour and water shall then be added to get the required consistency for the plaster.

5.3 Method of Plastering

5.3.1 Surfaces to be plastered must be clean and free from dust, loose material, oil, grease, mortar droppings, sticking of foreign matter, traces of algae, etc. It is very important to ensure that there should not be any chance of the plaster getting deboned' due to presence of materials harmful for bonding.

5.3.2 Raking out of joints is expected to be carried out along with masonry but it should be checked thoroughly so as to receive good key.

5.3.3 Walls should be sufficiently damp prior to plastering. Water from plastering mortar must not be absorbed by masonry under any condition.

5.3.4 Any unavoidable projections in masonry and concrete surfaces shall be chiseled back. Care shall be taken that surrounding surfaces are not damaged and reinforcement is not exposed.

5.3.5 Thickness of one coat should not be more than 15mm and less than 8 mm for single coat finished plaster.

5.3.6 In case of multi coat plaster, sufficient time shall be allowed for the undercoat to harden (cured, dried and shrunk properly) before subsequent coats are applied.

5.3.7 Undercoats shall be scratched or roughened before they are fully hardened to form' a mechanical key.

5.3.8 The method of application is also important and hence it is recommended that the mix be thrown on the surface rather than stuck with trowel. This increases the adhesion.

5.3.9 Independent double legged scaffolding free of masonry shall be provided. Scaffolding should be rigid, allowing free and safe movement on the platform and it should be at sufficient distance or height from the working areas. Scaffolding with railing gives more confidence to workers and improves the quality of work.

5.3.10 Actual plastering shall be undertaken only on the approval of the ENGINEER-IN-CHARGE. Plaster work should only follow the steps mentioned below:

a) Surface must be thoroughly cleaned.
b) Plaster area must be provided with, level dabs or spots allowing working and checking with 2-3 m straight edge. Depth of plaster must not be less than 8 mm at any point.
c) Required concealing services must be completed and tested.
d) No further cutting of masonry must be required.
e) Repairs carried out to masonry or concealing work must be cured and dry.
f) Surface must be sufficiently damp.
g) Plaster dabs are checked for plumb and level by the ENGINEER-IN-CHARGE or his representative.
h) Joints, concealing and repairing areas must be covered with 20 gauge GI chicken mesh as per the ENGINEER-IN-CHARGE's instruction.

5.3.11 Corners, external or internal, shall be finished along with final coat. It is advisable to have rounded corners.

5.3.12 Plaster shall be cured for 14 days by wet curing except in neeru finish plaster. During this period plaster shall be protected from exposure to extremes of temperature and weather.

5.3.13 Plaster shall be leveled and lined by aluminium hollow section, 2-3 m long. (This will give even and leveled surface). There shall not be more than 2 mm difference in level when checked with'3 m straight edge. It is important that enough pressing and beating is done to achieve compact filling of joints and that the area is fully compacted.

5.3.14 Finishing of plaster may be carried out with wooden float (randhas) or trowelled smooth with sheet metal trowels as specified. Care shall be taken to avoid excessive trowelling and overworking of the wooden float.

5.3.15 All corners, internal or external, shall be truly vertical or horizontal. These shall be finished with a proper template to achieve best workmanship for rounding and chamfering as specified or directed.

5.3.16 Plaster shall be cut to correct horizontal or vertical line at the' end of the day or if work requires to be suspended for any reason.

5.3.17 It is advisable to limit the area of plaster to 15 sq m to avoid cracks due to thermal movements of dissimilar material in contact; it is advisable to provide joints treated with groove or any other detail as suggested by the Architect. These joints if not specified shall be treated with 150 mm wide reinforcing chicken mesh (approved by the ENGINEER-IN-CHARGE) fixed over joints by GI nails and the area plastered.

6.0 TYPE OF PLASTER

6.1 12mm thick ordinary cement sand plaster

Single coat cement-sand plaster with cement-sand mix in proportion of 1:4 shall be carried out over the entire area as detailed above. This shall be finished just with wooden float to give the best smooth surface possible. This may be for internal or

external areas. Thickness may be from 10 to 15 mm maximum or as specified in the item or drawing.

6.2 18 to 25 mm ordinary cement sand plaster

This is the same as for the 12mm thick single coat plaster except that this shall be carried out in two coats. Maximum thickness of the undercoat shall be 12 mm and balance in the second finishing coat. All operations remain the same and are as detailed in Clause 3.0 of this section.

6.3 Cement Finished Plaster

This shall be carried out in the same manner as in Clause 5.1 and 5.2 of this section for specified thickness in single or double coat. Then it shall be finished uniformly over the entire area with a paste of neat cement when the plaster has just hardened and finished smooth with a steel trowel. It shall be worked over again to achieve a smooth leveled surface. Quantity of cement applied shall be about 1 kg/sqm.

6.4 Sand Face Plaster

6.4.1 This shall generally be carried out on the outside face and exposed area of masonry work and concrete work. It shall be of minimum 22 mm thickness and shall be in two coats (1st coat 16 mm and 2nd coat 6 mm). The coat shall be CM 1:4 (1 cement and 4 sand) mixed with water-proofing compound 2% by weight of cement and applied as usual and surface shall be keyed.

6.4.2 The second coat shall be applied after 7 to 10 days and shall be of CM 1:4 (1 cement and 4 sand). Mortar shall be mixed with slightly coarse sand. Mix shall be worked over with 3 m gauge or wooden float to achieve an uniform surface.

6.4.3 The surface shall be allowed to harden sufficiently for sponging operation. Sponging shall be done by dipping sponge in cement water and removing fine particles and exposing large sand particles. The movement of sponge shall be such that no patches develop nor excessive materials removed from the surface. There shall not be a difference of more than 7 mm when checked with a 2 m long straight edge.

6.5 Water proof plaster

The water proofing compound shall conform to IS 2645. The water proofing compound shall be mixed with dry cement in the proportion by weight as specified or recommended by the approved manufacturer of water proofing compound. Mixing should be thoroughly well integrated with cement. Addition of water must not allow any slips of mixed cement. The mix used, in general, shall be CM 1:4 (1 Cement: 4 Sand) and the balance application, curing, etc. remains the same as detailed above.

7.0 MEASUREMENT

7.1 Plaster work shall be measured in square meter to the second decimal place.

7.2 Thickness of plaster shall be the average depth of plaster as specified. But if extra thickness occurs due to bad quality of bricks, stones or blocks or due to bad workmanship, the repairs or extra thickness required to be carried out shall be at the cost of contractor.

7.3 Grooves, pattas in continuation of large areas or plaster areas shall be considered as part of the plaster and not measured separately.

7.4 Ceiling plaster, including ribbed beam slab shall be measured in square meters.

7.5 Beams and columns in continuation of masonry shall be measured in square meter.

7.6 Jambs, sills, coves, cornices, etc. shall be a part of plaster and no separate payment shall be made towards these items.

7.7 Deduction

- Deduction for an opening in plaster shall not be for area less than 0.5 sq m.
- In case the opening area is 0.5 sq m to 3.0 sq m, only 50% area shall be deducted from each face.
- In case the width of door or window frames is equal to masonry, full area of opening shall be deducted.

- In case of openings of area above 3 sqm each deduction shall be made for opening on each face and jambs, soffits, sills shall be measured.

7.8 Plaster to ceiling and walls shall be measured separately if specified in the BOQ.

8.0 RATE

8.1 Description of item in the BOQ, unless otherwise stated, includes, wherever necessary, conveyance and delivery handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting and fixing in position, straight cutting and waste, return of packings and other incidental charges.

8.2 Levels and heights shall be as indicated in the BOQ.

8.3 Preparation of surface shall be as approved by the ENGINEER-IN-CHARGE.

8.4 Trimming off the projections on masonry shall be included in the price.

8.5 Scaffolding and working platform shall be included in the price.

8.6 Materials as detailed and as required to complete item as specified shall be included in the price.

8.7 Curing of plaster shall be included in the price.

8.8 Cleaning of adjacent areas, windows/ door frames, etc. including 0masonry surface in exposed masonry work, shall be included in the price.

8.9 Forming grooves for joints between beams/columns and masonry etc. shall be ' included in the price. Any special treatment if detailed shall be measured separately and billed in BOQ.

8.10 Providing and fixing chicken mesh at junction of R.C.C., brick work, edges, corners, chiseled and repaired brick work prior to plaster over concealed conduit, etc. shall be as directed by the ENGINEER-IN-CHARGE. It shall be considered as part of item and no separate charge will be payable.

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SPECIFICATION FOR CONSTRUCTION OF SAND PAD FOUNDATION FOR VERTICAL STORAGE TANKS

1.0 SCOPE:

This specification and the method of measurements described thereon are applicable for Tank Pad Foundation to be carried out for different Tanks above ground level.

2.0 APPLICABLE CODES:

All work shall be carried out strictly in accordance with the Technical Specifications, unless otherwise approved by the Engineer-In-Charge in writing.

The Indian Standard Codes applicable to this section shall include but not limited to the following.

IS 383	Specification for coarse & fine aggregate from natural source or concentrate.
IS 1200	Method of measurement of building works. Part-1 Earth Work
IS 2386 (Part-IV)	Method of test for aggregates for concrete: Mechanical properties.
IS 2720 (Part 2)	Methods of test for soils: Determination of water content
IS 2720 (Part 4)	Methods of test for soils: Grain Size analysis.
IS 2720 (Part 5)	Methods of test for soils: Determination of Liquid and plastic limit.
IS 2720 (Part 7)	Methods of test for soils: Determination of Water content –dry density relation using Light compaction.
IS 2720 (Part 8)	Methods of test for soils: Determination of Water content –dry density relation using Heavy compaction.
IS 2720 (Part 15)	Methods of test for soils: Determination of Consolidation properties.
IS 2720 (Part 28)	Methods of test for soils: Determination of dry density of soil in place, by the sand replacement method
IS 3764	Excavation work. - Code of Safety
IS 2508	Specification for Low Density Polyethylene Films

3.0 MATERIALS

3.1. Sand

Sand shall be coarse sand from a source approved by the owner before commencement of work. It shall be clean, durable, angular, gritty & free from mica and organic or vegetable matter Sand shall be screened free of all foreign matter and shall conform in grading to the requirements in Grading Zone III of Table No. 3 of latest edition of IS 383 for fine aggregates.

3.2. Murrum / Clay

Murrum / clay shall be of best quality available and free from all foreign material. Same shall be brought at site after approval from site Engineer.

3.3. Water

Water for consolidation shall be potable and free from mineral salts. Same shall be got tested from a reputed test house for suitability before the start of works.

3.4. Bitumen

Bitumen for the Carpet shall be VG 10 grade as per IS 73: 2006.

4.0 SETTING OUT

Before starting the work, the contractor shall line out the position of the foundation as per layout drawing and also construct a concrete bench mark which shall be the datum for levels. The bench mark shall be constructed in a manner which will ensure that it is not disturbed or undergo settlement. The laying out of the benchmark shall be approved by Site Engineer.

5.0 SUBGRADE

5.1 Excavation shall be to the exact dimensions as per standard drawings for sand pad foundation unless instructed in writing by the Site Engineer.

5.2 The sub grade shall be watered and rammed to level and shall be free from soft spots.

5.3 Tank bottom will be concave shaped with the slope towards the center ranging from 1:40 to 1:100 depending upon the diameter of the tank so that central depression shall not exceed 250 mm

5.4 The diameter of bituminous carpet shall be kept 300 mm larger than the diameter of the tank.

5.5 Height of the Sand Pad Foundation shall be kept minimum 1.0 m above finish ground level.

6.0 SAND FILLING & MURRUM FILLING

Sand and murrum before filling shall be dry and shall be spread in layers of 150 mm thickness. Each layer shall be profusely watered and compacted using appropriate compaction techniques like plate vibrator or rammers so as to attain a relative density not below 90 to 95% of maximum laboratory density, up to the satisfaction of Site Engineer. The Relative density of a particular type of sand shall be predetermined in the laboratory by adopting methods given in IS- 2720 (part XIV).

7.0 BITUMEN CARPET

7.1 Sand or stone grit of fineness modulus 3.5 (max) or stone grit (6 mm down size) heated to 130□C shall be thoroughly mixed with bitumen VG 10 grade heated to the required temperature. The proportion of the mix shall be 100 KG of bitumen per cum. of sand or stone grit

7.2 Before laying the carpet any unevenness in the sand pad surface shall be made good and it shall be ensured that the surface is free from moisture.

7.3 The surface shall be lightly rolled to obtain a smooth surface and properly graded as per standard drawing.

7.4 Surface of the carpet shall be blinded by applying a 5 mm thick seal coat of hot bitumen and immediately spreading coarse sand uniformly.

7.5 The completed carpet shall conform to the profile given in drawing for sand pad foundation. No point on carpet shall be off from the specified level by more than 10

mm.

7.6 Levels shall be jointly recorded for:

- The sub-grade.
- Final consolidated surface before carpeting.
- Finished carpet surface.

These levels shall be the basis for computation of quantities of excavation, filling etc.

8.0 OTHER REQUIREMENTS

8.1 All materials required for the work shall be supplied by the contractor after being approved by the Site Engineer.

8.2 Drawing for sand pad foundation shows a central sump but the foundation shall be constructed complete without the sump.

8.3 Heating of bitumen shall be done only in area permitted as safe for open fire. The contractor shall obtain necessary permits from local authorities if heating has to be done outside premises.

9.0 DETAILS FOR CONSTRUCTION OF SAND PAD FOUNDATION

9.1 Sand Fill

Clean medium to coarse river sand layer, as per drawing, compacted using a vibrating plate in layers of 150 mm compacted thickness to at least 90-95% density index (relative density). A dozer may also be used for compaction. Each 150 mm thick layer may be watered first, before compaction. The density achieved in each compacted sand layer shall be monitored at the rate of 2 tests in each layer.

9.2 Crushed Stone Ring

9.2.1 Well graded hard broken stone, 80 mm and down size, well compacted, with

voids filled with clean river sand. This is to be done in three layers of about 300 mm thickness each. After placing the first layer of 300 mm thickness, place clean river sand, 50 mm thickness on top of the broken stone layer and it shall be copiously watered with a nozzle/ water jet in order to force the river sand into the void spaces of the broken stone. When all the sand goes into the voids of the broken stone, one more layer of clean river sand shall be placed again and copiously watered to force it into the voids of the broken. The process shall be repeated until no more sand and water get into the void space of the broken stone. At this stage, a thin sheet of water will stand on the layer.

9.2.2 The density achieved in each broken stone ring layer shall be monitored (using balloon method or any other suitable method), at the rate of at least two tests in each layer, to ensure that a density of at least 2.15 t/m3 is achieved.

9.2.3 The broken stone used in the ring layer mentioned above shall be well graded hard broken stone conforming to the following gradation (reproduced from IS: 383 - 1970 Table-2)

IS Sieve Designation	% age Passing
80 mm	100%
63 mm	85-100%
40 mm	0-30%
20 mm	0-5%
10 mm	0-5%

9.3 Anti-corrosive Layer

75 mm thick compacted layer using Sand or stone grit of fineness modulus 3.5 (max) in hot asphalt grade VG10, 8 to 10% by volume and rolled and compacted.

9.4 40mm Thick Concrete in CM 1:2:4

40 mm thick CC: 1:2:4. Expansion joints at 4 m c/c shall also be provided as part of construction. The expansion joints shall be filled suitably with polysulphide material as per manufacturer's specification.

9.5 Sieved Clean Sand

Sieved clean river sand, free from sharp objects such as broken shells, pebbles, stone pieces etc; Thickness of the second layer is 50 mm above and 50 mm below the LDPE film.

9.6 Black LDPE Film

Black Low Density Polyethylene (LDPE) film, 4000 gauge (1mm thick), as per IS: 2508-1984. Joints in the film shall be heat-sealed in-situ during laying of the film, using a 3-sealer iron and checked carefully.

The film shall be laid at a slope (towards the periphery of the tank pad) of at least 1 in 500 to effectively drain leaked product, if any, away from the pad. The film shall be anchored at the periphery of the tank pad, as shown in the sketch.

9.7 PVC Drain Pipe

PVC Sch 40-pipe of wall thickness 3.38 mm (0.133") as drain pipe, 25 mm inner diameter, perforated in the under-tank area, as per guide lines given in API Standard 650, Appendix - I. The outer end of the pipe may project 150 mm beyond the pad and covered with a nylon or Netlon mesh to prevent entry of insects and rodents. The maximum spacing of the pipes shall be 15 m centre to centre along the periphery. Minimum of four pipes to be provided.

9.8 Filter - 1

12 mm and down size stone chips layer of 300 mm horizontal thickness.

9.9 Filter - 2

40 mm and down size stone chips layer of 300 mm horizontal thickness.

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PREAMBLE TO SCHEDULE OF RATES FOR CIVIL WORK FOR TANK FOUNDATIONS

1. GENERAL

1.01 The plans have been evolved tentatively based on information available with Owner / Consultant but the dimensions and details etc. are liable to changes. The Tenderers shall not be entitled to claim any higher rate or compensation on this account. The tender drawings are intended mainly to give an indication of the probable type of construction. The successful Tenderers will, however, be required to execute the work as per detailed approved drawings issued to them from time to time. Steel structures can be changed to R.C.C. or vice versa. Owner reserves the right to add / delete any of the building works mentioned in the N.I.T., during the currency of the contract.

1.02 The Tenderers shall note that the quantities of the different Items, as given in the "Schedule of Rates" are tentative based on tentative tender drawings and are subject to variation and they shall not be entitled to claim any higher rate or compensation on this account. Owner / Consultant reserves the right to change / modify the size and type of sections at any time. Owner / Consultant does not guarantee work under each item of the Schedule of Quantities. The total quantum of work may vary up to 25% on either side and nothing extra will be paid on this account. Quantum of individual item may vary to any extent.

1.03 The Tenderers shall be fully responsible for the correct setting out and execution of the work in accordance with approved drawings which will be supplied to them progressively. All tools, tackles, construction equipments etc., required for the successful execution / construction of the complete work, shall be responsibility of the Tenderers.

1.04 The quantities given in the "Schedule of Rates" are approximate and are given only for the guidance for quoting rates. Payments on bills shall, however, be made on actual measurements of quantities of work done as per approved drawings. Unless otherwise specified, measurements of quantities shall be taken as per Indian Standards IS: 1200.

1.05 The rates to be inserted in the "Schedule of Rates" are to be inclusive of the value of the work described under several items including all costs and expenses which may be required for the construction of the work described together with all taxes, general risks, liabilities and obligations such as temporary buildings / hutments, fencing, watching, lighting, insurance, labour regulations, indemnity, maintenance and the like. The prices shall be inclusive of all labours, materials,

tools, plants, equipment, hoists, tackles, scaffoldings, the sundries, etc., as may be necessary for the completion of the work in all respects.

1.06 No work shall be undertaken at site until detailed approved drawings have been issued by the Owner / Consultant in writing. Subsequent revision in the drawings which become necessary shall be incorporated and revised drawings issued to the Contractor who shall execute the work as per the latest revised drawings. Nothing extra will be paid on this account and no claim whatsoever will be entertained on this account. The Owner / Consultant reserves to themselves the right to modify / revise / alter etc. in any drawing supplied to the Contractor.

1.07 Any fabrication / construction done before final approval of the drawings shall be the Contractor's responsibility.

1.08 In case of any discrepancy between the description of items given in the "Schedule of Rates" and Specifications, drawings and other documents, the decision of the Owner / Consultant in writing shall be final, binding and conclusive for the purpose of this contract.

1.09 The term "Design and drawings" mentioned in the description of Items in the "Schedule of Rates" means the detailed approved design drawings marked "Good for Construction".

1.10 The work "As described", "As shown", "As directed" or "As approved", "As mentioned" in the description of Items shall mean as directed in design or detailed drawings and as directed by the Engineer-in-Charge.

1.11 The Owner shall furnish the Contractor with only reference points of the job site and a level bench mark, and the Contractor shall at his own cost and initiative, set out the works to the satisfaction of the Engineer-in-Charge but shall solely be responsible for the accuracy of such setting up not withstanding satisfaction as aforesaid of the Engineer-in-Charge or any other assistance rendered by the Engineer-in-Charge for the purpose.

1.12 The Contractor shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and the like and shall take all precautions necessary to prevent their removal or disturbance, and shall be responsible for the consequence of such removal or disturbance and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all survey marks, boundary marks, distance marks and centre line marks, whether existing or supplied / fixed by the Contractor.

1.13 Before commencing the work, the Contractor shall at his own cost and initiative provide all necessary references, level posts, pegs, bamboos, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme for fixing bench marks acceptable to the Engineer-in-Charge. The centre of

longitudinal or face line and cross line shall be marked by means of small masonry pillars. Each pillar shall have distinct mark at the center to enable a theodolite/ Total Station to be set over it. No work shall be started until all these points are approved by the Engineer-in-Charge in writing.

But such approval shall not relieve the Contractor of any of his responsibilities in respect of the adequacy or accuracy, thereof. The Contractor shall also provide all labour, material and other facilities necessary for the proper checking of layout and inspection of the points during construction.

1.14 Pillars bearing geodetic marks located at the site / unit of works under construction should be protected and fenced by the Contractor.

1.15 On completion of works, the Contractor must submit to the Engineer-in-Charge the geodetic documents according to which the work was carried out.

1.16 The Contractor shall be exclusively responsible for the provision and maintenance of horizontal and vertical alignments and levels and for the correctness of every part of the work in accordance there with and shall at his own cost rectify any errors or imperfections therein.

1.17 The Contractor shall at all times during the progress and continuance of the works be responsible for and effectively maintain and uphold in good, substantial, sound and perfect condition of all / and every part of works and shall make good from time to time and at all times as often as the Engineer-in-Charge shall require any damage or defect that may during the above period arise in or be any way connected with works.

1.18 The portion which is under HOLD shown in the approved drawing or the portion which would be brought under HOLD during execution on account of coordinating different activities of other working agencies shall be taken up by the Contractor to execution only after the said HOLD is withdrawn. The Contractor on this account shall not be entitled to claim for any compensation.

1.19 The Contractor shall maintain adequate drainage facilities at the work site at all times during the execution of the work.

1.20 No compensation shall be made by the Owner / Consultant for any damage done by rain or traffic during the execution of the work.

1.21 The Contractor shall afford all reasonable facilities such as scaffolding etc., and cooperation to the various other agencies and Contractors, for services not included in this contract, who may be working on the site simultaneously so that entire work can proceed smooothly and simultaneously to a successful completion. The Tenderer must take all the aforesaid factors into consideration while quoting his rates. Nothing extra shall be paid on any ground out of or relating to the aforesaid factors.

1.22 For details of works, materials and workmanship, attention is invited to the "Schedule of Rates", Scope Drawings, Special Conditions of Contract, Materials and Job Specifications, this section, etc. and the Tenderers must quote the rates keeping in full view the requirement of the said documents.

1.23 Except otherwise clearly stated, CPWD Specifications with Correction Slips (latest) shall be followed in all Civil, Structural and other allied Works and in absence of CPWD Specifications for any work, relevant Indian Standard codes of practices (latest) shall be followed. Where there are no Specifications available for any work either in CPWD Specifications or in IS Codes of practices, the work shall be carried out as per the direction of Engineer-in-Charge.

1.24 The following notations have been used throughout the "Schedule of Rates" and Materials and job Specifications:

1.	Cu.M	Cubic Metre
2.	Sq.M	Square Metre
3.	m.	Metre
4.	mm	Millimeter
5.	Cm. / Cms.	Centimeter / Centimeters
6.	No. / Nos.	Number / Numbers
7.	Tonne / Te.	Metric Tonne
8.	Kg.	Kilogram
9.	RCC	Reinforced Cement Concrete
10.	PCC	Plain Cement Concrete

1.25 The quoted rates shall be applicable for all heights, depths etc. except otherwise clearly stated in the description of items and nothing extra shall be paid to the contractor on this account.

1.26 Description of items and mode of measurement for payment indicated herein shall override those given elsewhere if these are at variance.

1.27 Any materials / accessories / fittings etc. which may not be specifically mentioned in the description of items but which are normally used or necessary are to be provided by the contractor without any extra cost to Owner / Consultant and the work must be completed in all respects.

2.00 DEFINITION OF PLINTH

2.01 The portion of a structure between the surface of the finished ground and the surface of the floor immediately above the ground will be considered as plinth, which is generally 300 mm to 500 mm above finished ground level of the site area.

2.02 EL. 100.000 M / 0.0 M or as shown in the drawing shall be treated as plinth level for the purpose of payment.

3.00 MATERIALS

3.01 The supply / procurement of all materials, required for the job, shall be the responsibility of the Contractor unless otherwise stated in the "Schedule of Rates" and elsewhere in the tender documents. The quality of the materials procured by the Contractor shall be subject to the approval of Engineer-in-Charge or his authorized representative before the materials are allowed to be used in the works. All the materials to be procured by the Contractor shall be in conformity with the CPWD Specifications with correction slips (latest) and in absence of which as laid down in the relevant Indian Standard Codes of practices (latest).

3.02 Transport of all materials shall be the Contractor's responsibility and it shall be at their own risk and cost.

3.03 The Engineer-in-Charge shall determine the suitability of materials to be used on the job and the Contractor shall get all materials approved by the Engineer-in-Charge. Any material procured and brought to site by the Contractor, found not to conform to the specifications and does not meet the approval of the Engineer-in-Charge, for use, will be rejected, and the Contractor shall remove and dispose off the same at his own cost and he shall not have any claim for compensation in this regard.

4.00 TESTS

4.01 According to the nature and importance of works, Owner / Consultant will demand the conduct of tests on concrete and other building materials etc., in which case the Contractor shall get the same done at his own cost in a laboratory to be approved by the Owner / Consultant.

4.02 Providing and operating necessary measurements and testing devices, materials and consumables are included in the scope of work and the rates quoted shall be deemed to include the cost of such tests which are required to ensure achievement of specified quality of work.

5.00 EXECUTION OF WORK

5.01 EARTH WORK

a. The prices for all excavations shall include for removing and clearing away all shrubs, bushes, roots etc.

b. The prices for all excavations shall also include for all leveling and ramming foundation beds, trimming of sides and bottom, grading to proper level as required.

c. Removal and carrying shall include for all loading, unloading and handling as may be necessary and also all necessary means of transport (Mechanical or animal or manual) as required.

d. The prices are also to include removal of water caused by rain, seepage, spring due to water table or any other cause, either by pumping or by bailing, that may accumulate in the trenches, foundations, pits, etc. It is likely that the subsoil water may encounter during excavation. The Contractor shall be responsible to remove all water accumulated in trenches, foundations, pits, etc. due to subsoil seepage, rainwater or from any other sources. For the above reasons, if the Contractor is required to install some special type of dewatering system, the same shall be arranged by the Contractor at his own cost and nothing extra shall be payable. The Contractor shall be fully responsible for removal of all water from the working area including necessary shoring and strutting, etc., wherever required, in order to maintain safe working condition and good engineering practice at his own cost and nothing extra shall be paid on this account.

e. Where excavations are made in excess of the depth required the Contractor shall, at his own expenses, fill up to the desired level with lean concrete of nominal mix. 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size).

f. In case of hard / dense soil, the last 150 mm depth of such depth specified in the drawing or decided by the Owner shall be excavated just prior to the laying of plain cement concrete bed.

g. In case surplus excavated materials are to be disposed off at different leads as per items in the "Schedule of Rates" the distance for such disposal shall be measured over the shortest practicable route as decided by Engineer-in-Charge and not necessarily the route actually taken by the Contractor for disposal. For the purpose of measurement of lead, the area excavated shall be divided into blocks (mutually agreed) and for each block the distance from center of the block to center of disposed material pertaining to this block shall be taken.

h. For payment of Earthwork in foundations / pits / trenches, etc., the excavation in earthwork volume shall be calculated by multiplying the base area as per the dimensions of mat (lean) concrete indicated in the drawing for different foundations by the specified depth of excavation considering vertical cut up to the bottom of mat concrete level from ground level. Extra excavation carried out by the Contractor with sloping sides or with larger base area or with extra deepening of trenches / pits / foundations, etc. for working convenience shall not be measured and paid for.

   The payment for back filling and disposal of surplus excavated material shall also be made on the same basis as that for excavation. Therefore excavation, back filling and disposal of surplus earth resulting from the excavation over the

mat concrete dimensions and for the depth beyond bottom level of mat concrete as indicated in the drawings shall not be paid for. However, for the cases where waterproofing / acid proofing is indicated as per drawings on outer sides, the mode of measurement shall be as per IS: 1200.

i. Nothing extra shall be paid for sorting / screening of the excavated materials to obtain good earth for filling.

j. Nothing extra shall be paid on account of any lift for disposal of excavated materials.

k. Proper precautions shall be taken during the excavations to prevent any damage to the existing structures, pipes, sewer lines etc. If such damage occurs, it shall be rectified by the Contractor at his own expense.

5.02 PLAIN AND REINFORCED CEMENT CONCRETE WORKS

a. The prices for concrete beds and slabs are to include for laying on any type of subgrade, laying to falls or camber and for preparing surface to receive concrete.

b. All concrete surfaces shall be finished to a fair face to give smooth and even surfaces and nothing extra shall be paid on this account.

c. The prices are to include leaving pockets, cutouts and holes and to provide wooden boxes or any other suitable arrangement in R.C.C for providing pockets for bolts as per approved working drawings and nothing extra shall be paid on this account.

d. All pockets / holes are to be properly covered by suitable means, so that dirt, rain water etc., should not enter the pockets / holes etc. No deduction in R.C.C quantity shall be made for pockets and nothing extra shall be paid for providing pockets as mentioned in para 5.02c above.

e. For measurement of openings in plain concrete / R.C.C work, refer clause No. 4.13 of IS: 1200 (Part-3).

f. Threads of bolts etc., which have already been fixed in the pockets, are to be greased and properly covered with gunny bags or polythene sheet to protect it from damage from all sources and nothing extra shall be paid on this account.

g. The prices shall include for all rebating, throating, chamfering, weathering, moulding etc. to accord with the details shown in the approved working drawings.

h. Nothing extra shall be paid for any intricate work for foundation of equipments and machinery (Static / Dynamic) in R.C.C walls and other superstructure work or in concreting in small and thin sections in P.C.C or R.C.C work.

i. The prices for concrete are to include for hoisting and / or lowering to any heights and / or depth required and in any type of form work, packing around

reinforcement wherever required and finishing the surfaces to fair and even surfaces.

j. The prices shall include for working up or hacking of concrete surface for providing keys for further concrete work and shall also include all plane, rebated or grooved construction and other joints.

k. All reinforced cement concrete used shall be of controlled concrete with designed mix and weigh batched conforming to IS : 456 unless otherwise specified. In all concrete and R.C.C work, graded coarse aggregate shall be used. The design mixes of concrete of different grades shall be established at the beginning of the work considering the required workability. However, if batching plant facility is not available, only nominal mix concrete is permissible.

l. Concrete admixtures for workability, if necessary, may be used in R.C.C., if decided by the Engineer-in-Charge. No extra payment for material or mixing etc. shall be made on this account.

m. Machine and equipment foundations shall mean all foundations including pedestals of vessels, towers, pumps, compressors, motors or any other equipment or machinery (both static and dynamic), pipe supports etc., and / or the like.

n. The prices shall include applying cement slurry on reinforced cement concrete surfaces, keys of construction joints etc. @ 2.75 Kg/Sq.m of surface area of receiving cement concrete including roughening and proper cleaning etc., complete as directed by Engineer-in-Charge.

o. The prices shall include for performing water tightness for all water retaining R.C.C structure as stipulated in IS: 3370 (Part-I), wherever specified in the drawing.

p. Cement to be used for plain & reinforced cement concrete and other works shall be of Ordinary Portland Cement conforming to IS : 269 unless otherwise stated in the "Schedule of Rates" and elsewhere in this Section of NIT.

q. Any concrete having honeycomb is not acceptable and shall be rejected and redone at contractor's cost.

5.03 REINFORCEMENT AND EMBEDMENTS

a. Wastage in cutting will not be paid for. Steel actually fixed in position only will be paid by the linear measurement including hooks and laps. Lapping of bars will be allowed only where the required bar length exceeds the standard lengths available. All other laps provided, unless otherwise specified in the drawings, shall not be measured and paid for. Weight of binding wire shall not be measured for payment.

b. Bars shall be issued in lengths and in forms as available in the stores. Nothing extra shall be paid for decoiling and straightening of the bars.
c. Reinforcement are to be tack welded in addition to binding by 18 S.W.G annealed wire wherever necessary to improve efficiency of the joint. Bars of 28 mm diameter and above shall be provided with stitch weld in addition to binding with 18 SWG annealed wire and nothing extra shall be paid for stitch welding. Welding of mild steel plain and deformed reinforcements shall conform to IS: 2751, 'Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction'.
d. The Contractor shall prepare the bar bending schedule for all reinforced cement concrete work as per the approved / "good for construction" drawings furnished by the Owner / Consultant and nothing extra shall be paid on this account.

5.04 SHUTTERING

a. The prices for shuttering shall include for providing splayed edges, notching, chamfering, allowances for overlaps and passing at angles, battens, strutting bolting, wedging, easing, striking and removing.
b. The concrete work should have ply wood / steel shuttering as not to require any plastering, after striking out the shuttering. Any concrete having honeycomb is not acceptable and is liable to be rejected and redone at Contractor's cost.
c. The prices are also to include for all necessary supports, struts, braces, etc., dressing with shuttering compound and / or other approved method to prevent adhesion between concrete and form work and all raking for circular cutting and waste.
d. The prices shall also include for all labour and materials necessary for providing form work at all heights and depths and including striking, dismantling the form work assembly etc. after the necessary stripping period of concreting is over and also making all the joints in shuttering fully leak-proof providing low density polythene sheets / bitumen paper.
e. The prices shall also include for forming detailed design required for the form work and / or all other sundry labour.
f. All shuttering shall be either plywood or steel shuttering to produce plain, smooth and even surfaces, which will thus be integrally finished. If any impressions of the shuttering joints are noticed after the striking of the shuttering, the same should be treated by rubbing with Carborundum stones and nothing extra shall be paid on this account.

g. In case of dowel bars projecting out from R.C.C works such as columns, beams etc. nothing extra shall be paid for any special provision like making holes that may be required to be left in the form work.

5.05 MASONRY WORKS

The prices for brick work shall include the following:

a. Fair face of brick work with selected brick with class designation 75 or as specified in the description of relevant Items in the "Schedule of Rates" from the lot.
b. Raking out joints for plastering and pointing done as separate process of finishing joints, flush as the work proceeds.
c. All rough and / or fair cutting and waste unless specifically stated otherwise.
d. Plumbing to angles.
e. Providing holes left or formed for fixing pipes etc.
f. Forming reveals to the jambs, where fair cutting on exposed face is not involved.
g. All masonry work shall be done using mortar with coarse sand.

5.06 STRUCTURAL STEEL WORK

a. The weight of structural steel work for the sake of payment shall be calculated by linear measurements and unit weight taken from the relevant IS codes based on approved fabrication drawings assuming all members to be cut square without making any deduction for bolts, bevel ends or edges, beveling of plates. Gusset plates shall be paid for minimum rectangle enveloping their actual periphery.
b. Welds, black-bolts, high tensile bolts, nuts, plain and tapered washers etc. shall not be measured and paid for. Rate for the structural steel work shall be deemed to include the same. Nothing extra shall be paid on this account.
c. Nothing extra shall be paid over the unit rates for structural members to be built up by butt or fillet welding as indicated in the approved fabrication drawings or as per the instruction of Engineer-in-Charge, from either:
    i. Plates.
    ii. Two or more rolled steel sections.
    iii. One or more rolled steel sections and plates.
d. Nothing extra shall be paid over the unit rates for sealing the joints of box sections made out of channels or joists by continuous butt welding.
e. All paints and primers specified in various Items in the "Schedule of Rates" shall be best quality of approved brand and manufacturer such as M/s. Asian Paints, M/s. Berger Paints (India) Ltd., M/s. Johnson & Nicholson and / or other equivalent paint approved by the Engineer-in-Charge.

f. On box / compound sections, the painting shall be done before fabrication on all those surfaces which become inaccessible after fabrication.

g. Prior approval of the Engineer-in-Charge shall have to be obtained for changing the sections due to non-availability of certain sections and using built-up sections / compound sections and nothing extra shall be paid on this account.

h. The word "Fabrication" wherever used for the description of work herein shall include:
Straightening, cutting, notching, beveling, drilling or cutting holes, necessary welding, fastening, etc. to prepare the structural member as per fabrication drawings.

I. The word "Erection" wherever used for description of work shall include:
Hoisting, putting in position at all required heights, aligning and fixing with necessary welding, bolting and / or other fasteners, as per approved drawings and technical specifications with all safety standards.

j. Preparation of "AS-BUILT" construction drawings incorporating all approved changes at site shall be in Contractor's scope of work and it shall be considered included in relevant Items of the "Schedule of Rates".

k. For sand blasting / painting by the specialized agency other than indicated in the NIT, if proposed by the Contractor, the same shall be got approved from the Engineer-in-Charge at site.

l. The Contractor shall prepare design of joints and detailed fabrication and erection drawings in sequence of erection on the basis of detailed design drawings supplied by the Owner / Consultant from time to time. Nothing shall be paid extra on this account. The above fabrication drawings must show clearly all shop and site joints and connection with erection marks on each loose parts.

m. The Contractor shall submit his design calculations for the design of joints. All joints shall be designed for full strength of the members or otherwise as indicated in the design drawings.

n. The design calculations of joints and fabrication drawings will be checked and approved by the Owner / Consultant as per mutually agreed time schedule and the Contractor should strictly adhere to these approved drawings and specifications. Fabrication work shall be taken up only with the approved fabrication drawings.

5.07 FINISHING WORKS

a. The prices shall include for work at any height / depth and for all necessary scaffolding etc. as required.

b. The prices shall include for providing and laying of materials for all the Items of plaster and also raking to form key for plaster and for all work in narrow width, formed angles, chamfered external angles and for making good the faces.

5.08 MISCELLANEOUS

a. The Contractor may have to splice shorter length of structural steel members to obtain required length at site. If extra pieces of materials are required for splicing (say for lap jointing) then the same will be measured and paid for in the relevant structural steel items and nothing extra on any other account shall be paid to the Contractor for such splicing.

b. The Contractor should note that steel wedges, packing plates, shim plates, etc. used by them for leveling and alignment of structural members are to be considered erection devices and these should be taken out after proper alignment is over to the satisfaction of Engineer-in-Charge. Such erection devices shall neither be measured nor paid for.

SPECIFICATION FOR QUALITY ASSURANCE SYSTEM REQUIREMENTS FROM CONTRACTOR

1.0 INTRODUCTION

This specification establishes the quality assurance requirements to be met by contractors and vendors.

In case of any conflict between this specification and other provisions of the Contract/Purchase

Order, the same shall be brought to the notice of DAFFFPL, at the stage of bidding and shall be resolved with DAFFFPL, prior to the placement of order.

2.0 DEFINITION

2.1 BIDDER

For the purpose of this specification, the word "Bidder" means the person(s), firm, company or organization who is under the process of being contracted by DAFFFPL for delivery of some products (including service). The word is considered synonymous to supplier, contractor or vendor.

2.2 CORRECTION

Action is to be taken to eliminate the detected non-conformity.

Refers to repair, rework or adjustment and relates to the disposition of an existing non-conformity

2.3 CORRECTIVE ACTION

Action is to be taken to eliminate the causes of an existing non-conformity, defect or other undesirable situation in order to prevent recurrence.

2.4 PREVENTIVE ACTION

Action taken to eliminate the causes of potential nonconformity, defect or other undesirable situation in order to prevent occurrence

2.5 PROCESS

Set of inter-related resources and activities which transform inputs into outputs.

2.6 SPECIAL PROCESS

Processes requiring pre-qualification of their process capability.

3.0 SCOPE OF WORK BY CONTRACTOR

3.1 PRIOR TO AWARD OF CONTRACT

3.1.1 The bidder shall understand scope of work, drawings, specifications and standards etc., attached to the tender/enquiry document, before he makes an offer.

3.1.2 The bidder shall submit milestone chart showing the time required for each milestone activities along with over all time period required to complete the entire scope of work.

3.1.3 The bidder shall develop and submit manpower and resource deployment chart.

3.1.4 The bidder shall submit, along with bid, a manual or equivalent document describing/indicating/addressing various control /check points for the purpose of quality assurance and the responsibilities of various functions responsible for quality assurance.

3.2 AFTER THE AWARD OF CONTRACT

The bidder shall submit the schedule for submission of following documents in the kick-off meeting or within two week of the placement of order, whichever is earlier.

- Quality plan for all activities, required to be done by the bidder, to accomplish offered scope of work

- Inspection and test plans, covering various control aspects.
- Job procedures as required by DAFFFPL

Various documents submitted by the bidder shall be finalized in consultation with DAFFFPL. Here it shall be presumed that once a bidder has made an offer, he has understood the requirements given in this specification and agrees to comply with them in totality unless otherwise categorically so indicated during pre-award stage through agreed deviation/exception request. All quality assurance documents shall be

reviewed by concerned DAFFFPL functional groups and the bidder shall be required to incorporate all comments within the framework of this specification at this stage of the contract. It is also obligatory on the bidder that he obtains approval on every quality assurance document, before he starts using a particular document for delivery of contracted scope of work. Participation of DAFFFPL in review /approval of quality plan/QA documents does not absolve the contractor of the contractual obligations towards specified and intended use of the product (or service) provided by him under the contract.

3.3 DURING JOB EXECUTION

3.3.1 During job execution, the bidder shall fully comply with all quality documents submitted and finalized/agreed against the requirements of this specification. Approval of DAFFFPL on all these documents shall be sought before start of work.

3.3.2 Bidder shall produce sufficient quality records on controlled/agreed forms such that requirements given in this specification are objectively demonstrable.

3.3. Bidder shall facilitate DAFFFPL/ during quality/technical audits at his work/sites.

3.3.4 Bidder shall discharge all responsibilities towards enforcement of this specification on all his sub-contractors for any part of the scope which is sub-contracted.

4.0 QUALITY ASSURANCE SYSTEM REQUIREMENTS

4.1.1 The bidder shall nominate an overall in-charge of the contract titled as “Project Manager” for the scope work of agreed contract. The project manager of the bidder shall be responsible for co-ordination and management of activities with bidder’s organization and all sub-vendors appointed by the bidder.

4.1.2 After award of work the bidder may review augmentation of manpower and resources deployment charts (submitted earlier), detail it out, if so consented by DAFFFPL and resubmit the same as “Issued for implementation”

4.2 The bidder shall plan the contract scope of work on quality plan format such that that no major variation is expected during delivery of contract scope of work. This quality plan shall be assumed to be detailing bidder’s understanding and planning for the contract /offered scope of work. The bidder shall plan the type of resources including

various work methodology which he agrees to utilize for delivery of contact scope of work.

4.3 The bidder is required to review the contract at all appropriate stages to evaluate his capabilities with respect to timely and quality completion of all activities pertaining to contracted scope of work and shall report to DAFFFPL of constraints, if any.

4.4 The design activities, if any, performed during delivery of contract scope of work shall be so controlled that the output is reliable enough. It is expected that during development of design, the bidder shall take resource to detailed checking, inter departmental reviews and documented verification methods.

4.5 For all documents which the bidder is likely to utilize for delivery of contract scope of work, a system must exist which assure that latest/required version(s) of the document(s) is available at all location/point of use.

4.6 In case the bidder decides to sub-contract any part/full of the contract scope of work (without prejudice to main contract condition), the bidder shall:

- Evaluate the technical and financial capabilities and past performance of the sub contractor(s) and their product and/or services before awarding them with the sub-contracted scope of work. Selection of a sub-contractor should meet DAFFFPL/ approval in documented form.
- Requirement of this specification shall be enforced on sub-contracted agency also. The bidder shall choose sub-contractor based on their capability to meet requirements of this specification also.

NOTE
It may so happen that, in a given situation, a sub-contractor may not have a system meeting the requirements of this specification. In all such eventualities, bidder may lend his system to sub-contractor for the contract such that sub-contractor effectively meets the requirements of this specification. In all such cases DAFFFPL/ shall be duly informed.

4.7 Bidder shall establish adequate methodology such that materials supplied by the Owner/ shall be adequately preserved, handled and made use of for the purpose for which they are provided.

4.8 All output delivered against contract scope work shall be suitably identified in such a manner that either through identification or some other means, sufficient traceability is maintained which permits effective resolution of any problem reported in the outputs.

4.9 Critical activities shall be identified and the bidder is required to have documented methodologies which he is going to utilized for carrying out such activities under the contract scope of work. Wherever it is difficult to fully inspect or verify the output for special process, bidder shall prequalify the performers and methodologies.

4.10 All inspections carried out by the bidder's surveillance/inspection staff shall be in conformity to qualify plans and /or inspection and test plans. All inspection results shall be duly documented on controlled/agreed forms such that results can be co-related to specific product that was inspected/ tested.

4.11 All inspection, measuring and test equipments (IMTEs) shall be duly calibrated as per National/International standards/codes and only, calibrated and certified IMTEs shall be utilized for delivery of contract scope of work.

4.12 All out puts or products delivered against contract scope of work shall be duly marked such that their inspection status is clearly evident during all stages/period of contract.

4.13 All non-conformities (NCs) found by the contractor's inspection/surveillance staff shall be duly recorded, including their disposal action. The deficiencies observed during stage of the product shall be recorded and resolved suitably. Effective corrective and preventive action shall be implemented by the bidder for all repetitive NCs, including deficiencies.

4.14 All deficiencies noticed by DAFFFPL TPIA representative(s) shall be recorded on a controlled form. Such deficiencies shall be analyzed by a bidder and effective and appropriate correction, corrective and preventive action shall be implemented. Bidder shall intimate DAFFFPL/ TPIA of all such corrective and preventive action implemented by him.

4.15 Bidder shall establish appropriate methodologies for safe and effective handling, storage, preservation of various materials/inputs encountered during delivery of contract scope of work.

4.16 Bidder shall prepare sufficient records for various processes carried out by him for delivery of contract scope of work such that requirements of this specification are objectively demonstrable. In case DAFFFPL/ TPIA finds that enough objective evidence/recording is not available for any particular process, bidder shall be obliged to make additional records so as to provide sufficient objective evidence. The decision of DAFFFPL/ TPIA shall be final and binding on such issues.

4.17 The bidder shall arrange internal quality audits at quarterly intervals, to independently assess the conformance by various performers to the requirements of this specification. The findings of such assessment shall be duly recorded and a copy shall be sent to DAFFFPL/ for review.

4.18 For all special processes, bidder shall deploy only qualified performers. Wherever DAFFFPL/ observes any deficiency, the bidder shall arrange the adequate training to the performer(s) before any further delivery of work.

NOTE:

i) The Bidder ensures that the filled up Format conforms to minimum requirements on Quality Plan / Quality Assurance, specified by Consultant on Drawings / standards / specifications / write-ups.

ii) The Bidder confirms that document is issued for information / approval of DAFFFPL or for implementation.

Format For Quality Plan

<table>
<tr><td colspan="2">Job No. and description : No.:

Issued to : Date :</td></tr>
<tr><td colspan="2">Location of work :

Name of work :</td></tr>
<tr><td>Details of Observations(Deficiency)</td><td>Recommended Course of Action</td></tr>
<tr><td rowspan="2"></td><td></td></tr>
<tr><td>Time Allowed for Correction :</td></tr>
<tr><td colspan="2">Issued by :_____
Name and signature of Engineer</td></tr>
<tr><td colspan="2">Corrective Action taken report by contractor/vendor :

Date : Name and Signature</td></tr>
<tr><td colspan="2">Distribution(before resolution) :

Project Manager(Owner), TPIA Inspection</td></tr>
<tr><td colspan="2">Verification of resolution :

Date : Name and Signature</td></tr>
<tr><td colspan="2">Distribution after Resolution :

Project Manager(Owner), TPIA Inspection(HO,RPO)/RCM</td></tr>
</table>

Format For Observation on Quality Aspect

PO/Contract Ref.:	Audit Function	Owner's / PMC's review/		
		Audit Scope		
	Inspection Functions	Type of (Approval) Surveillance		
		Testing And Inspect		
		Sampling Plan		
Project Name :	Performing Functions	Reviewer/Approver		
		Checker		
		Performer		
Bidder's Quality Plan	General	Code of Conformanc		
		Procedure No.		
		Activity Description		

LIST OF APPROVED MAKES

S/N	ITEM	APPROVED MAKES/ VENDORS
1	CEMENT	ACC, AMBUJA, ULTRATECH, BIRLA, DALMIA, POP-CEM
2	STEEL STRUCTURALS	JSW, SAIL, SALEM STEEL, ISSCO, Vizag Steel, TISCO, Tata Steel
3	WATER PROOFING COMPOUND	FOSROC, PIDILITE, CICO, IMPERMO, ACURON, ROFF
4	DISTEMPERS/CEMENT BASED PAINTS	ASIAN, BERGER, SNOWCEM, SUPERCEM, JANATACEM, SUPER SNOWCEM,
5	REINFORCEMENT STEEL	SAIL,TATA,RATHI, KAMDHENU,AMBA,BALMUKUND
6	BITUMEN	LOCALLY AVAILABLE AND SUBJECT TO APPROVAL OF SITE ENGINEER
7	BRICKS	
8	SAND	
9	STONE, MORUM, WBM	

DATA SHEETS AND STANDARD DRAWINGS FOR CR & FR STORAGE TANKS

I. LIST OF DATA SHEETS

SR. NO.	DESCRIPTION	DOCUMENT NO.	REV.	NO. OF SHEET
1.	PROCESS DATASHEET OF fire water tanks		1	3

II. LIST OF STANDARD DRAWINGS

Sr. No.	DESCRIPTION	ENGG. STD No.	REV.	No. of Sheet
1	KEY DIMENSIONS OF WIND GIRDERS, ANNULAR PLATE AND CURB ANGLE FOR C. R. TANKS	BR/CR/130	R0	1
2	LOCATION & DIMENSIONS OF WIND GIRDERS FOR C.R. TANKS	BR/CR/146	R0	1
3	LOCATION & DIMENSIONS OF WIND GIRDERS FOR C.R. TANKS	BR/CR/149	R0	1
4	LOCATION & DIMENSIONS OF WIND GIRDERS FOR C.R. TANKS	BR/CR/151	R0	1
5	SIZING OF CURB ANGLE & ANNULAR PLATE FOR C.R. TANKS	BR/CR/156	R0	1

1.2 GENERAL ARRANGEMENT DRAWINGS OF TANKS FOR MS, HSD, SKO AND FIRE WATER

SR. NO.	DESCRIPTION	DOCUMENT NO.	REV.	NO. OF SHEET
.	G.A.DWG OF FIRE WATER TANK		1	1

1.3 CIVIL DRAWINGS

SR. NO.	DESCRIPTION	DOCUMENT NO.	REV.	NO. OF SHEET
1	RCC RINGWALL FOUNDATION DETAIL FOR TANKS		0	1

1.4 PLANT LAYOUT DRAWING

Sr. No.	Description	Drawing No.	No. of Sheet
1	LAYOUT PLAN		1

The drawings mentioned above, are to be read in conjunction with other documents and drawings for the works detailed in this document.

ABBREVIATIONS & NOTATIONS

13.12.1. UNLESS OTHERWISE SPECIFIED FOLLOWING NOTATIONS/ ABBREVIATIONS SHALL BE APPLICABLE TO DOCUMENT.

MM/mm - MILLIMETER
SQMM/sqmm/mm2 - SQUARE MILLIMETER
CM/cm - CENTIMETER
SQCM/Sqcm - SQUARE CENTIMETER
SFT/sft - SQUARE FEET
M/m/rm/RM - METRE / RUNNING METRE
SQM/sqm/m2/SM - SQUARE METRE
CUM/cum/m3 - CUBIC METRE
KG/kg - KILOGRAM
MT - METRIC TONNE
MS - MILD STEEL
DIA/dia/Φ - DIAMETER
NO (S) / Nos. / nos. - NUMBER(S)
PCC - PLAIN CEMENT CONCRETE
RCC - REINFORCED CEMENT CONCRETE
E-I-C - ENGINEER - IN - CHARGE
IS/BIS - INDIAN STANDARD
API - AMERICAN PETROLEUM INSTITUTE
JOB - JOB LUMPSUM
LS - LUMPSUM
EMD - EARNEST MONEY DEPOSIT
ISD - INITIAL SECURITY DEPOSIT
BG - BANK GUARANTEE

REPORTING & CO-ORDINATION

CONTRACTOR shall submit the following reports on regular basis for DAFFFPL information / review.

1.0 MONTHLY PROGRESS REPORT

The report shall be submitted on monthly basis within 5 calendar days from cut-off date covering overall scenario of the project.

2.0 WEEKLY PROGRESS REPORT – OVERALL

This report shall be prepared by CONTRACTOR and issued on weekly basis to / DAFFFPL at site. The report shall include the following as a minimum.

- Executive Summary
- Project highlights with dates of achievements
- Project exception (work programmed but not achieved with reasons for Non achievement) and work programmed for next week
- Critical areas
- Actions taken / to be taken for slippages
- Progress statistics

This shall cover both for CONTRACTOR's Home/Design office activities and construction activities at site.

3.0 WEEKLY PROGRESS REPORT-CONSTRUCTION

This report shall be prepared by CONTRACTOR and submitted on weekly basis within 1 Calendar day from cut-off date. The report shall cover following items, as a minimum.

- Progress statistics
- Work item wise quantity completed against programme for the week including reasons for shortfall.
- Programme for next week

- Work Front available

- Constraints, if any
- Resources deployed against planned with reasons for shortfall in resource deployed
- List of equipment/materials received at site during the week

5.0 EXPEDITING REPORT

Contractor shall submit fortnightly expediting report based on his representative's visit to vendor's work for orders where delivery of materials is critical to project completion. A list of such critical items/vendors shall be specified by OWNER/PMC during the kick-off meeting or at a later date.

In addition to the above, OWENR/PMC may request expediting report based on visit of CONTRACTOR's representative in case of orders which were though not critical at the time of order placement however become subsequently critical during project execution due to any reason.

NOTE:
This section shall be read in conjunction with "Project Planning, Scheduling, Monitoring & Control for Area Development Contract" document forming part of this bidding document.

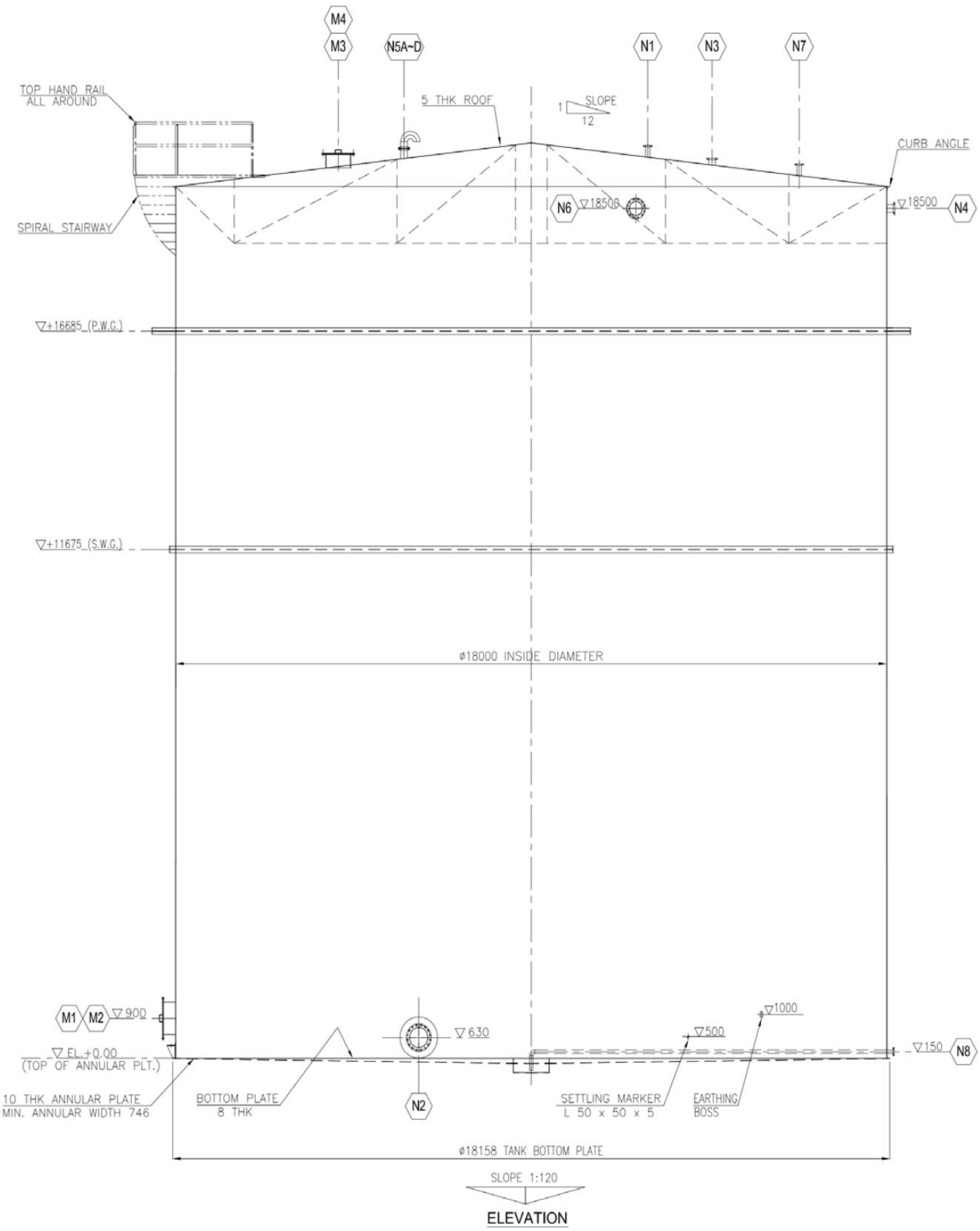
DATA SHEET AND SPECIFICATION FOR FIRE WATER STORAGE TANKS

0	31-07-2017	Issued for Approval	PVT	AAN	SJ	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

DATA SHEET
SIZE 18.0 M. DIA X 20 M. HEIGHT – 4705 KL

GENERAL	Status: • Tender ○ Order ○ As Built					
	Service		WATRE	Type of Tank		Fixed Cone Roof
	Location		DELHI AVIATION FUEL FACILITY (P) LTD.	Nominal Diameter		18.0 m
	Number of Tanks		2	Overall Height		20.0 m
	Equipment Tag Number		TK-101	Net Capacity (pump volume) m^3		4011
				Design capacity m^3		4705
PROCESS	Medium		WATER	Design Liquid Sp. gr.		1.00
	Specific Gravity		1.0	Design Liquid Level		20.0 m
	Viscosity	Cst	2.2 – 5.3 @40°C	Tank Heating / Cooling		Not Required
	Flash Point	°C	-	Nozzle Heating		Not Required
	Reid Vapour Pressure	Kg/cm2	-	Heating / Cooling Medium		Nil
	Corrosivity			Heat load (Kw/hr)		Nil
	Filling Rate	m^3/hr	100 (Assumed)	Tank Mixers		Not Required
	Emptying Rate	m^3/hr	1830	Water Draw off Sump		Yes
	Storage Temp.	°C	40	Tank Gauging		One Radar Gauge
	Storage Pressure	kPa	ATMOSPHERIC	Nitrogen Blanketing		Not Required
	Design (Vacuum) Pressure	MM WC	25	Ambient – Temp °C		45
	Design (Positive) Pressure	MM WC	FULL OF LIQUID	Atmos. Press. kPa		
	Design Temp.	°C	65	Vapour Space mm		5 %
MECHANICAL	Design & Const. Code		API 650, 11th Edition – Jun 2007 ADD-Aug 2013	Cathodic Protection		NO
	Shell Design Method		One Foot Method	Insulation Thickness (mm)		Not Applicable
	Design Wind Speed (m/sec)		33.3			Not Applicable
	Seismic Code / Zone		As per APP. E /O (Outside Seismic Zone)	Finishing & Painting	Shell:	Refer Painting Specification
	Foundation Type		Ring Beam		Roof:	Refer Painting Specification
	Corrosion Allowance mm		3.0 mm for Shell, Bottom & 1.0 mm for Roof		Bottom:	Refer Painting Specification
	Joint Efficiency		NA	Hydro test:		By Contractor
				Insulation		Not Applicable
	Tank Bottom Type		Cone down to Centre	External		
	Hand - Railing		Spiral Stairway & All around the roof	Access		Landing Platform
				Clean Out Door		NO
	Tank Roof Type		Fixed Cone	Earthing Boss		3 Nos.
	Slope	Roof	1 in 12	Lightning protection		NO
		Bottom	1 in 100	**WEIGHT**		
	Stiffening Rings		Required As per Code	Empty Weight (MT)		132.00
	Inspection & Testing	Hydro Test Level	Upto Full Level	Operating Weight (MT)		5222
		Radiography	As per Section 8 & Fig. 8.1 of API 650	Test Weight (MT)		5222
		Stress Relieving	As per code			
*ACCESSORIES	Level Gauge		Yes	Gauge Hatch		Yes
	Spiral Stairway		Yes	Name Plate		Yes
	Hand Railing (On Roof)		Yes	Atmospheric Vent Assembly		Yes
	Earth Connection		Yes	Foam System		Yes
	Platform at Roof		Yes	Instrumentation		Yes
	Foam Pourer Platform		Yes			
	Water Sprinkler		Yes			
MATERIALS	**BOTTOM, SHELL, ROOF & REINFORCEMENT PLATE**		A 36 / IS:2062 Gr.B	STAIRWAY PLATFORM AND STRUCTURAL		IS 2062 Gr A/B
	SHELL / ROOF NOZZLE NECK UPTO 250 NB		A 106 Gr.B	HAND RAILING		IS 2062 Gr A/B
	NOZZLE FLANGES		A 105	GRATINGS		CS GALV.
	MAN HOLE NECK / FLANGE / COVER PLATE		IS 2062 Gr B	GAUGE WELL / STILL WELL / SLEEVE		A 106 Gr.B / A 53/ A 36
	BOLTING FOR NOZZLES		A 193 Gr.B7 / A 194 Gr.2H	FITTINGS		A 234 Gr.WPB
	BOLTING FOR STRUCTURES		A 193 Gr.B7 / A 194 Gr.2H	NAME PLATE / BRACKET		SS 304 / A 36
	LEG PIPE SUPT. / SLEEVE		A 106 Gr.B	EARTHING CONN.		AS PER SPECIFICATIONS
	INTERNALS		IS 2062 Gr B / A 106 Gr.B / SS304	GASKETS (PERMANENT)		SS 316 Spiral Wound Graphite Filled
	STRUCTURES AND EXTERNALS (GUSSETS)		IS 2062 Gr B	SHELL / ROOF NOZZLE NECK ABOVE 250 NB		IS 2062 Gr B
	ANCHOR BOLTS / NUTS		IS 2062 Gr.B /A 307 Gr.B / A 563 Gr.A			

* - Free vents to be designed for max.flow rate.



All dimensions are in millimeters.

* All dimension subject to confirmation by contractor

NOTE 1

NOZZLE INDEX							
MARK.	**SERVICE**	**QTY.**	**NOM. SIZE**	**SCH.**	**THK.**	**RATING/ TYPE**	**DESCRIPTION**
MH1/2	SHELL MANHOLE	2	30”	AS PER CODE			WITH COVER
N2	OUTLET	1	24”		8	150/RF	
N4	OVER FLOW	1	6”	40	7.1	150/RF	
N6	RECIRCULATION LINE	1	12”	80	17.4	150/RF	
N8	DRAIN	1	4”	80	8.0	150/RF	
MH3/4	ROOF MANHOLE WITH COVER	2	24”	AS PER CODE			
N1	INLET	1	4”	40	7.1	150/RF	
N3	LEVEL TRANSMITTER	1	8”	40	8.1	150/RF	
N5A~D	ROOF VENT	4	4”	40	7.1	150/RF	
N7	SPARE	1	4”	40	6.2	150/RF	

DATA SHEET – FIRE STORAGE TANKS

NOTES

1. All dimensions are in MM unless otherwise specified.
2. Nozzles above 2"NB shall be provided with reinforcement pads as per API-650. Reinforcing pads shall have tell tale holes OF ¼"Ø. These pads shall be air tested at 1.05 kg/cm^2 (g), with soap solution & there after filled with hard grease in line with API 650 code.
3. All bolt holes in nozzle flanges & manholes to be straddle center lines of tank & nozzle
4. All tolerances shall be as per clause 7.5 of API – 650
5. All F.P weld to be chipped back to sound metal on the second side & rewelded.
6. Three plates joints on bottom shall not be closer than 300 mm from 1) Each other & 2)Tank Shell
7. All erection lugs & cleats to be removed before hydro test.
8. Curb angle joints shall stagger with shell joints at least by 300 mm.
9. Prj. Of nozzle shall be measured from intersection of nozzle axis & outer surface of shell/roof.
10. All weld spatters & large weld beads should be removed by grinding.
11. Flange gasket surfaces shall be 125 AARH finish
12. Calibration & strapping shall be done in accordance with IS 2550 & 2555 or equivalent.
13. Nozzles 2"NB & below shall be provided with 2 stiffener flats of size 40W*8THK at 90^O apart.
14. All nozzle flanges shall be of ASME B16.5 class 150# up to 24"NB & flanges shall be on both end of nozzle flange.
15. Water to be filled up to curb angle during hydro testing of tank.
16. All sharp corners to be rounded off.
17. Nozzles above 10"NB may be fabricated from plate with 100% radiography for welded seams.
18. Wherever the weld distance on nozzle opening or R.F pad does not comply the requirement of clause no. 5.7.2 same shall be as per fig. 5.9 of API-650.
19. Painting of tank shall be as per project specification.
20. Testing requirement:
    Bottom Plate: By partial vacuum T 3-5 P.S.IG
    Shell Weld: Radiography as per API-650 Fig.8.1
    Nozzle Pad on Shell only: By air pressure at 15 P.S.IG
    Shell to Bottom: By kerosene oil & chalk method. As per API-650 Clause no. 7.2.4.3
    Tank Shell: By filling water up to curb angle
    Fixed Roof: As per API-650 Clause no. 7.3.7
21. Electrodes:- E-6013 : Plates up to 12mm thick

TECHNCIAL SPECIFICATION – PAINTING FOR PIPING

1.0 SCOPE

This specification defines the minimum requirements for surface preparation, selection and application of paints, on equipment, piping, steel structures etc. for DAFFPL Project.

2.0 PAINTING SURFACES

2.1 The following surfaces and materials shall require painting:

a) All structural steel work, walk ways, pipe structural steel supports, ladders etc.
b) All uninsulated carbon steel piping, fitting and valves (including painting of identification marks) up to 80°C.
c) Identification lettering / numbering on all painted surface of equipment / piping.
d) Hazardous content marking / identification signs on painted surfaces of equipment / piping.
e) Owner's name and / or logo on tanks in size to be informed by the Owner and carried out by a third party.

2.2 The following surfaces and materials shall not require painting:

a) Austenitic stainless steel
b) Plastic and / or plastic coated materials.
c) Painted equipment like loading, pumps, valves etc. with finishing coats in good condition and with matching color code.

3.0 INSTRUCTION TO CONTRACTOR

The paint manufacturer's instructions shall be followed as far as practicable always. Attention shall be paid to the following:

a) Proper storage to avoid exposure, as well as extremes of temperature.
b) Surface preparation prior to painting.
c) Mixing and thinning.
d) Application of paints and the recommended limit on time intervals between coats.
e) Shelf life and expiry date as printed on the container.

Any painting work (including surface preparation) on piping or equipment shall be commenced only after the system tests have been completed and clearance for taking up painting work is given by the Owner / Consultant.

4.0 PAINTING EQUIPMENT

All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipment scaffolding material, shot / sand blasting equipment and air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantity.

Mechanical mixing shall be used for all paint mixing operations except that the Owner / Consultant may allow the hand mixing of small quantities at his discretion.

5.0 PAINT MATERIAL

Manufacturers shall furnish the characteristics of all paints indicating the suitability for the required service conditions. Primer and finish coats shall be of first class quality and shall conform to the following:

6.0 TECHNICAL SPECIFICATION - NEW PAINTING

6.1 PAINTING SCHEME FOR FIRE WATER PIPELINES

ABOVE GROUND

a) Surface preparation

All piping surface to be painted shall be grit blasted to SA 2.5 finish of Swedish standard SIS 05 5900, before painting.

b) Primer coat

After surface preparation as above, external surface of the tank will be painted with one coat of Epoxy Zinc Phosphate primer paint of 30 microns per coat.

c) Finish coat

Two coats of Epoxy finished paint to be provided at 40 microns per coat. Colour to be selected for Fire water, service water as per applicable/ governing codes & standard or colour coding specification of client.

e) Pipeline Supports, walkways / cross over etc.

For structural steel, hand rails, walkways, ladder, platform etc. the surface preparation shall be undertaken grit blasted to SA 2.5 finish of Swedish standard SIS 05 5900 after surface preparation as above, these will be painted with one coat of epoxy zinc phosphate primer 30 microns per coat and two coats of coal tar epoxy 125 microns per coat.

UNDERGROUND PIPELINE

Underground pipeline shall be protected with Fusio Bonded Epoxy (FBE) coat 1.5 mm thick (nominal) as stipulated.

UNDERGROUND COATING AND WRAPPING

Buried piping shall be coated and wrapped as follows:

Surface preparation: The pipeline surface shall be free of oil or grease before the cleaning operation. The oil/grease shall be wiped with clean rags saturated in a suitable solvent. The pipe surface shall then be cleaned using sand blasting (for new pipes) to SA 2 1/2. In case of existing lines where blasting is not possible, pipe should be manually cleaned with emery or sand paper to SA2.

- Application of coal tar primer, AWWA Corrosion 203 type B fast drying and synthetic.
- Inner wrap of glass felt fiber of thickness 0.76mm conforming to AWWA C-203-86 section 2.10
- Asbestos felt outer wrap of 0.5mm thickness conforming to AWWA C203-86
- Total dried coating thickness shall not be less than 2.5 mm for single coat and shall not be less than 4.75mm for two coats.

The materials and application methods including surface preparation shall conform to AWWA/ANSI C-203-86 and recommendations of the manufacturer of the coating materials. All materials shall be from the same manufacturer. After completion of the works the thickness of coating at select locations shall be checked by a pit gauge. The quality of wrapping shall be checked by a holiday test in accordance with AWWS-203-86 using efficient high voltage holiday detectors, operating at a voltage high enough to jump an air gap, the length of which is equal to the thickness of the coating/wrapping. All holidays found shall be marked with chalk or rayon, repaired and the repairs shall be retested with holiday detector to ensure that adequate repairs have been made. The test voltage shall not exceed 15000 Volts.

7.0 INSPECTION AND TESTING

Owner shall carry out the following inspections and tests to confirm the details of the paint manufacturer.

a) All paint material brought at site
b) Painting equipment / tools
c) Surfaces preparation.
d) Each coat of primer application
e) Each coat of finish paint
f) Stage wise DFT checks.
g) Holiday detection
h) Surface profile
i) Test for curing of paint system.

Documents will be produced by the Contractor for Owner's scrutiny with regard to the sourcing of paint material.

Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Owner before proceeding further work.

Irrespective of the inspection, repair and approval of intermediate stages of work, contractor shall be responsible for making good any defects found during final inspection / guarantee period / defect liability period.

Dry film thickness (DFT) shall be checked and recorded after application of each coat.

The thickness of each coat and complete coverage should be checked as per provision of this specification. This should be approved by Owner/ Consultant before application of successive coats.

The contractor shall provide thickness measuring instrument (ELKOMETER) duly calibrated with appropriate range (s) for measuring dry film thickness of each coat.

At the discretion of Owner / Consultant the paint manufacturer must provide the expert technical services at sites as and when required. This service should be free of cost and without any obligation to the owner as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations.

Final inspection shall include measurement of paint dry film thickness check of finish and workmanship.

RESTRICTION:

Paint shall not be applied on wet surface and during rain. Climate condition as specified by the paint manufacturer shall be observed while carrying out painting job. Sufficient time shall be given for curing and drying of each coat before application of subsequent quote as per stipulation by the paint manufacturer.

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

ANNEXURE II – DEVIATION SHEET

EXCEPTION AND DEVIATIONS STATEMENT				
S.NO.	PAGE NO. OF TENDER DOCUMENT	CLAUSE NO.	SUBJECT	DEVIATIONS

Bidder shall list all the deviations in the following given format only on their Letterhead. The Deviation sheet should be submitted along with technical bid.

In case no deviation sheet is submitted along with technical bid, it would be concluded that bidder has accepted all specifications, terms and conditions.

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

ANNEXURE III – DECLARATION SHEET

Date:

DECLARATION

We, M/s hereby, unconditionally accept all terms & conditions of TENDER NO.: DAFFPL/MOD/FF/2017-18/16 (JOB: CONSTRUCTION OF WATER TANKS & ASSOCIATED PIPING WORKS) including Scope of job, quantities, completion period, terms & condition without any deviations.

Sign & Stamp of Bidder

Note: In case of deviations (whether technical or commercial) the above declaration should not be submitted and the deviations should be mentioned separately on bidders letter head with the heading "DEVIATION SHEET". In absence of "DEVIATION SHEET", it would be concluded that bidder has submitted his offer as per tender specifications, terms & conditions. Corrections in tender booklet will not be accepted.

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

ANNEXURE-IV

PROFORMA OF BANK GUARANTEE
(EARNEST MONEY DEPOSIT)
(On Non-Judicial Stamp paper for appropriate value)

BANK GUARANTEE NO. :
BANK GUARANTEE AMOUNT:
CLAIM:
(Till 120 days from date of submission of Proposal)
TENDER NO. /DATE:
JOB DESCRIPTION/
LOCATION:

Tender Security No. [*]

Name and Address of the Beneficiary: Delhi Aviation Fuel Facility (Private) Limited
Aviation Fuelling Station, Shahabad Mohammadpur, IGI Airport, New Delhi – 110 061, India

We [*name and address of the issuing bank*] have been informed that [*Name of the Interested party*] (hereinafter called the "Interested Party") is submitting a proposal for the Award of the Works in response to a Request for Proposal ("RFP") by Delhi Aviation Fuel Facility (P.) Ltd. ("DAFFPL" or 'Beneficiary") for [*Insert description of work*] ("Works"). The conditions of the RFP, which are set out in a documents entitled Request for Proposal dated [*Please insert*] require its offer to be supported by a Tender Security.

At the request of the Interested Party, we hereby irrevocably undertake to pay you without demur, the Beneficiary, any sum or sums not exceeding Rs. _____ [*Please insert*].

Upon receipt by us of your demand in writing and your written statement (in the demand) stating that:

1) The Interested Party has, without written consent of DAFFPL, withdrawn its offer after the latest time specified for its submission and before the expiry of its period of validity; or
2) The Interested Party has refused to accept the correction of errors in nits offer in accordance with the instructions to Interested parties contained in the RFP; or

_____
Sign & Stamp of Bidder

3) DAFFPL entered in to the contract with the Interested party but the Interested party has failed to deliver the **COMPOSITE BANK GUARANTEE (SECURITY DEPOSIT & PERFORMANCE**) in compliance with the Contract conditions; or

4) The Interested Party has failed to enter into the Contract within 30 (Thirty) days of being required to do so by the Tender Officer.

Any demand for payment must contain your signature(s). The demand must be received by us at this office on or before the expiry of the earliest of the following dates, when this security guarantee shall expire and shall be returned to us:

a) Date of issue of letter communicating to the Interested Party that it has not qualified for the contract or the Proposal submitted by the Interested Party is unsuccessful or the TENDER is withdrawn and/or cancelled by the Beneficiary; or

b) 7 (seven) days after the date of delivery of an acceptable performance bond complying with the Contract conditions and execution of the Contract after the award of the works to the Interested Party; or

c) 120 (One hundred twenty) days from the last date of submission of Proposal in accordance with the TENDER.

Date:

Signature:

Designation:

Name of the Branch

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

ANNEXURE-V

PROFORMA OF COMPOSITE BANK GUARANTEE (SECURITY DEPOSIT & PERFORMANCE)

(On Non-Judicial paper of Rs. 100/-value)

To,

DAFFPL

Dear Sirs,

M/s ……..have taken tender for the work ……for DAFFPL,.

The tender Conditions of Contract provide that the Contractor shall pay a sum of Rs. …….. (Rupees ……..) as security deposit & performance guarantee in the form therein mentioned. The form of payment of security deposit & performance guarantee includes guarantee executed by Scheduled Bank at New Delhi, undertaking full responsibility to indemnify DAFFPL, in case of default. The said party …….. have approached us at and their request and in consideration of the premises we …….. having our office at …….. have agreed to give such guarantees as hereinafter mentioned.

1. We ----------hereby undertake and agree with you that if default shall be made by M/s. ----------in performing any of the terms and conditions of the tender or in payment of any money payable to Daffpl. We shall on demand pay to you, without demur, protest or requiring you to seek recourse to M/s _____, in such matter as to you may direct the said amount of Rupees ---------- ----only or such portion thereof not exceeding the said sum as you may from time to time require.
2. You will have the full liberty without reference to us and without effecting this guarantee, postpones for any time or from time to time the exercise of any of the powers and rights conferred on you under the contract with the said ---------- ----------and to enforce or to forbear from endorsing any powers of rights or by reason of time being given to the said ----------which under law relating to the sureties would but for provision have the effect of releasing us.
3. Your right to recover the said sum of Rs. ---------- (Rupees ----------) from us in manner aforesaid will not be affected or suspended by reason of the fact that any

_____
Sign & Stamp of Bidder

dispute or disputes have been raised by the said M/s. ----------and/or that any dispute or disputes are pending before any officer, tribunal or court.

4. The guarantee herein contained shall not be determined or affected by the liquidation or winding up dissolution or change of constitution or insolvency of the said ----------but shall in all respect and for all purposes be binding operative units payment of all money due to you in respect of such liabilities is paid.
5. Our liability under this guarantee is restricted to Rupees ----------our guarantee shall remain in force until ----------unless a suit or action to enforce a claim under Guarantee is filed against us within six months from ----------(which is date of expiry of guarantee) all our rights under the said guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there under.
6. NOT WITHSTANDING anything hereinbefore contained our liability under this Bank Guarantee is restricted to Rupees ----------(Rupees ----------).This Bank Guarantee shall be valid up to ----------and we are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before.
7. This guarantee is to be returned to us within fifteen (15) days from the date it ceases to be in force. If the guarantee is not returned to us within the date of aforementioned it shall be automatically cancelled.
8. We have power to issue this guarantee in your favour under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney dated ----------granted to him by the Bank.

Yours faithfully

----------Bank
By its Constituted Attorney
Signature of a person duly
Authorized to sign on behalf of the bank

_____
Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

Annexure- VI

Form of Letter of Undertaking

[On the letterhead of the Interested Party]

Letter of Undertaking

Date:

Delhi Aviation Fuel Facility (Private) Limited
Aviation Fuelling Station, Shahabad Mohammadpur,
IGI Airport, New Delhi – 110 061, India

Re:
The undersigned Interested Party acknowledges that the TENDER issued is confidential and personal to the undersigned Interested Party and hereby undertakes and agrees as follows:

1. "**Confidential Information**" means the TENDER and everything contained therein, all documentation, data, particulars of the Works and technical or commercial information made by (or on behalf of) Delhi Aviation Fuel Facility (Private) Limited or obtained directly or indirectly from Delhi Aviation Fuel Facility (Private) Limited or its representatives by the undersigned Interested Party or which is generated by the undersigned Interested Party or any information or data that the undersigned Interested Party receives or has access to, as a result of the TENDER, as being confidential information of Delhi Aviation Fuel Facility (Private) Limited, provided that such term does not include information that (a) was publicly known or otherwise known to undersigned Interested Party prior to the time of such disclosure, (b) subsequently becomes publicly known through no act or omission by undersigned Interested Party or any person acting on its behalf.

2. The undersigned Interested Party shall maintain the confidentiality of Confidential Information in accordance with procedures adopted by the undersigned Interested Party in good faith to protect confidential information of third parties delivered to it, provided that the undersigned Interested Party may deliver or disclose Confidential Information to its authorized representatives who agree to hold confidential the Confidential Information substantially in accordance with the terms of this Undertaking.

3. The undersigned Interested Party shall not at any time whatsoever:

   (i) Disclose, in whole or in part, any Confidential Information received directly or indirectly from the Delhi Aviation Fuel Facility (P) Limited to any third party.

_____
Sign & Stamp of Bidder

(ii) Reproduce, publish, transmit, translate, modify, compile or otherwise transfer the Confidential Information.

4. In case the Proposal of the undersigned Interested Party is not accepted and immediately upon the acceptance of the Proposal of any of the other Interested Party, the undersigned Interested Party, shall:

(i) Return all Confidential Information including without limitation, all originals, copies, reproductions and summaries of Confidential Information; and

(ii) Destroy all copies of Confidential Information in its possession, power or control, which are present on magnetic media, optical disk or other storage device, in a manner that ensures that the Confidential Information is rendered unrecoverable.

5. The undersigned Interested Party shall certify to Delhi Aviation Fuel Facility (Private) Limited that it has returned or destroyed such Confidential Information to the Delhi Aviation Fuel (Private) Limited within two (2) days of such a request being made by Delhi Aviation Fuel (Private) Limited.

Name of Interested Party's

Signature **of Authorized Representative**

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

Annexure VII

DECLARATION to be submitted along with Technical Bid

(M/s.) hereby declare / clarify that we have not been banned or delisted by any government or quasi Government agencies or Public Sector Undertakings.

Stamp & Signature of the bidder

NOTE: If a bidder has been banned by any Government or quasi Government agencies or PSUs, this fact must be clearly stated with details. If this declaration is not given along with the technical bid, the tender will be rejected as non-responsive.

_____

Sign & Stamp of Bidder

	DAFFPL				
	BOQ FOR RCC RING WALL SAND PAD FOUNDATION, SUPPLYING, FABRICATION, ERECTION & COMMISSIONING OF CR VERTICAL TANKS & ALLIED CIVIL WORKS				
	SUPPLY (A)				19-12-2017
SL. No.	**DESCRIPTION OF ITEM**	**QTY**	**UNIT**	**Unit Rate**	**Amount**
	REINFORCEMENT & EMBEDMENTS				
1	Supplying high yield strength deformed bars Thermo Mechanically Treated Bars Fe- 500 OR Fe-500 d grade, Conforming to as per IS: 1786 for all R.C.C works.	20.00	T		
2	Supplying MS foundation bolts with necessary GI nuts and sizes,with suitable anchorage all conforming to relevant Indian Standards / approved drawing.	200.00	Kg.		
	STRUCTURAL STEEL				
3	Supplying of all types of structural steel work in rolled steel joints, channels, angles, tees, flats, plates, lattice members built up / compound sections in columns, portals, girders, beams, bracings, trusses, purlins, rafters, staircase, steps, hand-railings, walkway, cat ladder with cages, toe plates, side walling, trestles, Conveyor gantries grating, chequred plate etc. including gusset plates, anchor plates etc., including site and shop fasteners, riveting, bolting, welding at shop or work site at all heights etc. & including applying approved two coat of primers and enamel painting Technical specification. Complete as per drawing and direction of Owner / Consultant. (All material supply is in contractor's scope including paints)	1.00	T		
4	Supply of Anchor bolt M30 x 1000 LG Material Gr A307.	24.00	Nos		
5	Supply of 1" pipe(SA 106 Gr. B) Sch. 40 in tank ring wall complete as per drawing.	110.00	Meter		
	TANK FABRICATION, ERECTION & COMMISSIONING				
6	Supplying of bottom, shell, wind girders, fixed cone roof as per our specifications and drawings with including transportation, Loading at stockyard and Unloading of Steel Plates at site and with all other items such as labour, materials, consumables, water, power, etc. supplied by the contractor. Steel plates for web and flange of wind girders, reinforcement plates for shell / roof manholes, nozlles, gusset plates etc, shall be in the scope of contractor and included under this item.	245.00	MT		
	a) CRVT - 18 M Dia x 20 M Ht Fire Water Tank - 2 no				
7	Supplying the structurals for CR vertical tank of following size such as rafters, curb angles, handrailing on tank shell, roof & stairways, spiral straicase with galvanised electro forged landing platforms and gratings, platform to approach combined gauge well, pipe supports on tank shell, shear plates, pad plates on shell for welding of spiral staircase and hand railing, base plates to tank bottom, as per specifications and standard drawings.	35.00	MT		
	a) CRVT - 18 M Dia X 20 M High Fire Water Tank				
8	**SUPPLY OF MECHANICAL LEVEL GAUGES FOR TANKS**	**2.00**	**NOS.**		
9	**SUPPLY OF PIPES**				
	STEEL PIPES,Material: IS1239 Part-I,Black pipe,Thick Heavy				
9.1	500 NB, PE	M	47.00		
9.2	300 NB, PE	M	47.00		
9.3	200 NB, PE	M	90.00		
9.4	100 NB, PE	M	129.00		
10	**SUPPLY OF FLANGES**				
	CS, Slip on Flanges, Material: A-105, END-RF/125AARH As per ASME B16.5				
10.1	100 NB, 150# SCH.40	Nos.	5.00		
10.2	200 NB, 150# SCH.40	Nos.	2.00		
10.3	300 NB, 150# SCH.20	Nos.	8.00		
10.4	500 NB, 150# SCH.20	Nos.	8.00		
11	**SUPPLY OF BLIND FLANGES**				
	CS,Blind Flanges, Material: A-105, END-RF/125AARH As per ASME B16.5				
11.1	100 NB 150#	Nos.	2.00		
11.2	200 NB 150#	Nos.	2.00		
11.3	300 NB 150#	Nos.	2.00		
11.4	500 NB 150#	Nos.	2.00		
12	**SUPPLY OF PIPE FITTINGS**				
	CS Elbows, Material: ASTM A 234 Grade WPB Seamless, Beveled end and dimensions as per ASME B 16.9 & all fitting should be forged fitting				
	90 Deg LR (1.5D)				
12.1	100 NB, SCH.40	Nos.	7.00		
12.2	200 NB, SCH.40	Nos.	5.00		
13.3	300 NB, SCH.20	Nos.	5.00		
12.4	500 NB, SCH.20	Nos.	5.00		
	45 Deg LR (1.5D)				
12.5	100 NB, SCH.40	Nos.	2.00		
12.6	200 NB, SCH.40	Nos.	2.00		
12.7	300 NB, SCH.20	Nos.	2.00		
12.8	500 NB, SCH.20	Nos.	2.00		
13	**PROCUREMENT & SUPPLY OF TEE**				
	CS Tee, Material: ASTM A 234 Grade WPB Seamless, Beveled end and dimensions as per ASME B 16.9 & all fitting should be forged fitting				
	Equal tee				
13.1	100 NB x 100 NB,SCH40 x SCH40	Nos.	3.00		
13.2	200 NB x 200 NB,SCH40 x SCH40	Nos.	2.00		
13.3	300 NB x 300 NB,SCH20 x SCH20	Nos.	3.00		
13.4	500 NB x 600 NB,SCH20 x SCH20	Nos.	3.00		
14	**SUPPLY OF GATE / Ball / Check / Needle VALVES AS PER SPECIFICATION**				

14.1	100 NB, 150#, FLG,BODY CS A105, TRIM SS304 +STL	Nos.	2.00		
14.2	200 NB, 150#, FLG,BODY CS A105, TRIM SS304 +STL	Nos.	2.00		
14.3	300 NB, 150#, FLG,BODY CS A105, TRIM SS304 +STL	Nos.	2.00		
14.4	500 NB, 150#, FLG,BODY CS A105, TRIM SS304 +STL	Nos.	2.00		
15	**PROCUREMENT & SUPPLY OF MECHANICAL LEVEL GAUGES FOR TANKS**	**Nos.**	**2.00**		
16	**Supply of Fire Fighting Equipments**				
16.1	Double Fire Hydrant as per specifications	Nos	2.00		
16.2	Water cum Foam Monitor as per specifications	Nos	1.00		
	Amount (A)				
	GST @ % on Amount (A)				
	Total Amount including taxes				
Total Amount in Words:					

Notes:	
1	Construction Water, loading and boarding, Site Storage with watch and ward, receipt, unloading, shifting material to store and internal shifting to site shall be included in Vendor's scope.
2	The unit rates as quoted to arrive at above total price shall be firm and inclusive of all taxes, duties, levies, transportation etc. No separate payment shall be made for site mobilization / demobilization, insurance etc.
3	The Schedule of Rates should be read with all the other sections of the tender.
4	The tenderer shall be deemed to have studied the drawings, specifications and the details of work to be done within the time schedule and to have acquainted with the conditions prevailing at site. Site visit is mandatory.
5	The quantities shown against the various items are only indicative of the quantum of work and it may vary to any extent. Billing will be done as per actual.
6	The rate quoted shall be inclusive of all work as mentioned in the scope of work (Technical Specifications).
7	All the items of work in the schedule of rates shall be carried out as per specifications, drawings and instructions of the Engineer-in-Charge.
8	The rates quoted by tenderers shall be inclusive of all costs for removal and re-installation, should any defects occur or modifications are required during testing, calibration and loop tests and no extra claims for such works shall be entertained.
9	Supply of Pipeline and associated fittings should be done after carrying out site survey and prior approval to be obtained from DAFFPL & DAFFPL representatives.

Signature of Bidder along with company seal

DAFFPL

BOQ FOR RCC RING WALL SAND PAD FOUNDATION, FABRICATION, ERECTION & COMMISSIONING OF CR VERTICAL TANKS & ALLIED CIVIL WORKS

INSTALLATION WORKS (B)

SL. No.	DESCRIPTION OF ITEM	QTY	UNIT	Unit Rate	Amount
	RCC RING WALL FOUNDATION FOR TANKS				
	EARTHWORK				
	a) The prices for all excavations are to include for removing and clearing away all shrubs, bushes, roots etc. b) The prices are also to include for all leveling and ramming foundation beds, trimming of sides and bottom grading to proper level as required. c) Removal and carrying shall include for all loading, unloading and handling as may be necessary and also all necessary means of transport (Mechanical or manual as required). d) The prices are also to include removal of water accumulated due to subsoil seepage, rains or from any kind of sources, either by pumping or by bailing or by any suitable method like well point dewatering etc. if reqd. No extra payment shall be made for dewatering. This also includes for draining out the pumped water to nearby available drainage system. e) Normally payment of earth work shall be made according to the sizes of PCC for trenches / pits as contemplated in the working drawings. Extra due to widening or deepening of trenches / pits shall not be paid for except for the cases where water / acid proofing would be accepted as per working drawings in such case the mode of measurement shall be as per IS : 1200 f) Nothing extra shall be paid for sorting / screening of excavated materials to obtain good earth for filling. g) Nothing extra shall be paid on account of any lift for disposal of excavated materials h) Where excavation are made in excess of the depth required, the contractor shall at his own expense fill up to the desired level with lean concrete of mix 1:5:10 (1 Cement: 5 Coarse sand: 10 Graded stone aggregate 40 mm nominal size. i) Rate shall include Royalty, Taxes, etc., levied by the local authorities, all transportation, loading and unloading, etc., and nothing extra will be paid on this account. j) Soft / loose soil also includes filled up earth / moorum.				
1	Earthwork in excavation (including all lead and lifts / depth) in all types of soils such as ordinary / hard rock and soil, RCC, Kankar, Murrum, gravel, pebbles, bajri, removal of shrubs, uprooting the tree roots etc. and all types of material encountered in excavation including excavation of saturated soils, mud, sludge etc. bailing out of sub-soil water or any other water, provision of shuttering, shoring etc. Available excavated earth free from all foreign matters, boulders shall be back filled in plinths, sides of foundation, within plot in layers not exceeding 150 mm thick, watering and consolidating of the same with hand / machine tamping and as per specifications / direction of Engineer-in-charge including disposing of all debris, unserviceable materials to an un-objectionable place as per directions of site Engineer.	2,600.00	Cu.M		
2	Supplying and filling coarse sand of Zone III as per IS Code, in plinth, under floors, under gorund tanks & tank foundations etc. in layers not exceeding 200mm in depth, each deposited layer shall be compacted by mechanical vibration and watering and dressing complete as per technical specifications and drawings.	2,450.00	Cu.M		
	CONCRETE WORK / REINFORCED CONCRETE WORK				
	a) The prices for concrete in beds and slabs are to include for laying on any type of sub grade, laying to falls, or cambers and for preparing surfaces to receive concrete. b) All concrete surfaces shall be finished to a fair face to give a smooth and even surface. Nothing extra shall be paid on this account. c) The prices are to include leaving pockets, cut outs and holes and to provide wooden boxes or any other suitable arrangements in RCC for bolt holes in slab, beams, walls, foundation of equipments etc. as per approved working drawing. (Nothing extra shall be paid on this account). d) No deduction in RCC quantity shall be made for pockets and nothing extra shall be paid for providing pockets as mentioned in para 'C' above. e) Measurement of opening in concrete work/RCC work: For measurement of openings in concrete work / RCC works, shall be as per IS: 1200 Part-III. f) All pocket holes are to be properly covered by suitable means so that dirt, rain water etc. etc., should not enter the pockets / holes etc. (Nothing extra shall be paid on this account.) g) Threads of bolts etc. which have already been fixed in the pockets are to be greased and polythene sheet properly covered with gunny bags to protect it from damages from all sources. (Nothing extra shall be paid on this account.) h) The prices shall include for all rebating, trotting, chamfering weathering, molding etc. to accord with the details shown on the approved working drawings i) Nothing extra shall be paid for any intricate concrete work for foundations of equipments and machinery (dynamic / static), RCC wall and other superstructure works or any delay in concreting in small and thin sections in PCC or RCC works. j) The prices for concrete are to include for hoisting and / or lowering to any height and / or depth required and in any type of form work, packing around reinforcement where required and finishing the surfaces, to fair and even surface. k) The prices shall include working up or hacking of concrete surface for providing keys for further concrete work and shall also include all plane, rebated or grooved constructional and other joints. l) The design mixes of all controlled concrete of various grades shall be established by the contractor on the basis of weigh batching, at the beginning of work. In all concrete / RCC work graded coarse aggregate shall be used. Any concrete work with honey comb shall be rejected and the work has to be redone by the contractor at his own cost. m) Concrete admixtures for workability if necessary, may be used in RCC if decided by Engineer-in-charge. No extra payment for mixing etc, shall be made on this account. n) Machine and equipment foundations shall mean all foundations including pedestals of vessels, towers, pumps, compressor motors, or any other equipment or machinery (both static and dynamic), pipe supports, etc. and the like. o) The prices are also to include the removal of water caused by rains / seepage etc. either pumping or by bailing out or by special means like well point dewatering etc. that may accumulate in the trenches and foundation pits etc. p) The prices are to include the supply of cement by the contractor. q) Anti shrinkage compound used in grouting shall be paid separately. r) The source of supply for sand and stone chips shall be approved by OWNER.				
	Following additional points to be noted for Ready Mix Concrete (RMC)				

	a) Ready mix concrete (RMC) of approved vendor at the site of casting including coordinating with Engineer-in-charge, prior to casting, making all arrangement to unload the concrete so as to ensure that RMC is not detained for unloading, placing the concrete at site, vibrating, taking concrete cubes, testing, curing the concrete etc. complete in relevant items. b) Necessary schedule will have to be submitted by agency 3 days in advance so that proper coordination with Engineer-in- charge is done. c) It shall be ensured that shuttering done by contractor shall be adequate to withstand pumping pressure. d) Any loss of material shall be contractor's responsibility. e) Submission of test results at RMC mixing plant site as well as casting site shall be contractors responsibility f) Desired design mix shall be got approved from Engineer-in charge before placing order for RMC. g) Any toll taxes applicable to be borne by the contractor. h) Any other taxes as levied by Govt. from time to time shall be deemed to be inclusive in the contract. i) Approved brand of 43 grade cement shall be used for preparing RMC & Cement shall be tested as per relevant IS Codes. Cement supply shall be in contractor's scope.				
3	PLAIN CEMENT CONCRETE				
	Providing and laying cement concrete in foundation, footings and base for columns / walls including proportioning, mixing in mechanical mixer, laying vibration by means of mechanical vibrators, curing etc. complete including the cost of shuttering:-				
3	Concrete of mix 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	45.00	Cu.M		
4	REINFORCED CEMENT CONCRETE				
	IN FOUNDATION & PLINTH:				
4.1	Providing and laying reinforced cement concrete of grade M - 25 (using 20 mm, nominal gauge graded stone aggregate) manufactured in fully automated batching plant and mechanically vibrated and finished to a fair face including the cost of centering, shuttering, including providing weep pipe as per drawing.etc. but excluding reinforcement, in foundation and plinth, for rafts, footings, bases of columns, pedestals, beams, walls, columns, slabs, machine and equipment foundations, box sections, lift shaft, pipe supports, etc., complete in all respects as per direction of Engineer-in-Charge. The quantity of cement shall be minimum 410 Kg./Cu.M. of concrete.	200.00	Cu.M		
	IN SUPERSTRUCTURE:				
4.2	Providing and laying reinforced cement concrete of grade M-25 (using 20 mm, nominal gauge graded stone aggregate), machine mixed, mechanically vibrated and finished to a fair face including the cost of centering, shuttering, etc. but excluding reinforcement, in superstructure up to 6m heights above plinth for columns, pillars, posts, attached pilasters, portals, struts, inclined posts, pedestals for equipments and similar vertical members, walls including walls of any thickness, shape or size including attached buttresses, pilasters, lintels, beams, portal beams, brackets, girders, cantilevers, suspended floors, roofs, staircase roofs and their supports, balconies, staircase waist and landing slabs and steps including preparation of top surface and finishing, nosing, etc. Chajja, fins, roof gutters, drop wall not exceeding 15 Cm. in thickness, railing, parapet wall, window sills, complete in all respects as per direction of Engineer - in - Charge.	20.00	Cu.M		
5	Providing grouting in pockets with cement concrete 1: 1: 2 (1 cement: 1 coarse sand : 2 coarse aggregate 10 mm nominal gauge) with approved anti shrinkage compound as per manufacturer's specifications (payment for anti shrinkage compound shall be made separately) with necessary finishing etc all complete as per directions of Engineer-in-Charge.	15.00	Cu.M		
6	Extra for providing and mixing MONOLITHEX or any other approved equivalent anti shrinkage compound as per manufacturer's specifications by weight of cement in grouting work as specified in the drawing and as directed by Engineer- in-Charge.	15.00	Kg.		
	REINFORCEMENT & EMBEDMENTS				
	a) Wastage in cutting will not be paid for. Only steel actually fixed in position will be paid by the linear measurement i/c hooks, chairs, dowels and laps. Only authorised hooks and laps approved in bar bending schedule shall be paid. Lapping of bars will be allowed only where the required bar length exceeds the standard lengths available. All other laps provided unless otherwise specified in the drawings shall not be measured and paid for. Weight of binding wire shall not be measured for payment. The prices are to include for the supply of all Reinforcement & Embedment at site by the Contractor				
	b) Reinforcement are to be tack welded in addition to binding by 18 SWG annealed wire wherever necessary to impart fixity. Bars of 28 mm dia & above shall also be provided with stitch weld in additions to binding with annealed iron wire and nothing extra will be paid for stitch welding. Stitch welding shall be done as per IS specifications. No extra claim shall be entertained on this account.				
7	Cutting, bending, hoisting, placing in position with proper precast concrete block cover and binding with 18 SWG annealed wire, high yield strength deformed bars Thermo Mechanically Treated Bars Fe- 500 OR Fe-500 d grade, Conforming to as per IS: 1786 for all R.C.C works including all necessary handling at all heights and depths complete in all respects and as per direction of the Engineer-in-Charge.	20.00	T		
8	Fixing of MS foundation bolts with necessary GI nuts and sizes,with suitable anchorage all conforming to relevant Indian Standards / approved drawing	200.00	Kg.		
	STRUCTURAL STEEL				
9	De-rusting, fabricating, erecting, hoisting and fixing in position with necessary welding and / or bolting with MS bolts conforming to property class 4.6 of I.S:1367 at all height as per approved fabrication drawings of all types of structural steel work in rolled steel joints, channels, angles, tees, flats, plates, lattice members built up / compound sections in columns, portals, girders, beams, bracings, trusses, purlins, rafters, staircase, steps, hand-railings, walkway, cat ladder with cages, toe plates, side walling, trestles, Conveyor gantries grating, chequred plate etc. including gusset plates, anchor plates etc., including site and shop fasteners, riveting, bolting, welding at shop or work site at all heights etc. & including applying approved two coat of primers and enamel painting Technical specification. Complete as per drawing and direction of Owner / Consultant. (All material supply is in contractor's scope including paints)	1.00	T		
10	Fixing of Anchor bolt M30 x 1000 LG Material Gr A307.	24.00	Nos		
	MISCELLANEOUS				

11	Making leak detection membrane by providing Black Low Density Ployethylene (LDPE) film, 4000 gauge (=1mm thickness) as per IS 2508-1984. Joints in the film shall be heat-sealed insitu during laying of the film, using a 3-sealer thermostatically controlled electric iron and checked carefully.The film may be laid at a slope (towards the periphery of the sand pad foundation) of atleast 1 in 200, to effectively drain leaked product, if any, away from the sand pad. The film shall be anchored at the periphery of the ring beam, as shown in attached drawing.	580.00	Sq.M		
12	Supplying and laying bituminous carpet (anti corrosive layer) 50 mm thickness for sand pad foundation in two layers using bitumen and stone grit mix made by throughly mixing dry stone grit with cut back bitumen 80 / 100 grade heated to about 105 C to 115 C proportion being 100 Kg of bitumen per Cu.m of stone grit, consolidating, rolling lightly to the required slope, etc., complete as per drawing and instruction at site.	545.00	Sq.M		
13	Supplying and laying 40 mm nominal size stone chips of sand of 300 mm horizontal thickness for sand pad foundation to the required shape and slope as per drawing and instruction at site.	85.00	Cu.M		
14	Erection of 1" pipe(SA 106 Gr. B) Sch. 40 in tank ring wall with stone gravels at its one end side of the tank for draining of any leaked product , complete as per drawing and direction of Engineer-in-charge.	110.00	Meter		
	TANK FABRICATION, ERECTION & COMMISSIONING				
15	Fabricating, erecting, welding, testing & commissioning of bottom, shell, wind girders, fixed cone roof etc including cutting, squaring, bevelling, rolling, etc., marking the plates for identification, lifting & placing the plates in position by any approved methods for the CR vertical tanks of following size by hydraulic jacking erection method, as per our specifications and drawings with including transportation, Loading at stockyardand Unloading of Steel Plates at site and with all other items such as labour, materials, consumables, water, power, etc. supplied by the contractor. Rates quoted should include radiographic examination as per specification,hydrostatic testing for shell, vacuum box testing for bottom plates, pneumatic test for roof plates, Chalk Kerosene Test for shell to bottom joint (on completion, tank has to be tested as per standards) etc. complete.	245.00	MT		
	a) CRVT - 18 M Dia x 20 M Ht Fire Water Tank - 2 no				
	i) Steel plates for web and flange of wind girders, reinforcement plates for shell / roof manholes, nozlles, gusset plates etc, shall be in the scope of contractor and included under this item.				
	ii) Testing of bottom plate lap welds with vacuum box method. Dye penetration test for the welding joints where vaccum box test is not possible, Chalk kerosene test for the periphery of the shell to bottom annular plate joints as per standard specification.				
	iii) Radiograph quality welding and carrying out spot radiography inspection of shell plates butt welds, manhole necks and other joints as per enclosed radiography procedure and specifications.				
16	Fabricating, erecting, assembling, fitting and welding the structurals for CR vertical tank of following size such as rafters, curb angles, handrailing on tank shell, roof & stairways, spiral straicase with galvanised electro forged landing platforms and gratings, platform to approach combined gauge well, pipe supports on tank shell, shear plates, pad plates on shell for welding of spiral staircase and hand railing, base plates to tank bottom, as per specifications and standard drawings.	35.00	MT		
	a) CRVT - 18 M Dia X 20 M High Fire Water Tank				
17	Supply, Fabrication,erection,welding and testing of all appurtenances such as roof manholes, shell manhole, shell nozzles (inlet & outlet, re-circulation) pressure transmitter nozzle, temperature hatch, gauge hatch, Nozzle for radar gauge & level switch (on seperate roof manholes i.e. other than normal roof manholes), roof vents, water draw off sump and water draw off pipe line with supports, expansion relief arrangements for inlet and outlet product lines,overflow arrangement for firewater tanks from roof upto the bottom of tank circular drain, GI pipe earthing arrangements as per standard, including earthing pits and GI flat connection from tanks to the pits, etc., complete(earthing pits shall be constructed outside the dyke).				
	a) The items include all the jobs to complete the Fire water tanks as per standard drawings as per requirement of API 650 latest edition and specifications except the fabrication works,steel structurals mentioned in item no.3 above. and combined gauge well unit which will be operated under relevant items of this schedule & as per directional drawigns.				
	a) CRVT -18 M Dia x 20 M Ht Fire Water Tank	2.00	NOS.		
	Note:				
	(i) CS Plates required for shear plates, pad plates, base plates for pipe supports, brackets, all manholes man hole neck and man hole covers shall be supplied and provided by the contractor at their cost.				
	(ii) All pipes and flanges required for shell and roof nozzles, water draw-off pipe, expansion / pressure relief line, overflow arrangement for fire water tanks and for all other appurtenances shall be supplied by contractor.				
18	Cleaning & painting of underside of bottom plates before laying as per the following scheme:- Shot / Grit Blasting to SA 2.5. - 1 coat of Epoxy Zinc Phosphate 75 microns. - 2 coats of High build bitumen coating of 90-100 microns each upto total DFT of 260 microns				
	a) CRVT - 18 M Dia X 20 M High Fire Water Tank	2.00	NOS.		
19	Calibration.				
	Conducting bottom calibration by providing the required water, labour, water meter, water pump, etc. The work involves pouring into the tanks measured quantities of water in the bottom saucer portion upto the level of the datum plate to ascertain the exact volume of the conical portion of the tank and removing the water after calibration and cleaning the tank bottom thoroughly as per instruction at site. The calibration has to be certified through competent authorities and certified calibration charts in Triplicate to be submitted.				
	a) CRVT - 18 M Dia x 20 M Ht Fire Water Tank	2.00	NOS.		
20	Shot / Grit blasting and painting the EXTERNAL surface of mild steel CR tanks to standard SA 2.5 (Swedish standard) including cleaning the surface thoroughly free from grease, dirt, rust, mill scales and removing all other sharp points weld splatter, flux etc. and supplying and painting the outside surface of the tank shell up to and including curb angle, shell extension, shell appurtenances, spiral staircase with hand rails, mid & top landing platforms, top handrailing, all other structures, appurtenances and fittings on the tank, labour, materials etc., complete in all respects as per technical specification mentioned in the scope or work and instructions at site.				
	The colour of finish coats for external surfaces and appurtenances shall be white or lustrous aluminium finish and black finish for staircase, hand railing, bands at bottom & dip hatch etc as per standards. The colour of finish coats for external surface of water tank shall be sky blue. DAFFPL logo and monogram shall be provided at two places on the shell. All other lettering such as tank no., product name etc. as per the drawings and specifications shall also be painted. The rate for external painting is inclusive of the above.				

	a) CRVT - 18 M Dia x 20 M Ht Fire Water Tank	2.00	NOS.		
21	INSTALLATION OF MECHANICAL LEVEL GAUGES FOR TANKS	2.00	NOS.		
FABRICATION AND ERECTION OF PIPING					
22	Laying of Above Ground Fire Water & Utilities pipelines of steel on pedastals/sleepers/Under culvert/overhead pipe rack/structures up to 10.0 m height etc. Pipes in the scope of DAFFPL shall be supplied anywhere within the terminal area and the contractor shall shift the same to the site of work at no extra cost with all leads and lifts. The pipeline laying includes cutting, beveling, positioning, setting, fixing the pipe fittings such as elbows, bends tees, reducers etc., complete with supports as per drawings and hydro testing the pipelines at 18.0 Kg/cm2 for a minimum period of 4 Hrs. Note: a. The job includes Blast cleaning (using Grit/ Shots) & painting of the outer surfaces of above ground pipeline/ fittings/ specials all leads & lifts etc. complete including all materials and machineries as per enclosed specifications and instructions at site. b. Pipe length indicated against each size is actual as per drawing. Payment will be made for the actual quantity executed at site.				
	c. Rates shall also include the cost of supervision, labour, overhead/profits, materials which are in Bidder's scope, consumables, conditions listed in Preamble to Schedule of Rates and other associated arrangements required to execute all the related activities d. Concrete sleepers/Pedestals to be constructed as per respective item. e. Structural Pipe rack is not in the scope of this tender. f.Hydrant pipe lines material confirm to API 5L Gr. B/ IS3589/ IS1239 g. Utility Pipe lines material confirm to IS-1239 Hvy Black & IS-1239 Hvy Galv. h.The primer and paint shall be as per the list of paint manufacturers enclosed.				
	i.Painting of pipes and blast cleaning of external surfaces of pipes to Sa 2½ & Primer:- one coat of Zinc Ethyl sylicate (P1) 75 micron, Undercoat: one coat of 2 pack Epoxy Polyamide MIO (U1) 120-125 micron, Finish coat:- Two coats of 2 pack Aliphatic Polyurathane (F1) 40-45 micron each coat, for corrosive zone. Rates includes painting of fittings, flanges, valves & Strainers. Pipeline colour coding shall be carried out as per DAFFPL specifications at no extra cost for FIRE WATER piping.				
	k. The rates are inclusive of providing assistance during commissioning with necessary tools , tackles and manpower. Note: Item includes providing Cleaning of pipelines after Hydrotesting with compressed air for fully draining of hydrotested water from the pipe line.				
	500 NB SCH 20	M	47.00		
	300 NB SCH 20	M	47.00		
	200 NB SCH 40	M	90.00		
	100 NB SCH 40	M	129.00		
23	Fabrication & Edge preparation for butt weld as per ASME B 31.3, tack welding, and final welding of Utility pipelines including pipe fittings (3 runs minimum) with supply of approved electrodes/consumables, welding machine, tools & tackles etc.The rate also includes the branch connection of smaller dia pipe to run pipe, pipe to pipe connection with RF pad as per specification.Reinforcement pads shall be paid on the basis of one weld joint on main pipe on which pad is welded. No extra payment will be made for conducting tests for establishibg welding procedure (PQR and WPS) as per ASME Section IX and Third Party Inspection. All pipes material confirm to IS-1239 Hvy				
	500 NB	JOINTS	8.00		
	300 NB	JOINTS	8.00		
	200 NB	JOINTS	15.00		
	100 NB	JOINTS	22.00		
24	Welding of CS SORF flanges & socket welded falnges confirming to materail A105 of the following sizes on the Fire Hydrant,OWS & UTILITY pipelines including setting, positioning, setting, welding with min. three runs outside and one inside, all leads & lifts etc., complete as per specifications and instructions at site.				
	500 NB	JOINTS	16.00		
	300 NB	JOINTS	16.00		
	200 NB	JOINTS	4.00		
	100 NB	JOINTS	10.00		
25	RADIOGRAPHY				
	The unit rate to include cost of film, its developing charges and cost of taking radiographs etc., labor, supervision, overheads/profits scaffolding, dark room, radiograph viewer, overheads/ profits etc. Payment shall be made only for those films which are found suitable after examination and for joints found acceptable as per codes, standards & enquiry specification. Films for defective joints shall not be paid for.Re-taking of radiography due to defective welds/ defective films/ defective workmanship etc., will be to contractor's cost.				
	NOTES: 1. Bidder shall consult with DAFFPL /DAFFPL'S Representative before execution of radiography for lengths and width of the film to be used. 2. Payment shall be made on the basis of weld length radiographed & for only those joints which are found acceptable by Owner/Owner's representative.				
	500 NB	JOINTS	16.00		
	300 NB	JOINTS	16.00		
	200 NB	JOINTS	4.00		
	100 NB	JOINTS	10.00		
26	Dye penetration examination for the welded pipes of FIRE WATER lines including providing all equipment & materials necessary for the job & labour etc as directed by the site in charge.				
	500 NB	JOINTS	16.00		
	300 NB	JOINTS	16.00		
	200 NB	JOINTS	4.00		
	100 NB	JOINTS	10.00		
27	Fixing the supplied CS Gate / Ball / Check / Needle valves of following sizes for Fire Hydrant & Utility PIPELINE. For size 50 mm dia. and above Fixing shall include supplying and fixing of Compressed Non Asbestos Fiber gaskets confirm to IS 2712-GR W/3,Thick 3 mms (with 100% spare quantity),nuts & stud bolts confirm to ASTM A194-2H & ASTM A193B-7 respectively.				
	500 NB	Nos	2.00		
	300 NB	Nos	2.00		

	200 NB	Nos	2.00		
	100 NB	Nos	2.00		
28	**PIPING SUPPORT**				
	Supply, fabrication,edge preparation & erection of pipe supports along with requirement of shoes, cradles, hangers, clamps (of all sizes/thicknesses), turn buckles, corrosion pads, stiffening rings, saddles, guides, special supports, pads, T post etc as per drawings, standards, specifications, conditions & instructions of Owner / Owner's representative. The work shall include blast cleaning of external surfaces of supports to SA 2½ & painting as per DAFFPL spec,the cost of materials, consumables, labor and overheads/profits etc. Category PS 1: Means carbon steel structural members and wrapper plates/corrosion pad plates (CS) and pipe trunnion.				
	Providing and laying in position, machine batched, machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work(including trenches, plinth, sides of foundations,culverts,wing walls etc), using cement as per approved design mix, including pumping of concrete to site of laying and cost of centering, shuttering but excluding the reinforcement. including Admixtures in recommended proportions as per IS 9103 to accelerate, retard setting of concrete,improve workability without impairing strength and durability as per direction of Engineer-in-charge. (Note :- a. Minimun Cement content considered in this item is @410 kg/cum.) b. Batch mixing plant of capacity to be approved by Site Engineer for the works to be installed by the Contractor at site along with required NOCs from concerned Authorities. Alternatevely, Contractor shall also be permitted to use RMC (if available) at no extra cost to DAFFPL & after obtaining prior approval from Engineer In-Charge. c. For small quantities (up to 5 cum per day), mixing & placing of concrete using mechanical mixer shall be permitted with the prior approval of DAFFPL. d. Hacking of exposed surface of green concrete (wherever applicable) as Key to plaster shall be done at no extra cost to DAFFPL.	Cu.M	10.00		
	PLAIN CEMENT CONCRETE Providing and laying cement concrete in foundation, footings and base for columns/walls including proportioning, mixing in mechanical mixer, laying vibration by means of mechanical vibrators, curing etc. complete including the cost of shuttering:- Concrete of mix 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	Cu.M	5.00		
29	REINFORCEMENT & EMBEDMENTS Thermo Mechanically Treated Bars Fe- 500 grade,Conforming to IS1786	Te	2.00		
30	Providing & fixing suitable 18mm Dia Teflon Ram Extruded Rod ,in possition for pipe line point support at all levels with necessary cleats welded on insert plate @ 150 c/c approx., complete in all respect as per approved drawing.	Rm	35.00		
30.1	MS Flat	Kg	650.00		
30.2	MS Strip 100 x 50 x 5 thk	Kg	34.00		
31	Installation of Fire Fighting Equipments				
31.1	Double Fire Hydrant	Nos	2.00		
31.2	Water cum Foam Monitor	Nos	1.00		
32	**MISCELLANEOUS**				
	Dismantling of existing water tanks structural plates works like trusses, purlin, column, frames for louvers, bracing, ladders, cage ladders, sag rods, cable racks, pipe bridges, chequered plates, bottom plates, grating along with all accessories viz nuts, bolts, cleats, gussets, suspenders etc. All necessary safety precautions, fire screen, scaffolding works etc to be considered in quoated price. Mechanically / Manually Breaking & removing existing tank pad foundations of any size / thickness including removing debris out side of terminal / site or as directed by Engineer-In-Charge.				
	20M Dia X 15 M Ht	Nos	1.00		
	14M Dia X 15 M Ht	Nos	1.00		
	09M Dia X 15 M Ht	Nos	1.00		
	Complete Fire Hydrant Pipeline and other supports & Fittings associated with above mentioned tanks	Lumpsum			
	Amount (A)				
	GST @ % on Amount (A)				
	Total Amount including taxes				

Total Amount in Words:

Notes:

1	Construction Water, loading and boarding, Site Storage with watch and ward, receipt, unloading, shifting material to store and internal shifting to site shall be included in Vendor's scope.
2	The unit rates as quoted to arrive at above total price shall be firm and inclusive of all taxes, duties, levies, transportation etc. No separate payment shall be made for site mobilization / demobilization, insurance etc.
3	The Schedule of Rates should be read with all the other sections of the tender.
4	The tenderer shall be deemed to have studied the drawings, specifications and the details of work to be done within the time schedule and to have acquainted with the conditions prevailing at site. Site visit is mandatory.
5	The quantities shown against the various items are only indicative of the quantum of work and it may vary to any extent. Billing will be done as per actual.
6	The rate quoted shall be inclusive of all work as mentioned in the scope of work (Technical Specifications).
7	All the items of work in the schedule of rates shall be carried out as per specifications, drawings and instructions of the Engineer-in-Charge.
8	The rates quoted by tenderers shall be inclusive of all costs for removal and re-installation, should any defects occur or modifications are required during testing, calibration and loop tests and
9	Supply of Pipeline and associated fittings should be done after carrying out site survey and prior approval to be obtained from DAFFPL & DAFFPL representatives.

Signature of Bidder along with company seal