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

TENDER NO: DAFFPL/FF/2022-23/07

INVITING TENDER FOR ELECTRICAL & INSTRUMENTATION WORKS FOR NEW RECIEPT HEADER & NEW 9000KL AG TANK

BID DUE DATE & TIME: 1500 Hrs. IST on 20th July 2022

OPENING OF TECHNICAL BIDS: 1100 Hrs. IST on 21st July 2022

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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 TERMS.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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Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

TENDER NOTICE
DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

INVITING TENDER FOR ELECTRICAL & INSTRUMENTATION WORKS FOR NEW RECEIPT HEADER AND NEW 9000KL ABOVE GROUND TANK AT DAFFPL

TENDER NO: DAFFPL/FF/2022-23/07

Delhi Aviation Fuel Facility (P) Ltd (DAFFPL) invites bids from eligible bidders for ELECTRICAL & INSTRUMENTATION WORKS FOR NEW RECEIPT HEADER AND NEW 9000KL ABOVE GROUND TANK AT DAFFPL FUEL FARM.

Brief Scope of work:
We intend to carry out electrical & instrumentation works for new receipt header and new 9000KL ATF above ground tank along with allied works including interfacing with existing SCADA/PLC System complete as per specifications.

Bid Security (EMD):	As mentioned in the Tender document
Date, Time & Venue for Pre-bid Meeting:	05th July 2022; 1500 HRS (IST) at DAFFPL, Aviation Fueling Station, Shahabad Mohammadpur, New Delhi-110061
Last Date of Submission of Queries	Upto 18:00 HRS (IST) on 15th July 2022.
Bid Due Date, Time & Place of Submission:	Upto 15:00 HRS (IST) on 20th July 2022, at e-Tendering Portal of DAFFPL.

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

Chief Executive Officer
DAFFPL, New Delhi

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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/ bidder's responsibility to execute the job in all respects as per specification furnished by consultant / owner and as per applicable codes, standards & in line with 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 teamwork, workmanship of the workers and supervisors.

The Contractor/Bidder 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 tenders in prescribed tender form under two-bid system. For viewing details including EMD, BID QUALIFICATION CRITERIA etc. please visit our e-Tendering web site **http://daffpl.enivida.com**

The bids are to be submitted on the e-Tendering portal of **Delhi Aviation Fuel Facility Private Limited (DAFFPL).**

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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/uploaded on DAFFPL e-tendering portal. 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. The bids submitted should be valid for **four months** from the due date of bid submission for Owner's acceptance. Once accepted it will remain firm till completion of contracts/orders.

5. 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.

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

7. The bidders to provide their bank details/ PAN / 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.

8. Party can quote with the deviations as referred in Point No.5 above. Please refer query end date / time in tender calendar after which no query posted by bidder shall be considered. However, DAFFPL reserves the right to respond the queries after cutoff date / time mentioned in tender calendar.

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9. Please note that queries related to scope of job, tender specifications, terms & conditions etc., should be submitted on e-tender portal before the query closing date. 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 e-tender portal.

10. 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.

11. EMD & Techno Commercial bid shall be opened on or after the date mentioned on tender opening date on e-tender portal. Price Bid of only those bidders whose offer is found meeting both BQC & techno-commercially acceptable, shall be opened on a later date as decided by DAFFPL.

12. DAFFPL reserves the right to accept any one or more 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. Ajay Singh, Asst. Manager Projects, ajay.singh@daffpl.in, 9999946309,	Mr. Manish Kumar Project Officer manish.kumar@daffpl.in, vishvajit@daffpl.in 9810640818

13. 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.

14. A Pre-bid meeting shall be conducted & is scheduled for **05th July 2022 at 1500 Hrs IST** at the office of DAFFPL, New Delhi. All prospective bidders can participate in the same. Any clarification regarding 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.

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b. Bidder(s) are requested to submit their queries, mentioning form name, clause no. & clause 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.

15. **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 bank transfer (IMPS/RTGS) in favor of Delhi Aviation Fuel Facility Private Limited. 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.

Direct bank transfer for Tender Fee and Earnest Money Deposit to DAFFPL account as detailed below. The UTR Reference and date shall be provided in the Tender portal for DAFFPL verification.

Name of Account	**DELHI AVIATION FUEL FACILITY PRIVATE LTD.**
Account No.	39040531887
Name of Branch	Corporate Accounts Group-II Branch, New Delhi
IFSC Code	SBIN0017313
SWIFT	SBININBB824
MICR	110002562
PAN	AAACS8577K
TAN	DELS55939C
BSR	0017313

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 1.0 (One) Lakh INR.**
c. Firms registered with National Small-Scale Industries (NSIC)/MSME of India are exempted from submission of EMD/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 EMD/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.

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16. **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 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.

    Also, work may get delayed due to operational requirement. Any extra claims on account of the same will not be entertained. Fire Screen as mentioned in specifications & BOQ will have to be installed to completely seal the area under work.

    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.** It is strongly urged that the contractor visits DAFFPL terminal and examines the condition of site.

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17. **Completion Period:** Time is the essence of the contract. The time period of contract for part-1(New Receipt Header) is **06 (Six) months and** part-2 (New 9000KL Tank) is **09 (Nine) months** from the date of Letter of Intent/notification of award. Bidder shall design & develop/modify graphics (SCADA/PLC) for both parts and any other applicable software and hardware within **06 (Six) months** from the date of Letter of Intent/notification of award. The time includes necessary time required for mobilizations and demobilizations after the execution of work. Successful bidder is required to provide a bar chart /schedule showing the activities/events with time within 10 days from date of award of work. Also, the jobs may get delayed due to monsoon. Any extra claims on account of the same will not be entertained.
18. The above-mentioned contractual completion is inclusive of all the lead time for procurement of raw materials, inspection / testing, packing or any other activity whatsoever required to be accomplished to complete the work in all respect.

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

20. **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.

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

22. 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.

23. All electrical works shall be carried out by qualified workers under supervision of class-A/valid electrical license holder.

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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, excavated earth (Sand/soil) 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 or disposed off to a government approved site & as per government guidelines on 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. Chapter 1 : Covering Note
2. Chapter 2 : Instructions To Bidders
3. Chapter 3 : Bid-Qualification Criteria
4. Chapter 4 : Performance of Work
5. Chapter 5 : General Purchase Conditions
6. Annexures attached are as follows:
   - Annexure A – Scope of Work & Vendor List
   - Annexure B – Technical Specification
   - Annexure C – Cable Schedule
   - Annexure C – Drawings
   - Annexure I – DEVIATION SHEET
   - Annexure II – DECLARATION SHEET
   - Annexure III – FORMAT FOR DRAFT BANK GUARANTEE IN LIEU OF BID SECURITY (EMD)
   - Annexure IV - FORMAT DRAFT COMPOSITE BANK GUARANTEE FOR SECURITY DEPOSIT/PERFORMANCE GUARANTEE
   - Annexure V – FORM OF LETTER OF UNDERTAKING
   - Annexure VI – DECLARATION TO BE SUBMITTED ALONGWITH Technical BID
   - PRICE BID

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

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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. The bidders should have valid class 3 Digital sign certificate with encryption.

3. Bidders are requested to register on our E-Tendering portal on https://daffpl.enivida.com

4. Bidder can contact on e-portal helpdesk numbers 011-49606060, 9355030617 during 9:30 hrs to 18:00 hrs for any query/assistance for registration & tender documents submission.

5. 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 only through e-Tender portal.

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

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

8. 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.

9. Undertaking by the bidder:
    a. I/we hereby undertake that the statements made herein/information given in the bids through e-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.

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

11. Bidder to submit documents/information to satisfy the bid qualification criteria. Bidders should also be able to produce further information as and when required by DAFFPL with in a time limit as specified by DAFFPL.

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

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

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

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

16. 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.

17. 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.

18. 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 for e-tender 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

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bids, we may, at our discretion, extend the bid due date.

19. 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.

20. 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.

21. 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.

22. 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 e-tendering portal.

23. 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.

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

25. 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

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Bidder. Withdrawal of a bid during this interval shall result in the forfeiture of Bidder s EMD.

26. 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.

27. 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.

28. 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.

29. 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.

30. 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).

31. 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.

32. 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 contract/purchase order incorporating all the terms and conditions agreed between the parties. Within 05 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.

33. Vigil Mechanism: DAFFPL has developed the Vigil Mechanism to deal with references/ grievances, if any, that is received from bidders who

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participated / intends to participate in the tender. The details of the same are available on our website www.daffpl.in

34. 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.

35. 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 & if they are free of any computational errors, 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.
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 through the e-tendering portal.
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.

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f. A bid determined as substantially non-responsive after final evaluation 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.

g. The Bidders qualifying the initial criteria as set out will be evaluated for the following criteria by scoring method based on details furnished by them.

DAFFPL, however, reserves the right to restrict the list of such qualified contractors to any number deemed suitably by it.

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.**

CHAPTER 3: BID-QUALIFICATION CRITERIA

Bidders need to meet following pre-qualification criteria to qualify for short-listing as a successful vendor for this tender;

- ***Technical Criteria:***

The bidder shall have satisfactorily executed either of the following during the last 7 years ending 31/03/2022:

The Bidder should have completed at least **one similar work,** costing not less than **INR 80 LAKHS.**

OR

The Bidder should have completed at least **two similar works,** each costing not less than **INR 50 LAKHS.**

OR

The Bidder should have completed at least **three similar works,** each costing not less than **INR 40 Lakhs.**

Notes:

a. Similar works means Electrical/Instrumentation/Automation/Electrical & Instrumentation works.

b. Bidder to submit work completion certificates/proof of work executed against orders submitted by them

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FINANCIAL CAPACITY

Bidder shall have minimum average annual turnover of **Rs. 40.00 Lakhs** 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"

Bidder

Note: Turnover for this purpose should be as per audited P&L statement including Balance Sheet/ Published Account/ Profit & Loss Account Statement of the tenderer. However, if the tenderer is not required to get its accounts audited under Section 44AB of the Income Tax Act, 1961, (Applicable for FY21-22 as well, in case financial statement of bidder has not been audited at the time of submission of bids) certificate from a practicing Chartered Accountant towards the turnover of the tenderer along with copies of its income tax return should be obtained.

Total revenue as per schedule III of companies' act, 2013 (earlier revised schedule VI of companies Act, 1956) shall be considered as Turnover. Audited balance sheet / published accounts on calendar year basis shall also be acceptable. The financial statements copy must bear the registration number of the authorised chartered accountant and its seal. (This is not applicable for published annual reports).

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

OTHER INFORMATION OF BQC

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

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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 consortium;
      III. the consortium member descriptions shall indicate what

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

XII. 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

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Owner. The guarantees shall cover inter alia the commitment of the foreign company 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 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. The Bidder shall quote for the entire Works, such that the total Tender (lump sum) price inter-alia covers break ups of the price of all cost centres and applicable taxes thereon, if any, along with all its risks, obligations and liabilities set out in or to be reasonably inferred from the Tender Documents in respect of the procurement, supply, construction, erection, installation, setting to work, testing, pre commissioning, successful commissioning and completion of the Works, all in accordance with the requirements of the tender and applicable laws. 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. 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 and to the entire satisfaction of the DAFFPL.

    The bidders are required to note that the contract shall be awarded and the works shall be executed on a lump sum price basis and not on unit rate basis and the unit rates provided in the bill of quantities have been provided only for the purpose of providing the basis of deriving the lump sum price. bidders must note that the bill of quantities is solely for guidance purposes.

    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.

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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. MATERIALS TO BE SUPPLIED BY CONTRACTOR:
   a. The contractor shall procure and provide the whole of the materials required to complete the job including tools, tackles and equipment etc. The materials procured by the contractor shall be DAFFPL approved/specified quality.
   b. All materials procured/used 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. 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.

3. 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

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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.

4. 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.

5. 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 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.

6. 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.

7. 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

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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.

8. 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

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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.

9. 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. 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.

10. RESPONSIBILITY FOR LEVEL AND ALIGNMENT:

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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.

11. MATERIALS TO BE SUPPLIED BY CONTRACTOR:
    d. 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.
    e. 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.
    f. 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.

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

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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.

13. 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/bidding for these works 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

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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.

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.

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14. 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 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.

15. 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.

16. 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.

17. 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

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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.

18. 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 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:

Works defined/showcased/depicted in drawings/scope of works/indicative BOQs/specifications if altered while construction at site shall not constitute as "additional work". "Additional work" shall only be the works which are not defined in the above-mentioned documents.

- 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

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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.

19. 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.

20. 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.

21. 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

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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 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.

22. 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.

23. 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.

24. SAMPLES:

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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.

25. 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 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.

26. 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

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suspension was not consequent to any default or failure on the part of the contractor.

27. 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.

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

29. 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

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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 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

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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.

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

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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 affected 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. 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.

3. 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.

   Contractor shall intimate the fuel farm operator, EIC & DAFFPL a month in advance about their plans to take shutdown of any facility/equipment/tank etc. inside the fuel farm.

   In case of any delay in handover of any facility as per approved / mutually agreed plan to the contractor by the Fuel Farm Operator/DAFFPL, Or any other hinderance beyond the contractor's

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scope/control (as approved by EIC) the delay period shall be added to the delivery period of this contract. The hinderance register has to be maintained by the contractor duly approved/counter signed by EIC on the day/time of hinderance. The liquidated damages shall be calculated on the basis of scheduled completion & actual data from hinderance register.

The decision of EIC shall be binding on the contractor & non-negotiable.

4. Construction Water and Power:

   - ✓ The contractor has to make necessary arrangement for metering and further distribution for power required for job at no extra cost. All arrangement/material shall be as per electrical rules/standards/Approved makes.
   - ✓ Electricity will be provided by DAFFPL @ Rs. 18.00 per unit plus tax.
   - ✓ Water will be provided at a point inside the terminal and the contractor then has to be make subsequent arrangements at no extra cost.
   - ✓ Tariffs are subjected to change as per revisions.
   - ✓ The DAFFPL shall not take any guarantee for the supply of water & electricity 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.

5. Safety Rules and Regulations:
   All Safety rules and regulations of the terminal operator have to be followed by the contractor without fail. If any damage occurs due to negligence of safety, contractor will be held responsible for the same.

6. 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

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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.

7. 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.

8. 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.

9. 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.

10. 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

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and assess the applicability of taxes, duties, levies etc. In case of any difference of opinion between Vendor's proposal and interpretation by any tax/assessing (or similar) authorities, on the rate or terms and conditions related to taxes and duties etc., owner's 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.

11. 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.

12. Bidder shall quote considering the cost of all approvals, insurances and other applicable charges; nothing shall be paid/reimbursed additionally on any account.

13. Goods & Services Tax (GST): -The tenderer should have valid Goods & Service Tax registration. Tenderer should enclose the copy of the registration (GST) /copy of acknowledgement along with the tender. The Parties without valid Goods & Service Tax number need not quote. As per Section 171 of CGST/SGST Act, "Any reduction in rate of tax on any supply of goods or services or the benefit of input tax credit shall be passed on to the recipient by way of commensurate reduction in prices.

14. TAXES & DUTIES:
    a) Bidder(s) quoted prices shall be exclusive of all taxes, duties, cess, levies etc.,
    b) The invoice should clearly mention 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/GST 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 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.

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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 deducted before releasing any payment to the Bidder and a TDS (Tax deducted at source) certificate will be furnished to the Bidder.
c) Bidder may note that where the responsibility to deduct TDS under section 194Q of Income Tax Act is on DAFFPL, bidder shall not collect any TCS under section 206C(1H) of the Income Tax Act from DAFFPL.
d) Accordingly, Bidder shall have the responsibility to check and include such provision of taxes in the prices.
e) 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

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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 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) 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

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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 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 06 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/WORK COMPLETION:

The inability of successful bidder to execute orders in accordance with the agreed completion schedule will entitle DAFFPL, at its options, to:

a) Accept delayed work completion at prices reduced by a sum equivalent to half percent (0.5%) of the total order value (i.e. sum of amount of purchase order for supply part and amount of work order for installation part) of Part-1 or Part-2 of work, as the case may be

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for every week of delay or part thereof which is to be considered as a week, limited to a maximum of 10% of the total order value (sum of supply part value and installation part value)of part-1 or part-2 as the case may be. Date of completion of all works at DAFFPL site shall be considered for calculation of price reduction.

19. Purchase order for supply part will be placed by DAFFPL and work order for installation part will be placed by fuel farm operator M/s IOSPL on behalf of DAFFPL. The billing by contractor shall be done on DAFFPL only on both the cases.

20. INSURANCE

Contactor 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.

TRANSIT & COMPREHENSIVE INSURANCE

The vendor shall arrange transit Insurance for door delivery of equipments to DAFFPL Fuel Farm, New Delhi for delivery.

21. INSPECTION:

a) Material / construction/Fabrication 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 commissioning or start up 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

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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.

22. GUARANTEE/WARRANTY:

a) Materials/workmanship shall be guaranteed against manufacturing defects, materials, workmanship, and design for a period of 12 months from the date of completion of work at DAFFPL site. 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 subcontracted 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.

e) Vendor shall guarantee that the performance of the EQUIPMENT/MAT 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.

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

24. Construction power, 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.

25. The unit rates as quoted to arrive at a total price shall be firm and inclusive of all duties, levies, transportation etc. No separate payment shall be made for site mobilization / demobilization, insurance etc.

26. The Schedule of Rates should be read with all other sections of the tender documents.

27. 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 strongly recommended.

28. All supply and work shall be in line with tender specifications, drawings and instructions of the Engineer-in-Charge.

29. The quantities shown against the various items are only indicative of the quantum of work and it may vary to any extent. Billing/payment will be done as per payment terms. Vendor to make measurements at site before dispatch of any material.

30. The rate quoted shall be inclusive of all work as mentioned in the scope of work in tender documents.

31. In case of any rework due to faulty workmanship or any defects occur or modifications are required no extra claims for such works/supply shall be entertained.

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32. PAYMENT TERMS: The payment will be made after making necessary deductions as applicable & stipulated elsewhere in the tender document for materials, security deposit or any moneys due to the Owner etc. Works have to executed as per drawings & scope of work.

- Contractor should submit PBG equal to 10% of Total Order Value with in 30 days of issue of LOI/PO.
- PBG/retention amount will be released after completion of guarantee/warranty/defect liability period.
- Payment will be released within 30 days from the receipt and acceptance of Invoice along with all required documents.
- Notwithstanding any other clause of the tender documents, payment for Goods and Service Tax amount claimed in the invoice for work done by the successful bidder will be released only after the invoice is reflected in GSTR-2A of DAFFPL/Owner

The following payment terms shall be applicable:
For Supply Part:

- 70% will be released within 30 days after receiving invoice after the receipt and acceptance of material at site adjusting deductable if any.
- 10% of material consumed after completion of installation, testing & commissioning of individual work and certification by site engineer/PMC on prorata basis.
- Balance 20% of material consumed after completion of installation, testing & commissioning of all works in all respect and handover of same to operations.

For Installation Part:

- 80% will be released after completion of installation, testing & commissioning of individual work and certification by site engineer/PMC on prorata basis.
- Balance 20% after completion of installation, testing & commissioning of all works in all respect and handover of same to operations.

Note: Payment will be done on actual consumption of material & works carried out. Amount for unused material will be adjusted in final billing.

Note: No Mobilization advance will be paid against the purchase/work

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order issued against the subject tender.

Arrangement for Transit e-way Bill under the GST Act for all the purchases is the responsibility of the tenderer.

33. 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 shall be final and binding on vendor.

34. 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.

35. Repeat Order: DAFFPL reserves the right to place repeat order up to the order quantity within One Year from the date of original order on mutual agreement basis.

36. 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.

37. 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.

38. PATENTS & ROYALTIES: The vendor shall fully indemnify owner and users of

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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.

39. 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 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.

40. 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.

41. REJECTION, REMOVAL OF REJECTED GOODS AND REPLACEMENT: In case the testing and inspection at any stage by inspectors reveal that the

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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/purchaser. The Purchaser 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 Purchaser for such disposal shall be to the account of the vendor. The freight paid by the purchaser, if any, on the inward journey of the rejected materials shall be reimbursed by the vendor to the purchaser before the rejected materials are removed by the vendor. The vendor will have to proceed with the replacement of the Equipments without claiming any extra payment if so required by the purchaser. The time taken for replacement in such event will not be added to the contractual delivery period.

42. 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 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.

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

44. 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

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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.

45. 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 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.

46. 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.

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

48. 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.

49. 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, equipment's, 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 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.

50. REFERENCE FOR DOCUMENTATION:

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

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

51. 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 referred 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.

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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 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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GLOBAL CONSULTANTS

Annexure - A

Scope of Work & Vendor List

GLOBAL CONSULTANTS

SCOPE OF WORK
ELECTRICAL & INSTRUMENTATION WORKS FOR ADDITIONAL NEW RECEIPT HEADER & ADDITIONAL TANK VF 207 WORKS

1	04-06-2022	Issued for Tender	DR	AP	SKJ	
0	07-05-2022	Issued for Tender	DR	AP	SKJ	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

1.0 Scope of Electrical Works

Part 1: Electrical Works for Additional new receipt header

Part 2: Electrical Work for Additional tank VF 207 works

The below scope of work shall be applicable for both the Electrical works under this tender document and Bill of Quantity shall be referred along with below Scope of Works.

1.1 This tender document covers detailed scope for Electrical works including supply of material and bought out items / equipment. Contractor shall submit the spare list including erection & commissioning spares, mandatory spares & tools /tackles.

1.2 The scope includes works / services like supply/laying of Power Cables, Supply/ Installation of Power Junction boxes, Supply and installation of Push Button Stations, termination of power cables to actuator of MOV / Panels / Distribution Boards etc., supply / installation of cable trays, supply/ installation of heavy duty conduits for RCC duct banks, cable loop testing, inspection & testing, Site Acceptance test, field trials, performance tests, electrical work completion in all respect, calibration as required, commissioning, pre-commissioning, obtaining approvals from statutory bodies / other agencies, performance test runs, rectification of any defect and handing over the package / equipment as per data sheets and specification to the complete satisfaction of the Engineer-In-Charge including supply of all labour, consumables & hardware etc. as required, for the scope of work.

1.3 Contractor shall submit the QAP for all electrical items supplied. Contractor shall also provide the Test Report for the tests carried out by supplier / vendor.

1.4 Contractor shall be responsible for Supply and laying the Power and Control Cables as per approved Power Cable Schedule / approved good for construction drawings, however before laying the cable Contractor to confirm the length of the Cable as per site conditions.

1.5 Contractor shall be responsible for preparation of drum schedule and get the approval for the same from Owner / Client before placing order for the supply of Power as well as Control Cables.

1.6 Contractor shall be responsible for Cable continuity check test for the supplied Cable drums.

1.7 Contractor shall earmark the Cable drum based on the length of Cable to be laid in RCC duct bank or on Cable tray. Contractor shall obtain permission from Owner / Client before laying Power / Control Cable if the Cable length needs to be cut from the earmarked Cable drum.

1.8 Contractor shall be responsible for stable and secure power delivery to maintain a reliable operation of the system. Internal distribution of electrical power shall be carried out through the main switchboard room. The electrical power system shall be designed with focus on the following areas: Safety, Operational security and Flexibility.

1.9 Contractor shall be responsible for Supply and Installation of Power Junction boxes, Local Push button stations for ROSOV /MOV / DBBV, Distribution Boards, Cable trays inside Admin cum Control Room / Electrical Room etc. Flameproof Light Fittings inside Tank Dyke area. Contractor shall also responsible for termination of Power and Control cables including supply of necessary material of Glanding as per approved Cable schedule.

1.10 Contractor shall submit all the relevant Good for Construction / Vendor drawings and approvals as per the requirement of individual specifications. Contractor shall not start fabrication / manufacturing unless the drawings and documents are approved by the Owner / Client. Any manufacturing done prior to the drawing/document approval from the purchaser shall be rejected.

1.11 Scope of Work also includes obtaining statutory approvals as required for electrical installation of the system. All equipment not mentioned but required for satisfactory operation of the plant and to meet desired intent of specification shall be included in the scope of supply of Contractor. Such equipment if noticed during residual Engineering shall be supplied by Contractor without any additional financial implication to Owner / Client. Make of equipment shall be subjected to Owner / Client approval.

1.12 Third party inspection for all supply items. Third party inspection prices are included in the supply price. Contractor to appoint Third Party Inspection Agency (TPIA) from the approved vendor list for carrying out various stage-wise and final inspection. The scope includes preparation of as-built drawings.

1.13 Contractor shall be responsible for Supply and installation of earthing material including Earthing rope / Earthing strips for MOV, ROSOV's, Above Ground Tank, Panels, Field Power and instrumentation Panels, Local Push button stations, Lighting Distribution Boards, Power Junction boxes, Instrumentation panels inside

control room, Emergency shutdown Buttons and Cable trays, Field Instruments etc. installed for the Tank VF 207 and additional Receipt header line works.

1.14 Contractor shall be responsible for supply and installation of structural steel (Including GI High strength Anchor Fasteners) for support of Cable trays, Power junction boxes (Field and inside Control / Electrical Room), supports for Electrical and Instrumentation Panels, supports for instruments etc. The Fabricated supports shall be blasted for SA 2.5 and painted with one coat of primer, one coat of intermediate paint and final finished Paint. The Contractor shall get the approval for shed of the Paint from Owner / Client before application of painting works.

1.15 Any Other work as may be required to complete the Job in all respect.

1.16 Scope of Supply for Electrical Works

A. Contractor's Scope of Supply

i. Electrical Bulk Items, Power and control Cables, earthing materials, Power Junction Boxes, Lighting Fixtures (Flame proof / Non Flameproof), Distribution Boards, Local Push buttons stations, Structural steel for supports of panels / Cable Trays, Cable Trays, Heavy duty Cable Conduits for Duct Bank, Earthing Cables, rigid PVC conduits for Cable crossings, GI Conduits for underground crossings, Cable termination Glands / Ferule, Cable Tags, Lightning Protectors, Surge Arrestors etc. complete in all respect.

ii. All items consumables / non-consumables required to complete the job

iii. All tools tackles, skilled/ unskilled manpower, machinery etc. to complete the job.

2.0 Scope of Instrumentation Work

Part 1: Instrumentation Works for Additional new receipt header

Part 2: Instrumentation Work for Additional tank VF 207 works

The below scope of work shall be applicable for both the Instrumentation works under this tender document and Bill of Quantity shall be referred along with below Scope of Works.

2.1 This tender document covers detailed scope for Instrumentation works including supply of material and bought out items / equipment. Contractor shall submit the spare list including erection & commissioning spares, mandatory spares, Hardware, Software & tools /tackles.

2.2 The scope includes works / services like supply/laying of Instrumentation Control / Signal / FO Cables, Supply/ Installation of Instrumentation Control / Instrumentation Junction boxes, Supply and Installation of Field Instruments Pressure Transmitters, Temperature Transmitters, Float Switch, Radar Level Gauges, multi point temperature averaging sensor, Tank Side indicator, TSVs, Pressure Gauges, etc. complete in all respect as per P&ID / Piping General Arrangement Drawing / Piping Layout / Equipment Layout with local & remote indication & interface facility with SCADA etc. as per the P&ID / Piping General Arrangement Drawing / Piping Layout / Equipment Layout., termination of Control / Signal / FO cables to actuator of MOV / ROSOV / Instruments / Field Instrumentation Junction Boxes, supply / installation of cable trays, Supply & Installation of Control Panels inside Control room at Fuel Farm, Control / Signal / FO cable loop testing, inspection & testing, Site Acceptance test, field trials, performance tests, Instrumentation work completion in all respect, calibration as required, commissioning, pre-commissioning, obtaining approvals from statutory bodies / other agencies, performance test runs, rectification of any defect and handing over the package / equipment as per data sheets and specification to the complete satisfaction of the Engineer-In-Charge including supply of all labour, consumables & hardware etc. as required, for the scope of work.

2.3 All normal operations for the entire new installation shall be automated and integrated with existing control systems. Contractor has to assess the existing automation and provide the automation to the new tank area in line with the requirements. All hardware and software required to integrate and operate as per the existing control philosophy shall be provided by the contractor. To achieve the seamless integration of control system, any up gradation needs to be done in the

existing control system shall form part of scope of works of contractor.

2.4 Contractor shall submit the QAP for all Instrumentation items supplied. Contractor shall also provide the Test Report for the tests carried out by supplier / vendor.

2.5 Contractor shall be responsible for Supply and laying the Signal and Control Cables as per approved Instrumentation Cable Schedule / approved good for construction drawings, however before laying the cable Contractor to confirm the length of the Cable as per site conditions.

2.6 Contractor shall be responsible for preparation of drum schedule and get the approval for the same from Owner / Client before placing order for the supply of Instrumentation Cables as well as Control Cables.

2.7 Supply & Installation of Radar Level Gauges, multi point temperature averaging sensor, Tank Side indicator, TSVs, Pressure Gauges, Pressure transmitters, etc. complete in all respect as per P&ID / Piping General Arrangement Drawing / Piping Layout / Equipment Layout with local & remote indication & interface facility with SCADA etc. as per the P&ID / Piping General Arrangement Drawing / Piping Layout / Equipment Layout.

2.8 Contractor shall be responsible for Cable continuity check test for the supplied Cable drums.

2.9 Contractor shall earmark the Cable drum based on the length of Instrumentation / Signal / FO Cable to be laid in RCC duct bank or on Cable tray. Contractor shall obtain permission from Owner / Client before laying Instrumentation / Signal / FO Cable if the Cable length needs to be cut from the earmarked Cable drum.

2.10 Contractor shall be responsible for Supply and Installation of Instrumentation Junction boxes and Cable trays. Contractor shall also responsible for termination of Cables to Actuator of MOV, ROSOV installed inside Fuel Farm, Field Instruments inside Fuel Farm including supply of necessary material of Glanding and termination of cables.

2.11 Contractor shall be responsible for laying Instrumentation / Signal / FO Cable cables inside Field Instruments mounted inside fuel farm up to Control Room including supply and installation of Master Control PLC / SCADA Panel, ESB Panel etc. complete in all respect.

2.12 The scope includes preparation of detailed engineering drawings and gets the approval from Client / Owner for proceeding for Good for Construction Drawings.

Contractor shall submit all the engineering drawings and approvals as per the requirement of individual specifications from Owner / Client. Contractor shall not start fabrication / manufacturing unless the drawings and documents are approved by the Owner / Client. Any manufacturing done prior to the drawing/document approval from the purchaser shall be rejected.

2.13 The scope includes supply and installation of work station for PLC, Modification of existing logic control to include additional Tank VF 207 / Additional Receipt header line MOV and ROSOV, survey for existing PLC panels for getting signal cable termination (If sufficient space not available then Contractor to propose new PLC and integration of the same with existing PLC), Graphics for new Tank (VF 207)/ Additional Receipt header line MOV and ROSOV, modification of graphics for existing system to add new graphics of VF 207 / Additional Receipt header line MOV and ROSOV, Logic, graphic, Hardware, software required shall be compactible to existing SCADA/ PLS/ TFMS system.

2.14 The Scope of work includes integration of new Tank VF 207 controls / Additional Receipt header line MOV and ROSOV controls and logic with existing system including visit of OEM, survey for existing system for logic and control features and design of the new logic and control to include additional Tank VF 207 and Additional Receipt header line MOV and ROSOV. All necessary Hardware, Software, Licenses, Certificates new or modification to existing hardware, software including amendment in license / certificate is in the scope of the Contractor. All required manpower and OEM person visit charges, consultancy work charges are in the scope of the Contractor.

2.15 Scope of Work also includes obtaining statutory approvals as required for Instrumentation installation of the system. All equipment not mentioned but required for satisfactory operation of the plant and to meet desired intent of specification shall be included in the scope of supply of Contractor. Such equipment if noticed during residual Engineering shall be supplied by Contractor without any additional financial implication to Owner / Client. Make of equipment shall be subjected to Owner / Client approval.

2.16 Any Other work as may be required to complete the Job in all respect.

2.17 Scope of Supply for Instrumentation Works

A. Contractor's Scope of Supply

i. All Instruments as per P&ID / Piping General Arrangement Drawing / Piping

Layout / Equipment Layout, Instrument bulk items, Control / Signal Cable, FO Cable, Cable Trays, Instrumentation Junction Boxes, Master Control PLC Panels, Signage's, Emergency Shutdown System Buttons, Hardware / Software for the SCADA system, Modification of existing Logic and control system including OEM Person visit and work charges, Workstation, PLC Control and additional Graphic for VF 207 / Additional Receipt header line MOV and ROSOV, Modification of existing graphic to accommodate VF 207 controls / Additional Receipt header line MOV and ROSOV controls including its valve control and instrument controls, Spare inventories etc. Complete in all respect.

ii. All items consumables / non consumables required to complete the job

iii. All tools tackles, skilled /semiskilled manpower, machinery etc. to complete

3.0 LIST OF APPROVED MAKES FOR ELECTRICAL / INSTRUMENTS

SR NO.	MATERIALS	APPROVED MAKES
1.	FLP JUNCTION BOXES, ENCLOUSERS, CABLE GLANDS, PLUGS, PUSHBUTTON STATIONS	BALIGA FEPL LTD. FCG FLAMEPROOF CONTROL GEAR CEAG FLEXPRO EX-PROTECTA
2.	RTD WITH THERMOWELL	NAGMAN GENERAL INSTRUMENTS ALTOP DETRIV INSTRUMENTATION THERMOCOUPLE PRODUCT CHEMTROL PYRO ELECTRIC
3.	PRESSURE SWITCH - FLP / WP	INDFOS SWITZER INSTRUMENTS LIMITED FITZER DANFOS BOURDAN
4.	ULTRASONIC LEVEL TRANSMITTER / GUIDE WAVE LEVEL TRANSMITTER	EMERSON PROCESS MANAGEMENT ENDRESS + HAUSER KROHNE MAGNETROL VEGA
5.	CONTROL GUIDED WAVE RADAR	EMERSON HONEYWELL - ENRAF ENDRESS + HAUSER VEGA
6.	CONTROL PANELS & CONSOLES	RITTAL ENCLOTEK LOTUS PYROTECH HOFFMAN

		SCHNEIDER ELECTRIC EVANS
7.	CABLE - SIGNAL & CONTROL	ASSOCIATED CABLE ASSOCIATED FLEXIBLES AND WIRE DELTON UNIVERSAL CORDS CABLES RELIANCE ENGG. NICCO BROOKS THERMOCABLES KEI BELDEN RADIANT LAPP UDEY PYRO CABLES T. C. COMMUNICATIONS PVT. LTD.
8.	CABLE- POWER & EARTH	CCI FORT GLOSTER DELTON CORDS CABLES THERMOCABLE ASSOCIATED CABLE ASSOCIATED FLEXIBLES AND WIRE UNIVERSAL NICCO KEI BELDEN RADIANT LAPP UDEY PYRO CABLES T. C. COMMUNICATIONS PVT. LTD. (TECHNOCAB CABLES) POLYCAB
9.	CABLE TRAY & TRAY COVERS	GRAM ENGG. HOPES METAL

		INDIANA GLOBE ELECTRICALS MM ENGG. CALCUTTA MANUFACTURERS (KOLKATA) ELCON CABLE TRAYS PVT. LTD. RUKMANI
10.	ELECTRICALS PROTECTIVE RELAY	ALSTOM INDIA LTD. (EE) ABB
11.	LAMP CLUSTER / (PUSH BUTTON	SIEMENS LARSEN & TOUBRO BCH
12.	CONTROL & SELECTOR SWITCHES	SIEMENS LARSEN & TOUBRO GE POWER CONTROLS KAYCEE SCHNEIDER ELECTRIC
13.	COMPRESSION FITTINGS	EXCELISOR RELIANCE ENGG. EXCEL HYDRO PNEUMATIC.
14.	AVERAGE PITOT TUBE	STAR-MECH MICRO PRECISION SWITZER INSTRUMENTS LIMITED
15.	ORIFICE PLATE & ACCESSORIES	BALIGA I.L. PALGHAT MICRO PRECISION GENERAL INSTRUMENT GURU NANAK ENG. SPECIALIST.
16.	LIMIT SWITCH	HONEYWELL DANFOSS JAI BALAJI LEVCON DAG BCH TELEMECHANIQUE LARSEN & TOUBRO

		SIEMENS
17.	COMPRESSOR	INGERSOLL RAND KG KHOSLA KIRLOSKAR PNEUMATIC ELGI EQUIPMENTS GODREJ CHICAGO PNEUMATIC
18.	CABLE HIGH VOLTAGE	UNIFLEX CABLE LTD. KEI INDUSTRIES LIMITED POLYCAB WIRES PVT. LTD. RAVIN CABLES LTD. TORRENT CABLES UNIVERSAL CABLES LTD. CABLE CORPORATION OF INDIA RPG CABLES KEC INTERNATIONAL HAVELLS INDIA LTD.
19.	CABLE MEDIUM VOLTAGE - POWER (1.1 KV GRADE)	GEMSCAB INDUSTRIES LTD. KEI INDUSTRIES LIMITED POLYCAB WIRES PVT. LTD. RAVIN CABLES LTD. UNIVERSAL CABLES LTD. RPG CABLES – KEC INTERNATIONAL CRYSTAL CABLES HAVELLS INDIA LTD. FINOLEX CABLE CORPORATION OF INDIA UNIFLEX CABLE LTD.
20.	CABLE - CONTROL / SIGNAL (650 V GRADE)	THERMO CABLES LTD. KEI INDUSTRIES LIMITED POLYCAB WIRES PVT. LTD. RAVIN CABLES LTD. UNIVERSAL CABLES LTD. RPG CABLES – KEC INTERNATIONAL CRISTAL CABLES DELTON CABLES LTD. CABLE CORPORATION OF INDIA

		RPG CABLES FINOLEX INSUCON CABLE & CONDUCTOR PVT. LTD. ORIENT CABLE INDIA PVT. LTD. V GUARD CABLES HAVELLS INDIA LTD.
21.	MOTOR-INDUCTION-MV (FLP & NON-FLP)	BHARAT BIJLEE LTD. CROMPTON GREAVES LTD. KIRLOSKAR ELECTRIC CO. LTD. ABB SIEMENS LTD.
22.	LIGHTING FIXTURES & ACCESSORIES (NON-HAZARDOUS)	BAJAJ ELECTRICALS LTD. CROMPTON GREAVES LTD. PHILIPS INDIA LTD. WIPRO HAVELLS SYSKA GE SURYA ROSHNI OSRAM
23.	CABLE GLAND	DOWELLS SUNILCO COSMOS
24.	CABLE LUGS	DOWELLS COSMOS

Annexure - B

Technical Specification

GLOBAL CONSULTANTS

DATA SHEET AND TECHNICAL SPECIFICATION FOR INSTRUMENTS, EQUIPMENTS AND SYSTEMS

0	27-02-2021	Issued for Approval	PBS	SJ	SKJ	
Rev	Date	Description	Prepared	Reviewed	Approved	Client Review

CONTENTS

1.0 SPECIFICATION FOR INSTRUMENTS, EQUIPMENTS AND SYSTEMS

1.1 FLP LOCAL PUSH BUTTON STATION OUTSIDE TANK DYKE WALL (ROSOV / DBBV)

Sr. No.	Parameter	Minimum Requirements
1	Explosion proof	Zone -1, Gas groups – I, IIA & IIB as per IS: 2148/1981, Temp. Class – T6.
2	Weatherproof	IP 65 or better Degree of protection as per IS: 13947 (Part -1) 1993.
3	Material	Cast Aluminum Alloy (LM6)
4	Finish	Inside & Outside Light Grey Epoxy Powder coated to shade 631 As per IS: 5
5	Earthing	1 No. Inside & 2 Nos outside Brass/ S.S. (M6) screws with washers.
6	Gasket	O Ring endless Neoprene rubber gasket or better
7	Terminals	2.5/4 sq mm clip-on type terminal
8	Cable Entries	¾" NPT cable entries from bottom side or as per design required
9	Indicating Lamp	Open& close Indication Cluster LED type Indication Lamp (240V AC or 24V DC)
10	Contact ratings	5A, 240V AC, 2NO+2NC contact element. / 24 V DC (2 nos.)
11	Push Button	Open – Green push button Close - Stop Push Button of Red mushroom head press to Stop & Reverse turn to release with pad locking arrangement in stop position.
12	Mounting.	Wall / Column type along with canopy
13	Approvals	CMRI & PESO (CCOE)
14	Note	Operation of Local Push button station shall be as per operation philosophy`
15	Cover for Protection & safety	Covered with fabricated Box
16	Indication Lamp	Red for close & green for Open, 230 V Ac, cluster LED type Lamp

Note:

Local push button stations shall be provided outside the Dyke walls of tanks, for operating (ROSOV), DBBV 0of Tanks as applicable to open & close from outside dyke wall.

2.0 CONTROL ROOM EQUIPMENTS

2.1 CONTROL FOR MOTOR OPERATED VALVE (DBBV / MOV)

Each field actuators are to be connected to Master Control Station / PLC over two wire communication link in LOOP Topology with both ends of the loop connected to MCS / PLC or in Redundant LINE topology with each actuators multi dropped and connected to MCS / PLC such that failure / power Off of any actuators / single cable fault shall not cause any loss of control or communication with all the actuators except those which are powered OFF / in between actuators if multiple cable cut occurs.

Supply, installation, powering and commissioning of repeater if required for establishing communication between actuators and MCS / PLC is in the scope of successful bidder. The cable topology so adopted must ensure smooth and fast communication of filed units and MCS / PLC as per OEM's of actuators recommendations for smooth operation of at least 240 actuators per redundant MCS / PLC without loss of data and delayed response. Vendor to get the cable topology to be adopted at site vetted by respective actuator's OEM (site specific) prior to commencement of work. In case the performance and response of the actuators during commissioning are not found satisfactory and job has not been carried out as per OEM's vetted cabling drawing, Client may ask the vendor to redo the entire cabling and termination works as per OEM's recommendations (site specific recommendations) at no additional cost to Client.

Vendor to ensure that all the actuators are properly sealed and proper cable terminations as per termination drawing mentioned on the actuators (in case not available, the same to be sought from Client for free issue actuators) and proper cable glanding are done.

In case during commissioning or at later date if any actuator (free issue or vendor's supply) is found faulty due to water ingress or in correct termination or glanding then the same to be rectified by the vendor at no additional cost to Client during commissioning or CAMC period.
The master Control Station if provided by vendor or free issue item, then the same has to be integrated with TAS over redundant communication link.

All the actuators shall be configured and tested as per for status and control both from field and from Control room as per functional design requirements and all the valves feedback and Control as stated in the specification of the actuators shall be available in TAS.

The supervisory system shall be capable of displaying the status and Tag number of every connected field unit (actuator) or other device associated with the field unit, the system settings, the host protocol messages, the loop performance, any alarms present on the system and the status of any host standby partner. It shall provide a graphical interface to the valves and plant using mimic diagrams to show plant layout.

The system shall permit viewing any or all of the system data, including present parameters in each field unit. It shall also allow the connected actuators or other devices to be operated. A security system

shall be included to prevent access to control and setting of parameters. It shall be possible to set the highest address numbers of connected field units to minimize scanning times.

Real time clock sync with TAS system shall be included for alarm event, time / data marking and it shall be possible to connect a serial event printer from Master station.

The Master station / PLC and field units shall be protected against lightning by the provision of transient suppresser devices on all 2 wire connection ports at 1.5 KV for 1millisecond. Opto / Galvanic isolation shall be used within the field units and Master station / PLC for enhanced noise protection.

All the actuators connected in product lines and dyke drain valves are also to be hardwired through control cable for ESD.

Separate looping to be done for all the actuators connected to sprinklers, foam and hydrant lines. Dedicated GUI along with touch screen monitors as per tender specification to be provided for status and control of actuators connected on sprinkler, foam and hydrant lines. These actuators should not be linked with ESD and can be operated remotely as well as locally even in ESD conditions.
All the actuators connected to sprinkler and the requirements stated in respective actuators and Master Control Station specification and suitable graphical User Interface to be developed showing the plant layout along with valve status and control.

In case actuators are supplied by Vendor and to be retrofitted with existing valves, then suitable adaption kits to be provided and installed at no additional cost to Client.

It the actuators to be integrated are inside tank Dyke wall except for tank water draw off line, separate FLP push button stations to be provided and installed along with canopy and structural support. These push buttons shall be hardwired with the actuators for OPEN, CLOSE and status indication. Close operation from the push button station shall be irrespective of mode (Local / Remote) selected and to be installed just outside dyke wall in such a position that the operator can see the respective valves to the extent possible during operation from the push button station.

2.2 MANAGED NETWORK SWITCH

SR. NO.	PARAMETERS	MINIMUM REQUIREMENTS
1	Type	Layer-2 Industrial Grade Managed Switch
2	Size	Standard Rack-Mount, 1U Height
3	No. of Ports	4 / 8 / 16 / 24 / 32
4	No. of Ports 100 / 1000BASE-TBase SFP combo ports	2 / 4
5	Flash Memory	8 MB on board
6	64 Byte Packet Forwarding rate	9.5 MBPS
7	Switch Capacity	12.8 GBPS or better-
8	Power	240 VAC, 50 Hz, Internal UPS
9	Diagnostic LED Indicator	Power, Console, Link Activity, Speed
10	MAC Address Table Size	8 K
11	Console Port	RS232 or USB-serial console (Type B connector)
12	IP Address Allocation	DHCP, Manual
13	Software	Backup & Restore TFTP configuration TFTP agent
14	Security Management	Web interface (HTTP and HTTPS) Command Line Interface (Serial, Telnet and SSH) SNMP
15	Power Input Voltage	Dual Redundant 110/230 VAC (85 to 264 VAC)
16	Overload Current Protection	Should be Present
17	Reverse Polarity Protection	Should be Present
18	Operating Temperature	-5 deg C to 55 deg C
19	Ambient Relative Humidity	5 to 95% (non-condensing)
20	Standards and Certifications	Safety UL 60950-1, EN 60950-1
		EMI FCC Part 15 Subpart B Class A, EN 55022 Class A, EMS
		EN 61000-4-2 (ESD) Level 3, EN 61000-4-3 (RS) Level 3,
		EN 61000-4-4 (EFT) Level 3, EN 61000-4-5 (Surge) Level 3,
		EN 61000-4-6 (CS) Level 3, EN 61000-4-8, EN 61000-4-11
		Rail Traffic EN 50121-4, Shock IEC 60068-2-27
		Freefall IEC 60068-2-32, Vibration IEC 60068-2-6

2.3 MASTER CONTROL STATION

2.3.1 General

This specification provides the minimum requirements for design, manufacture, supply, inspection & testing of Master Control Station. This standard specification is part of job specifications & it shall be read in conjunction with tender document. The requirements which have not been explicitly identified, but required for the completion and efficient performance of the entire system are in Bidder's scope.

2.3.2 Applicable Codes, Specifications and Standards

International Codes and Standards:

Standard	Description
ANSI / ISA S5.1	Instrumentation Symbols and Identification
API RP552	Recommended Practice – Transmission Systems API RP
ISA S5.4	Instrument Loop Diagrams ISA
ISA-S5.3	Graphic Symbols for DCS / Shared Display Instrumentation Logic and Computer System
IEC 60079	Equipment for Explosive Gas Atmospheres
IEC 60332	IEC 60332 Test on Electrical Cables under Fire Conditions
IEC 60381	Analogue signals for Process Control Systems
IEC 60529 (BS/EN)	Classification of Degrees of Protection Provided by the Enclosures
IEC 60654	Operating Condition for Industrial Process Measurement and Control Equipment
IEC 61131-1	Programmable Logic Controller Standard Requirements
IEC 61508	Functional Safety of Electrical / Electronic / Programmable Electronic Safety Related Systems (excluding field devices)
IEC 61511	Functional Safety- Safety Instrumented Systems for the Process Industry Sector (excluding field devices)
IEEE 802.3	Standard defining the hardware layer and transport layer of (a variant of) Ethernet
ISA S-71.04	Functional Safety- Safety Instrumented Systems for the Process Industry Sector (excluding field devices)
OISD-STD 144	LPG Gas Detection System
OISD-STD 163	Safety of Control Room for Hydrocarbon Industry
OISD-STD 214	Cross-Country LPG Pipelines
PESO / CCOE Certifications	Petroleum and Explosives Safety Organisation (PESO) / Chief Controller of Explosives (CCOE), Nagpur or Director General of Mines Safety (DGMS) in India.

Standard	Description
IEEE 472	Surge withstand capability

2.3.3 Deviations to Specification

The Bidder shall provide an itemized list of any deviations to this specification. These shall be listed on the compliance sheet with seal & duly signed by his authorized signatory & shall be submitted along with offer.

Where a conflict between standards occurs then the Bidder shall seek a clarification ruling from the Owner. Where a deviation from the standard is required, then the Bidder shall make a formal request with full supporting information.

Only those deviations that are agreed between the Owner and the Bidder will be incorporated into the requisition at the time of order.

2.3.4 Conflicting Requirements

In case of conflict between this specification and its associated specifications and the above codes and standards, the Vendor shall bring the matter to the Contractor's attention for resolution and approval in writing. The order of precedence shall be as follows:

First priority:	Statutory Regulations
Second priority:	This Specification
Third priority:	Datasheet
Fourth priority:	Referred Codes & Standards
Fifth priority:	Manufacturer's Standard

Note: Should any conflict arise either before or after order placement the Vendor shall immediately inform the Owner for technical resolution of the conflict.

2.3.5 Environmental Conditions

For plant location and environment condition refer to respective Process Design Basis document.

2.3.6 Hazardous Area Classification and Protection

Instruments located in hazardous area shall be certified to meet or exceed the electrical hazardous area defined by Area classification.

2.3.7 Technical Requirements

1. General:

   Master Control Station (MCS) shall be Microprocessor based and shall be connected with motor operated valve actuators over two wires communications and PLC for remote monitoring and control of the motor operated valves. Master Control Station (MCS) shall be complete with a dedicated keyboard / Touch Screen and a display unit (LCD / LED). It shall be possible to operate the actuators and configure the network devices from the keyboard / display unit. Protection shall be provided in the MCS for selecting configuration mode.

   Master station and field units shall be protected against lightening by the provision of transient suppressor devices on all 2 wire connection ports at 1.5 KV at 1 mS. Opto-isolation / Galvanic isolation shall be used within the field units and Master station for enhanced noise protection.

2. Hot Standby:

   Master Control Station shall be with dual redundant configuration (Hot Standby). The Master Systems shall monitor health status of each other. In the event of failure of one Master Station, the redundant Master Station shall automatically take over. This transfer of control shall be bump less and switch over time shall be less than 1 sec. The status of the standby and the primary units shall be available in the host system at all times. It shall be possible to change control from primary to standby unit either remotely over the communication link or locally by the keypad.

3. Communication between MCS and valve actuators:

   The master control unit shall be connected to each field mounted valve actuator through two wire communication link over LOOP Topology with both ends of the loop connected to MCS / Redundant LINE topology and communicates with actuators for monitoring and control of the valves on MODBUS RS-485 / current protocol / any other internationally accepted communication protocol. The communication protocol so opted must be compatible with the communication protocol of the valve actuators to be supplied with the MCS (if any) / MODBUS RS-485 (existing valve actuators protocol of respective location).

   The master control unit shall perform tasks of data collecting from each actuator, storing the data's and receiving the command signals from PLC and send the same to respective actuators for its operation. It shall be possible to operate the valve from the master station. Vendor shall include necessary software and hardware to establishing communication between actuators & MCS. If any special programming tool is required, the same shall be supplied.

The system shall continuously poll each connected field unit and report any changes in status of the field unit or communication failure. On receipt of any command from the Master Control Station's keypad / touch screen or through the host system, such as a PLC, the command shall take precedence over the data collection, polling shall cease and the command shall be immediately transferred to the field unit.

Provision shall be included to ensure the field units on the 2 wire cable shall not cause loss of control or communication with remaining devices connected to the cable in case any one of the field devices is failed/ powered off. On restoration/ Power ON of the failed unit, it shall be located and communicated automatically. The system shall tolerate a single open, short or ground fault in the 2 wire cable without losing the ability to communicate and control any remaining connected field units.

4. Communication between MCS and PLC (Host Communication):

Master Control station shall be housed in panel located in control room and interfaced with PLC over redundant communication link through MODBUS RS-485 or Ethernet (MODBUS TCP / IP) – Ethernet 10 BaseT or 100 BaseT (IEEE 802.3.)) protocol. Minimum 2 serial and 2 Ethernet ports to be provided for redundant communication of MCS with PLC in addition to any other ports (if required) for configuration etc.

PLC and master station will operate on master / slave mode. Master station shall receive commands like open / close / stop / ESD from the PLC and MCS shall operate the valves. All information about all actuators shall be available at PLC through master station.

5. Feedbacks and Controls:

Following minimum feedback and control of all the actuators connected to MCS over two wire communications shall be available in MCS and PLC through MCS.

Feedbacks:

- Valve opened
- Valve closed
- Actuator fault
- Cable fault
- Continuous Valve Position
- Monitor Relay Trip
- Thermostat trip
- Local stop selected

- Local Control selected
- Valve obstructed
- Valve jammed
- Internal battery low (if provided)
- Diagnostic display

Controls:

- Open fully
- Close fully
- Stop at any time
- Assume an intermediate position
- Assume Emergency Shut Down position

6. Nos. of Actuators per MCS

Each Master Control station / Central control unit shall have capacity to connect and control minimum 240 motor actuated valves. The Field Unit addresses shall be in the range from 1 to 240. The nos. of actuators per loop shall be as per communication standards with or without repeaters.

7. Software & HMI:

The system software shall include all software necessary for operation, displays and configuration of the complete system, along with software for communication with RTU. Software shall also be provided for the detailed diagnostics within the system including in the master control unit and in the network. The system shall also be capable to display all diagnostic alarms including those for field control units, network and of central control unit. Diagnostics shall also identify and display the exact location of network fault. It shall have its dedicated self-diagnostic features to find out faults like cable fault (for cable open and cable short or grounded), actuator communication is not reached and all actuator faults and alarms, etc.) and it shall have real time clock to monitor alarm events / data / faults and it should be in sync with PLC clock.

It shall have facilities to set parameters like baud rate, address, skipping of few actuators during maintenance, etc. It shall have capacity to receive all the specified actuator status, alarms, positions and diagnostics through communication link from each valve actuator. The system configuration shall be stored in the retentive memory. It shall be possible to include or delete any of the MOV from the system from Master Control Station.

It shall have capacity to store and display the following events. The memory size shall be 20% extra for future expansion.

a. Valve actuator and control signals and its operation status.
b. Number of operations of each MOV'S from its normal state.
c. Valve and operator position log
d. Actuator control status log
e. Statistics
f. Historical data/ events
g. Actuator failure information.

2.3.8 Housing for mounting of MCS:

Master Control Station / unit shall be 19" Rack Type and to be mounted in 19" rack cabinet. Cabinet for mounting of MCS along with accessories line MCB, terminal blocks etc. required for commissioning of the MCS and valve actuators are to be provided as detailed below

1. Cabinet Design Requirements

a. Control room Cabinets shall be from approved vendor list with RAL 7032 finish. Plinth shall be black RAL7022.
b. Each cabinet shall be 2000 mm in height bolted to a 100 mm high plinth x 800 mm width x 800 mm depth, with 4 nos. of removable lifting eye bolts. The eye bolt size shall be 4 inch minimum. Blanking plugs shall be provided for lifting eyebolt holes.
c. The cabinet plinth shall be constructed from steel channel section 100mm deep drilled with 4 holes to receive bolts for fixing on cabinet base frame.
d. Side panels of the cabinet shall be fabricated from cold rolled steel sheet of minimum 1.6 mm thickness, while doors shall be of 2.0 mm thickness. Cabinets shall be thoroughly debarred and all sharp edges shall be grounded smooth after fabrication.
e. The enclosures shall be of sheet steel, weatherproof to IEC 60529, degree of protection IP42 as a minimum.
f. Stiffeners shall be provided as necessary to ensure a rigid structure and prevent warping.
g. Front and rear access shall be provided via detachable steel doors, preferably with 180° opening. Doors shall be double leaved type with lockable handles. Bolts and nuts and other fitting material shall be corrosion resistant material.
h. If any system has more than one cabinet, then they shall be designed to be connected together. The Bidder shall advise on the use of side/back plates with regard to ventilation, heat dissipation and interconnection of cabinets.
i. No equipment shall be mounted, inside the cabinet, within 200 mm of the gland plates.

j. All labels shall be in English. Cabinet shall be provided with a permanently fixed trafolite nameplate detailing Cabinet number and function. A drawing pocket shall be attached to the inside of each door, capable of holding a folded A1 size drawing.

k. All cabling to cabinets, cabinets and consoles shall be bottom entry. Split removable gland plates shall be provided fitted with metal brush seals. Cables shall be clamped within the cabinet base utilizing the standard Rittal cable clamp system.

l. Cabinets shall contain sufficient terminal blocks, cable trunks and raceways to accommodate all assigned wiring, plus spares. DC Power Supplies shall be mounted within the cabinets they service.

m. All Internal cabinet components including Power Supplies, relays, fuses and terminals shall be clearly labeled with engraved trifoliate labels. Labels shall not be obscured by wiring or components, nor should they be fitted to cable trunking covers. All power supplies labels shall be in English.

n. All cabinets shall be equipped with internal lights of high efficiencies supplied from the 230V 50Hz Non UPS supply. The light shall be switchable from within the cabinet and segregated from other cabinet wiring.

o. Requirements of System cabinets and Marshalling cabinets are mentioned in this tender document. In case, the system is not large enough then both these cabinets can be combined with system and marshalling sections on opposite sides of the cabinet.

p. Terminals connections within cabinets shall be made using terminal blocks, Crimped lugs and ferrules.

q. Power wiring for 230 VAC 50Hz circuits within the cabinet shall not be less than 2.5 mm2, but otherwise shall be rated for the duty.

2.3.9 Make and Country of Origin:

As per Recommended Vendor List of the Actuators.

3.0 CABLE, CABLE TRAY, JB, EARTHING

3.1 SPECIFICATION OF CABLES

1. FRLS Control Cable

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
1	Make	As per Recommended Vendor List
2	Quantity	As required
3	Type of Cable	Multi core Copper cable
4	Voltage Class	1100 VAC grade
5	Size of Cable	NC x 1.5 sq. mm
6	Applicable standard	IS 1554 Part-1/1988

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT	
	CONDUCTOR		
7	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130	
8	Size	1.5 Sq. mm	
9	No of Strand	7	
10	Diameter of Strand	0.525 mm	
	INSULATION		
11	Material	PVC type C as per IS 5831/1984	
12	Type	Extruded	
13	Thickness	As per Table 2 of IS 1554 (Part-1)	
14	Color Scheme	As per IS 1554 (Part-1)	
		2 cores	Red & Black
		3 cores	Red, Yellow & Blue
		4 cores	Red, Yellow, Blue & Black
		5 cores	Red, Yellow, Blue, Black & Grey
		More than 5 cores	Grey Coloured core with number marked at interval of every 250 mm
	INNER SHEATH		
15	Material	PVC compound type ST2 as per IS 5831/1984	
16	Type	Extruded	
17	Thickness	As per Table 4 of IS 1554 (Part-1)	
	ARMOUR		
18	Material	Galvanized round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanized steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1	
19	Size	As per Table 5 of IS 1554 (Part-1)	
20	Armour Resistance	As per Table 6 of IS 1554 (Part-1)	
21	Galvanization	Shall be as per IS 3975 and IS 10810 (Part 41)	
	OUTER SHEATH		
22	Material	FRLS PVC compound type ST2 as per IS 5831/1984	
23	Type	Extruded	
24	Thickness	As per Table 7 of IS 1554 (Part-1)	
25	Marking on outer sheath	By embossing / printing Make, Year of Manufacture, Voltage grade and Size of cable	
26	Sequential length marking	At every interval of 1 meter	
27	Color	Black	

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
28	Rodent and Termite attack protection	Yes
29	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
30	Temperature Index	Min 250 Deg C to ASTM D 2863
31	HCL Emission	Max 20% by weight to IEC 754-1
32	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
	ELECTRICAL PARAMENTERS	
33	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
34	Minimum volume resistivity (for insulation)	1 x 10 e13 @ 27 deg.C 1 x 10 e10 @ 85 deg.C As per IS 5831 - 1984
35	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour
36	Polyester Tape	Required thickness – 0.023, 100% coverage & 20% overlap
37	Drain Wire/Type/Size	Annealed Tinned, Copper / 0.5 mm^2 / 7Strands/ in contact with the shield
38	Number of Strands/Formation	Flame retorolant , Non hygroscopic, Moisture resistant
39	Filler	Suitable for operating temperature
40	Rip Cord	Non Metallic under inner sheath

Note

1. Cable weight and Conductor weight per meter shall be provided.
2. Rip cord to be provided below the inner sheath

2. FRLS Power Cable

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
1	Make	As per Recommended Vendor List
2	Quantity	As required
3	Type of Cable	3 core, 4 core Copper cable
4	Voltage Class	1100 VAC grade
5	Size of Cable	2.5sqmm, 4 sqmm, 6 sqmm, 10 sqmm

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT			
6	Applicable standard	IS 1554 Part-1/1988			
	CONDUCTOR				
7	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130			
8	No of Strand	7			
9	Size (sq mm)	2.5	4	6	10
10	Diameter of Strand (mm)	0.67	0.85	1.02	1.35
	INSULATION				
11	Material	PVC type C as per IS 5831/1984			
12	Type	Extruded			
13	Thickness	As per Table 2 of IS 1554 (Part-1)			
14	Color Scheme	As per IS 1554 (Part-1)			
		3 core Red, Yellow & Blue			
		4 core Red, Yellow, Blue & Black			
	INNER SHEATH				
15	Material	PVC compound type ST2 as per IS 5831/1984			
16	Type	Extruded			
17	Thickness	As per Table 4 of IS 1554 (Part-1)			
	ARMOUR				
18	Material	Galvanized round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanized steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1			
19	Size	As per Table 5 of IS 1554 (Part-1)			
20	Armour Resistance	As per Table 6 of IS 1554 (Part-1)			
21	Galvanization	Shall be as per IS 3975 and IS 10810 (Part 41)			
	OUTER SHEATH				
22	Material	FRLS PVC compound type ST2 as per IS 5831/1984			
23	Type	Extruded			
24	Thickness	As per Table 7 of IS 1554 (Part-1)			
25	Marking on outer sheath	By embossing/printing Make, Year of Manufacture, Voltage grade and Size of cable			
26	Sequential length marking	At every interval of 1 meter			
27	Color	Black			
28	Rodent and Termite attack protection	Yes			
29	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863			

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
30	Temperature Index	Min 250 Deg C to ASTM D 2863
31	HCL Emission	Max 20% by weight to IEC 754-1
32	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
	ELECTRICAL PARAMENTERS	
33	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
34	Minimum volume resistivity (for insulation)	1 x 10 e13 @ 27 deg.C 1 x 10 e10 @ 85 deg.C As per IS 5831 - 1984
35	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note

1. Cable weight and Conductor weight per meter shall be provided.
2. Rip cord to be provided below the inner sheath.

3. FRLS SIGNAL CABLE

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
1	Make	As per Recommended Vendor List
2	Quantity	As Required
3	Type of Cable	Single / Multi pair / Triad Shielded Copper Signal cable
4	Voltage Class	500 V Grade
5	Size of Cable	NP x 1.5 sq mm / NT x 1.5 sq mm
6	Applicable Standards	BS EN 50288 - 7
	CONDUCTOR	
7	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7
8	Size	1.5 Sq. mm
9	No of Strand	7
10	Diameter of Strand	0.53 mm
	INSULATION	
11	Material	PVC Type TI53 to BS EN 50290-2-21
12	Type	Extruded

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
13	Thickness (Minimum)	0.44mm as per Table 1 of BS EN 50288 - 7
14	Colour Scheme of Pair	BLACK & WHITE
	Pair Identification	One core of each pair / triad will be number printed at an interval of 250 mm
	INDIVIDULA PAIR & OVERALL SHIELD	
15	Material	Pair and over all Shield with Al mylar tape
16	Type	Helical
17	Thickness(Min)	0.05 mm
18	Coverage	25% overlap on either side & 100% Coverage
19	Pair twist	10~15 twists / mtr uniformly
20	Drain wire Material	Annealed tinned Copper in continuous contact with Aluminum side
21	Drain wire Resistant size	30 Ohm/Km / 0.5 sq mm dia. / 7 strands / 0.3 mm
	INNER SHEATH	
22	Material	PVC Type TM53 to BS EN 50290-2-22
23	Type	Extruded
24	Thickness (Nominal)	As per BS EN 50288 - 7
25	Rip cord	Required, Non-metallic type below inner sheath
	ARMOUR	
26	Material	0.9 mm Galvanized round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4 mm x 0.8 mm Galvanized steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1
	OUTER SHEATH	
27	Material	FRLS PVC Type TM53 to BS EN 50290-2-22
28	Type	Extruded
29	Thickness (Nominal)	As per BS EN 50288 - 7
30	Color	Blue
31	Marking on outer sheath	By embossing / printing Make, Year of Manufacture, Voltage grade and Size of cable
32	Sequential length marking	At every interval of 1 meter
33	Rodent and Termite attack protection	Yes
34	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863
35	Temperature Index	Min 250 Deg C to ASTM D 2863

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
36	HCL Emission	Max 20% by weight to IEC 754-1
37	Smoke Density	Max Smoke Density Rating shall be 60%, tested as per ASTM D 2843.
	ELECTRICAL PARAMENTERS	
38	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
39	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
40	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
41	L/R Ratio	Better than 40 microH/ohm
42	Electrostatic noise rejection ratio	over 76 dB
43	HV Test Core to Core & Core to Screen	2.0 KV for 1 minute

Note

1. Binder Tapes to be provided below and above individual and overall shield.
2. Cable weight and Conductor weight per meter shall be provided.
3. Rip cord to be provided below the inner sheath.

4. FS Control Cable

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
1	Make	As per Recommended Vendor List
2	Quantity	As required
3	Type of Cable	Multi core Copper cable
4	Voltage Class	1100 VAC grade
5	Size of Cable	NC x 1.5 sq. mm
	CONDUCTOR	
6	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130
7	Size	1.5 Sq. mm
8	No of Strand	7
9	Diameter of Strand	0.525 mm
	INSULATION	

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT	
10	Material	Mica Glass+EPR / XLPE or Silicon	
11	Type	Extruded	
12	Thickness (Min)	0.7 mm	
13	Color Scheme	As per IS 1554 (Part-1)	
		2 core	Red & Black
		3 cores	Red, Yellow & Blue
		4 cores	Red, Yellow, Blue & Black
		5 cores	Red, Yellow, Blue, Black & Grey
		5 cores	Grey Coloured core with number marked at interval of every 250 mm
	INNER SHEATH		
14	Material	Low Smoke zero Halogen compound	
15	Type	Extruded	
16	Thickness	As per Table 4 of IS 1554 (Part-1)	
	ARMOUR		
17	Material	Galvanised round steel wires over inner sheath where calculated diameter below armouring < 13 mm OR Galvanised steel strips over inner sheath where calculated diameter below armouring > 13 mm as per IS 1554 Part 1	
18	Size	As per Table 5 of IS 1554 (Part-1)	
19	Armour Resistance	As per Table 6 of IS 1554 (Part-1)	
20	Galvanisation	Shall be as per IS 3975 and IS 10810 (Part 41)	
	OUTER SHEATH		
21	Material	Low Smoke zero Halogen compound	
22	Type	Extruded	
23	Thickness	As per Table 7 of IS 1554 (Part-1)	
24	Marking on outer sheath	By embossing / printing Make, Year of Manufacture, Voltage grade and Size of cable	
25	Sequential length marking	At every interval of 1 meter	
26	Colour	Black	
27	Rodent and Termite attack protection	Yes	
28	Oxygen Index	Min 29 at 27 Deg C to ASTM D 2863	
29	Temperature Index	Min 250 Deg C to ASTM D 2863	

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
30	HCL Emission	Max 0.5% by weight to IEC 754-1
31	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
32	Fire Survival test	As per IEC 60331-11 Flame at 750 deg C for 90 minutes
	ELECTRICAL PARAMENTERS	
33	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
34	Minimum volume resistivity (for insulation)	1 x 10 e13 @ 27 deg.C 1 x 10 e10 @ 85 deg.C As per IS 5831 - 1984
35	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note

1. For XLPE insulation - applicable standard shall be IS-7098.
2. For EPR and silicon insulated cables - applicable standard shall be IS-9968.
3. Cable weight and Conductor weight per meter shall be provided.
4. Rip cord to be provided below the inner sheath.
5. Fire Barrier tape to be provided.

5. FS Power cable

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT			
1	Make	As per Recommended Vendor List			
2	Quantity	As required			
3	Type of Cable	3 core, 4 core Copper cable			
4	Voltage Class	1100 VAC grade			
5	Size of Cable	2.5s qmm, 4 sqmm, 6 sqmm, 10 sqmm			
	CONDUCTOR				
6	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of IS 8130			
7	No of Strand	7			
8	Size (sq mm)	2.5	4	6	10

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT			
9	Diameter of Strand (mm)	0.67	0.85	1.02	1.35
	INSULATION				
10	Material	Mica Glass+EPR / XLPE or Silicon			
11	Type	Extruded			
12	Thickness(Min)	0.7 for 2.5 sq. mm & 4 sq.mm,			
		0.82 mm for 6 sq. mm & 10 sq. mm			
13	Color Scheme	As per IS 1554 (Part-1)			
		3 core Red, Yellow & Blue			
		4 core Red, Yellow, Blue & Black			
	INNER SHEATH				
14	Material	Low Smoke zero Halogen compound to BS EN 50290-2-26			
15	Type	Extruded			
16	Thickness	1.0 mm Nom and 0.8 mm Min			
	ARMOUR				
17	Material	Galvanized round steel wires over inner sheath where the calculated diameter below armouring < 13 mm OR Galvanized steel strips over inner sheath where the calculated diameter below armouring > 13 mm as per IS 1554 Part 1			
18	Size	As per Table 5 of IS 1554 (Part-1)			
19	Armour Resistance	As per Table 6 of IS 1554 (Part-1)			
20	Galvanization	Shall be as per IS 3975 and IS 10810 (Part 41)			
	OUTER SHEATH				
21	Material	Low Smoke zero Halogen compound to BS EN 50290-2-26			
22	Type	Extruded			
23	Thickness	As per Table 7 of IS 1554 (Part-1)			
24	Marking on outer sheath	By embossing/printing Make, Year of Manufacture, Voltage grade and Size of cable			
25	Sequential length marking	At every interval of 1 meter			
26	Color	Black			
27	Rodent and Termite attack protection	Yes			
28	Oxygen Index	Min 30 at 27 Deg C to ASTM D 2863			
29	Temperature Index	Min 275 Deg C to ASTM D 2863			
30	HCL Emission	Max 2 % by weight to IEC 754-1			
31	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.			
32	Fire Survival test	As per IEC 60331-11			

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
		Flame at 750 deg C for 90 minutes
	ELECTRICAL PARAMENTERS	
33	Maximum resistance of the conductor of complete cable at 20 deg.C	As per Table 2 of IS 8130
34	Minimum volume resistivity (for insulation)	1 x 10 e13 @ 27 deg.C 1 x 10 e10 @ 85 deg.C As per IS 5831 - 1984
35	High voltage test	3 KV rms for 5 min between core to core 3 KV rms for 5 min between core to armour

Note

1. For XLPE insulation - applicable standard shall be IS-7098.
2. For EPR and silicon insulated cables- applicable standard shall be IS-9968.
3. Cable weight and Conductor weight per meter shall be provided.
4. Rip cord to be provided below the inner sheath.
5. Fire Barrier tape to be provided.

6. FS SIGNAL CABLE

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
1	Make	As per Recommended Vendor List
2	Quantity	As Required
3	Type of Cable	Single/Multi Pair/Triad Shielded Copper Signal cable
4	Voltage Class	500V Grade
5	Size of Cable	NP x 1.5 sq mm/NT x 1.5 sq mm
6	Applicable Standards	BS EN 50288 - 7
	CONDUCTOR	
7	Material	Multi-stranded Electrolytic annealed bare copper as per conductor class 2 of BS EN 50288 - 7
8	Size	1.5 Sq. mm

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
9	No of Strand	7
10	Diameter of Strand	0.53 mm
	INSULATION	
11	Material	Mica Glass+EPR / XLPE or Silicon
12	Type	Extruded
13	Thickness (Minimum)	0.6 mm
14	Color Scheme of Pair	BLACK & WHITE
15	Pair Identification	One core of each pair / triad will be number printed at an interval of 250 mm
	INDIVIDUAL PAIR & OVERALL SHIELD	
16	Material	Pair and overall Shield with Al mylar tape
17	Type	Helical
18	Thickness(Min)	0.05 mm
19	Coverage	25% overlap on either side & 100% Coverage
20	Pair twist	10~15 twists / mtr uniformly
21	Drain wire Material	Annealed tinned Copper in continuous contact with Aluminum side
22	Drain wire Resistant size	30 Ohm/Km / 0.5 sq mm dia. / 7 strands / 0.3 mm
	INNER SHEATH	
23	Material	Low Smoke zero Halogen compound to BS EN 50290-2-26
24	Type	Extruded
25	Thickness (Nominal)	As per BS EN 50288 - 7
26	Rip cord	Required, Nonmetallic type below inner sheath
	ARMOUR	
27	Material	0.9 mm Galvanized round steel wires over inner sheath where calculated diameter below armouring < 15 mm OR 4 mm x 0.8 mm Galvanized steel strips over inner sheath where calculated diameter below armouring > 15 mm as per EN 10257-1 and EN 10218-1
	OUTER SHEATH	
28	Material	Low Smoke zero Halogen compound to BS EN 50290-2-26
29	Type	Extruded
30	Thickness (Nominal)	As per BS EN 50288 - 7
31	Color	Blue
32	Marking on outer sheath	By embossing / printing Make, Year of Manufacture, Voltage grade

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT
		and Size of cable
33	Sequential length marking	At every interval of 1 meter
34	Rodent and Termite attack protection	Yes
35	Oxygen Index	Min 30 at 27 Deg C to ASTM D 2863
36	Temperature Index	Min 275 Deg C to ASTM D 2863
37	HCL Emission	Max 2.0 % by weight to IEC 754-1
38	Smoke Density	Max Smoke Density Rating shall be 20% and min light transmission of 80%, tested as per ASTM D 2843.
39	Fire Survival test	As per IEC 60331-11 Flame at 750 deg C for 90 minutes
	ELECTRICAL PARAMENTERS	
40	Max. Conductor resistance at 20 deg C	12.30 Ohm/Km
41	Mutual capacitance @1 KHz between adjacent core	250 pF/Mtr
42	Max. Capacitance between any core & screen @ 1 KHz	400 pF/Mtr
43	L/R Ratio	Better than 40 microH/ohm
44	Electrostatic noise rejection ratio	over 76 dB
45	HV Test Core to Core & Core to Screen	2.0 KV for 1 minute

Note

1. For XLPE insulation - applicable standard shall be IS-7098.
2. For EPR and silicon insulated cables- applicable standard shall be IS-9968.
3. Cable weight and Conductor weight per meter shall be provided.
4. Rip cord to be provided below the inner sheath.
5. Fire Barrier tape to be provided.
6. Binder Tapes to be provided below and above individual and overall shield.

7. FIBER OPTIC CABLE

SL. NO.	DESCRIPTION	SPECIFICATION / MINIMUM REQUIREMENT

1	Type of Fiber	Single Mode
2	Specification	IEC 60793-2-50, ITU G.652
3	Construction	Multi-Fiber loose tube jelly filled
4	No. of fibers	6 / 12
5	No. of loose tube	1
5	Laying	Direct Burial (Underground) / Inside HDPE conduit / cable tray (Above Ground)
6	Strength member	2 Nos. of steel wires
7	Armour	G.I. / Electrolytic chrome coated steel
8	Overall sheath	Tough weather resistant made High Density Polyethylene compound (HDPE) with anti-termite and anti-rodent properties.
9	Attenuation at 1310 nm	0.38 dB/Km
10	Attenuation at 1550 nm	0.25 dB/Km
11	Fiber cutoff wavelength	> 1150 < = 1320 nm
12	Polarization Mode Dispersal (PMD)	≤0.5 /√km
13	Microbending loss at 1550 nm	≤0.05
14	Proof stress level	≥ 0.7 Gpa

Note

1. Optical fibers shall be with buffer loose tube filled with Thixotropic Gel. Cable shall be rodent and termite resistant and designed to protect the fibers from environmental hazards in direct burial use.
2. Internal test certificate for attenuation and length shall be available

Earth Cable

All the instruments and Junction Boxes to be earthed using 1C X 6 Sq. mm Flexible copper insulated green wire.

8. CAT 6 Ethernet cables

S. NO.	DESCRIPTION	MINIMUM REQUIREMENT
1	Type of Cable	Armoured CAT 6 cable Pair-shielded 100 Ohm installation cable with overall braided screen, suitable for transmission frequencies of up to 650 MHz, 4 x 2 x 0.56 mm.

2	Conductor	4 pair STP cable 23 AWG Annealed bare stranded copper
3	Primary insulation	Polyethylene insulation
4	Outer Sheath	Low-smoke in acc. with IEC 61034, flame-retardant in acc. with IEC 60332-1 and halogen-free in acc. with IEC 60754-2. Cable jacket material LSZH Cable jacket characteristics cable, metal-free
5	Armour over inner sheath	Required
6	Shielding	Screened to ensure protection against EMI and for cross talk compliance.
7	Application standard	ISO / IEC 11801 2nd Ed., EN 50173-1 May 2007 (DIN EN 50173-1), DIN 44332-5, IEC 61156-5 2nd Ed., EN 50288 x-1, 10GBase T in acc. with IEEE 802.3, tested and certified by independent laboratory. TIA/EIA 568.B
8	Application	Indoor / outdoor installation Maximum permissible – 70 mtrs for one point to another.

CABLE LAYING

Cabling Philosophy

- All Power, signal and Control field cables shall be FLRS armoured copper cables except for cables used inside tank dyke wall and ROSOV cables as per tender specifications. All cables inside tank dyke wall and ROSOV control cables shall be Fire Survival Multi core cable of 1.5 mm2 as per OISD.
- All signal and control cables shall have core sizes minimum 1.5 sqmm and power cables of minimum size 2.5 sqmm or as per actual load requirement whichever is higher. In the event of limitation in cable gland sizes entry in batch controller, lower sizes cables of min core size 0.75 sqmm or as per load requirement whichever is higher can be used from batch controller to respective Loading point JB.
- All cables from tank farm Junction box to tank farms covering all instruments inside tank farm shall be fire resistant cables and testing as per IS-9968 / IEC 60331.
- Optical fibre cable along with along with OFC components (conversion kit) shall be considered for inter building LAN cabling if the distance between the two buildings are more than 100 M. Ie from Control room (CR) to Security room, CR to S&D building, CR to TM room & CR to lock room (invoice generation room). OFC cable shall also be laid for connecting CCTV cameras, etc.
- All Power, Signal & Communication cables from Control room to respective field junction boxes shall have 20 % spare cores.
- All Power, Signal & Communication cable from Control room to Main JB at the Gantry shall be laid in two runs where each run shall be suitable for 50% of theeach Gantry (Each battery of TLF). Each run shall have 20 % spare capacity.
- All Power, Signal & Communication cable from Control room to Main JB at the Tank Farm for above ground tanks shall be laid Product wise which shall have 20 % spare cores.

- All Power, Signal & Communication cable from Control room to Main JB at the Tank Farm for Underground tanks shall be laid in single run which shall have 20 % spare cores.
- Other power, signal, control, CAT 6, communication cables etc. to be used as per tender specification / Technical requirements and OEM's recommendations.

Cable Laying:

All armoured power, control & signalling cables shall be laid above ground over Aluminium cable trays. In case cables are required to be laid underground in extreme conditions, then the same to be laid in RCC trenches with RCC cover at driveways with cable trays fixed on the side wall of the trenches or inside NP3 hume pipe at road crossing or inside HDPE pipes buried underground not less than 300 mm deep in tank farm area along with PCC after laying of the cables if catwalk not available.

Power and signal cables shall have to be laid in separate pipes or on separate cable trays as the case may be, by adequate spacing of min. 300 mm. Bending radius of armoured cables shall not be less than 12 times O.D. of cable. Necessary loops to be provided at both ends. There shall be no joints in the cables.
HDPE pipes if used, it shall have dia minimum 25 mm for single cable and 50 mm for two cables. For higher number of cables, suitable size of the pipe is to be considered.

Supply of anodized Aluminium perforated type cable trays along with cable tray cover (2.5 mm Thick 25 mm edge height), fixing at site by doing necessary welding on steel structure, laying of cable trays over the pedestals including making of pedestals wherever required are all included in the scope of work.

The perforated trays shall be properly supported at a regular interval of maximum 1000 mm from insert plates or steel structures. Wherever insert plates are not available, supports on concrete structures on ceiling shall be fixed with minimum 10 mm diameter expansion bolts. Angle supports for perforated trays shall be fabricated from 40mm x 40mm x 5mm MS angles minimum size. The cable within cable tray shall be clamped with Al clamp. GI wire or nylon tie are not to be used. All cable trays shall be covered along with clamp at every 1 m.

All cores of cable shall be identified at both ends by means of PVC ferrule. Ferrules shall be of single sleeve type. Ferrule numbering shall be source destination type (cross ferruling). Cable leads shall be terminated at both ends by crimped type soldering.

The cost for making RCC trenches or overhead cable bridge shall be paid separately, however cost of cable trays, supports for trays at regular intervals, Hume pipes, HDPE pipes etc shall be part of cable laying and no separate payment shall be made.

For RCC trench, minimum depth shall be 750 mm from ground to the top of cables, 600 mm width and minimum 250 mm wall thickness with RCC cover of minimum 150 mm thick. Bottom of the trench shall be PCC of minimum 100 mm thick.

Wherever the cables have to cross the asphalt roads, the rate quoted shall include cutting of the asphalt and WBM roads including soling and necessary excavation to the required depth, laying of hume pipe and back filling the trench with river sand and restoring the asphalt / WBM roads to its original condition including compacting and rolling the surface.

Cable routing shall be planned to be away from heat sources, gas, water, oil, drains piping air conditioning duct etc. Cables are identified close to their termination point (Cable numbers are to be punched on aluminium straps of minimum 2 mm thick and securely fastened to the cable, wrapped around it) and also along the route at recommended intervals, by cable number tags.

As far as possible, each cable tray shall contain only one layer of cables and minimum required vertical clearance between racks is maintained. All wall openings / pipe sleeves are effectively sealed after installation of cables to avoid seepage of water inside building/lined trench. MCT blocks to be provided at cable entry points inside Control Room and S&D building. The cost of same to be included in cabling cost. No separate payment for the same to be paid.

Where cables rise from trenches to Instruments, junction boxes, control station, panels etc. these are to be taken through HDPE / GI protection pipe sleeves ends of which should be sealed after cabling. Conduit ends are to be plugged with approved weather proof sealing plastic compound. At road crossing and other places where cables enter pipe sleeves, recommended bed of sand and bricks are to be provided so that the cable do not slacken and get damaged at pipe ends. Metallic pipe ends if used should be bell mouthed. A separate earth strip is run along each cable tray. Equipment earthing is taken from the earth grid and not from the cable rack earthing. Cables are clamped on trays using aluminium clamps at intervals not exceeding 1 meters.

Cable Termination

Identification number tags of the cable for the equipment are to be provided correctly at both ends of the cable. The tag size is not less than 2 mm thick and 20 mm wide and of enough length to contain all required details. Cable termination is done with proper crimpling lug and use of antioxidant paste. Wherever lugs are used for termination, size of lug matches with cable core and material of lug is suitable for application. Proper mechanical protection shall be provided support of cable.

The scope shall include

1. Supply laying and termination of 1C x 6 Sq. mm Flexible copper insulated green wire for earthing instruments and junction boxes to earth grid. Earthing to be done as per OEM's recommendation and preferably double earthing to be provided.
2. Supply, laying, jointing 50 x 6 mm GI flat from earth pit to TLF Gantry.
3. Earth work, excavation for all kinds of soil as per cable trench cross section drawing including shorting, shuttering, dewatering etc. as per instruction of engineer in charge (750 mm depth).
4. Supply and laying of approved class B Bricks of size 9" X 4" X 3" (Brick flat soiling underneath PCC) in cable trenches as per specification and direction of site in charge.
5. WBM Road, Dyke cutting, concrete breaking for cable trenches including shoring, strutting etc., if required and repairing of the road, dyke to original condition and disposing off excess materials within the work site as per direction of site engineer. Breaking the existing RCC work and disposing off the malba to an unobjectionable place as per the instruction of the site engineer. Job shall be complete in all respect including the cost of all labour, tools, materials, load lift hire charges of equipments if any.
6. Supply, erection and installation of cable trays along with structural support in trenches already made, on walls, concrete structures etc. including supply and installation of all necessary pipe fittings such as bends, sockets, elbows, tees etc. bending threading, binding etc. as required for laying of cables in road, station piping crossing and cable rising up to instruments as per direction of site engineer including the cost of all materials, labour, tools etc. complete in all respects.

3.2 EARTHING SYSTEM DESIGN & SPECIFICATION

All junction boxes, local cabinets, field mounted instruments shall be connected to the nearby earth bus bar / earth pit through minimum 6 mm^2 Insulated copper conductor.

All joints in the pipeline, valves and associated equipment shall be made electrically continuous by bonding. The resistance value between each joint shall not exceed 1 ohm.

Earthing network shall be realized with earth electrodes and / or buried bare conductors.

Two types of earthing system shall be envisaged –

- Main earthing system (ME)
- Electronic earthing system (EE)

In general, the following rules shall apply for earthing

- The metallic housing of electronic equipment / junction box / panel shall be connected to the main earthing system (ME).
- All armours of armoured cables shall be connected to the earth (ME) at both ends.

- The shield of the shielded cable shall be earthed with electronic earth at one end only i.e. at control room end.

The main Earthing System (ME) and Electronic Earthing system shall be in separate loop and not to be interconnected.
In general, the earth conductor between cabinets / instruments / junction box up to the local earth bus of ME shall be 6 mm^2 insulated copper conductor.

The entire earth pits (ME) shall be connected to form a grid using 50 X 6 mm2 GI strips and the same to be connected to existing grid. All branch earth conductors from each field unit shall be connected in loop the main grid. Double earthing is to be provided for all electrical actuators and other instruments as per OEMs recommendations.

EARTH PITS

Separate earth pits shall be provided for system earth, IS earth, power earth, and general body earth for instruments, equipments, junction box body etc. These earth pits shall be separate and isolated from electrical earth pits. Individual Earth pits resistance and grid resistance shall be as standard codes and accordingly nos. Of earth pits / electrodes shall be considered. For system earth redundant earth pits shall be provided and to be connected form ring loop. Earth pit (ME), earth electrodes, earthing connection etc. shall be as per IS – 3043 standards with electrode length 3m and dia. 100 mm. Maintenance free earth electrodes of minimum 3m length and 100 mm dia. can also be used.

The earth electrode(s) for EE shall be of the same type as those for the ME, but in addition shall be placed in a galvanized steel pipeline for a depth of 4m to shield the electrode from surface earth stray currents, which may cause unwanted interference.

Instrument Grounding System

In principle, grounding earth for instruments shall be provided in compliance with instrument manufacturer's recommendation. However, two independent earth pits shall be provided for following

Signal Earth Low voltage / IS signals (Shield) etc. shall be connected to this earth. Grounding shall have 1 ohms or less than 1 ohms earth resistance unless otherwise recommended by System manufacture. When recommended by system manufacturer for independent earth pit it shall be provided as specified.

Power Earth The frame of Panels / cabinets / junction boxes, instrument body etc. shall be connected to this earth. Power earth for high voltage level of 240 / 110 VAC shall be connected to this grounding. Earth resistance shall be 5 ohms or less than 5 ohms for standard electrical earth pits in this project.

TT body earthing: Separate redundant earth pit to be provided for TT earthing through earthing device / grounding units. The earthing cable/ strip should not touch the TLF structure.

Earthing

Each panel, cabinet, console and other equipment in control room shall be provided with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.
88 Redundant earth pits & bus shall be provided for the system earth. Both earth pits shall be connected to form a ring. Suitable distance shall be maintained between various earth pits (minimum 3 meters) as per guidelines of API RP550.

Separate earth-pit networks are desirable for various instrumentation sub-systems like PLC earth, cable-screen earth, chassis earth, power earth etc. so that the problem in one system is not affecting the other system

All circuit grounds of electronic instruments, shields and drain wires of signal cables shall be connected to instrument ground bus which is electrically isolated from the AC mains earthing bus. This bus shall be typically 25mm wide and 6 mm thick of copper or 50 x 6 GI strip.

The instrument ground bus is connected to independent instrument system ground buses through insulated wires.

Earth-pit head must be covered properly, and clearly visible identification tags indicating earth pit no, Earth pit resistance and date of testing etc. as per direction of site in-charge.

Periodic checks of each earth pit shall be carried out and maintenance record must be kept.

The earthing cables from the earth-pit to the respective systems shall be insulated and use of bare cable / strips shall be avoided. Such cable shall be laid away from power cables etc.

3.3 EXPLOSION PROOF JUNCTION BOX

SR. NO.	DESCRIPTION	MINIMUM REQUIREMENT
1	Body & Cover	Cast Al. Alloy (LM-6) minimum 5 mm thick.
2	Gasket	Neoprene rubber
3	Terminals	Clip on type, block locked at both ends suitable for up to 2.5 mm 2 conductor.
4	Tag nameplate	to be provided
5	Paint	Anti-corrosive epoxy paint, shade light gray

SR. NO.	DESCRIPTION	MINIMUM REQUIREMENT
6	Protection class	Suitable for area classified as zone-I, IIA & IIB, T6 as per IS2148 IP – 65 or better as per IS – 2147
7	Other	Explosion proof junction boxes shall have detachable cover, which is fixed, to the box by means of cadmium plated hexagonal head screws. Terminal shall be spring loaded, vibration proof, clip-on type, mounted on nickel plated steel rails complete with end cover and clamps for each row. Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines 50 to 60 mm between terminals and sides of box parallel to terminals strip for up to 50 terminals and additional 25 mm for each additional 25 terminals. 100 to 120 mm between terminals for up to 50 terminals and additional 25 mm for each additional 25 terminals. All junction boxes shall be provided with external earthing lugs All junction boxes shall be provided with 20% spare cable entries and terminals. Each junction boxes shall have a minimum of 10% or 2 Nos. whichever is higher, spare entries. All spare entries shall be with EXD plugs. All cable glands and plugs shall be of nickel-plated brass material. All the cable glands shall be preferably NPT with PVC hoods unless otherwise specified. Double compression type cable glands shall be used for armoured cable.

SPECIFICATION FOR SUB DISTRIBUTION BOARDS

0	27-02-2021	Issued for Approval	PBS	SJ	SKJ	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

TABLE OF CONTENTS

1.0 SCOPE

This standard covers the technical requirements of design, manufacture, testing at works and delivery in well packed condition of distribution boards.

2.0 DISTRIBUTION BOARDS

2.1 AC DISTRIBUTION BOARDS

2.1.1 General

a. Distribution boards shall comprise factory assembled and wired, totally enclosed, metal clad fabricated from 14-gauge M.S. sheet with gasket at all points or shall be readymade as specified in the material list.
b. It shall be of double door type with hinged (lockable if required) door suitable for recessed mounting in wall. Distribution boards shall be epoxy powder coated with minimum 7-tank process application for de-rusting, de-greasing, rinsing, phosphate etc.
c. The distribution boards shall be provided with phase barriers, wiring channels to accommodate wires and individual per phase neutral links. There shall be separate or individual earth link as per requirement. Proper arrangement shall be made for mounting of MCCB's / MCB's and other accessories.
d. Distribution boards shall meet with the requirements of IS: 2675 and marking arrangement of bus bars shall be in accordance with I.S. relevant standards. Updated and current Indian Standard Specifications codes of practice will apply to the equipment and the work covered by the scope of this contract.
e. In addition, relevant clauses of the Indian Electricity Act 1910, Indian Electricity Rules 1956, National Building Code 2007, National Electric Code 2011, Codes of Practice for Fire Safety of Building (general): General principal and Fire Grading – IS 1641 – 1988 as amended up to date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and / or IEC Standards shall be applicable.

Miniature Circuit Breakers for AC circuits	IS 8828 – 1996 and IEC 947
Residual current operated circuit breakers	IS12640 – 1988
Low voltage switch gears and control gear part-II	IS 13947 – 1993
Degrees of protection provided by enclosures for low Voltage switchgear	IS 10118 – 1982
General requirements for switchgear and control gear For voltages not exceeding 1000 volts	IS 4237 – 1982

2.1.2 Bus Bar

a. Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 40 °C over the ambient temp of 50 °C. Each board shall have two separate earth terminals. Circuit diagram indicating the load distribution shall be pasted on the inside of the DB as instructed. One earth terminal for single phase and two terminals for 3 phase DB's shall be provided with an earth wire as per table 250.122 of NEC 2008 connecting the studs and the outgoing ECU earth bar. The degree of protection for the distribution board should be IP 42.
b. The bus bars shall be supported on non-breakable, non-hygroscopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand operating temperature of 110°C at regular intervals, to withstand the forces arising from a fault level of 16 / 10kA as stipulated in SLD. The bus bar shall be hard drawn annealed tinned ETP grade copper.
c. The top and the bottom faces of the D.B. shall be provided for conduit entry of minimum 20 mm. dia. The faces if asked shall be kept detachable.
d. All outgoing feeders shall terminate on a terminal strip which in turn is interconnected to the MCB / Fuse base by means of insulated multi strand copper conductor, FR PVC insulated copper wires as follows

Up to 15 A	2.5 sq. mm.
25 A	4.0 sq. mm.
32 A	6.0 sq. mm.
40 A	10 sq. mm.
63 A	16 sq. mm.

e. Each DB shall have indicating lamps preferably neon type denoting power availability in the board after the switch, indicating lamps shall be complete with fuses.

2.1.3 Moulded Case Circuit Breaker

I. General

a. Moulded-Case Circuit Breakers (MCCB) shall comply with IS 13947: 1993 standards.
b. They shall be of utilization category A on all the operational voltage range – till 250 A and category B on all the operational voltage range – for any rating with adjustable short time delay (if specified) with a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) up to 500 V for the greater ratings
c. They shall have a rated operational voltage of 690 V AC (50 Hz)
d. They shall have a rated insulation voltage of 800 V AC (50 Hz)
e. They shall be suitable for isolation, as defined by IS 13947: 1993 for the Overvoltage Category IV for a rated insulation voltage up to 690 V.
f. MCCBs shall be designed according to Eco-design complying with ISO 14062 Especially MCCB's materials shall be of halogen free type. They shall be supplied in recyclable packing complying with European Directives.
g. The manufacturer shall implement non-polluting production processes that do not make use of chlorofluorocarbons, chlorinated hydrocarbons, ink for cardboard markings, etc.
h. MCCBs shall be available in plug-in versions in 3-pole and 4-pole versions. A safety trip shall provide advanced opening to prevent connection and disconnection of a closed-circuit breaker
i. MCCBs shall be designed for both vertical and horizontal mounting, without any adverse effect on electrical performance. It shall be possible to supply power either from the upstream or downstream side MCCBs shall provide class II insulation between the front and internal power circuits.

j. Rated short circuit (breaking capacity) shall be 50kA and making capacity shall not be less than 105kA.

II. Construction, Operation, Environment

a. For maximum safety, the power contacts shall be insulated in an enclosure made of a thermosetting. material from other functions such as the operating mechanism, the case, the trip unit and auxiliaries
b. All poles shall operate simultaneously for circuit breaker opening, closing and tripping.
c. MCCBs shall be actuated by a handle that clearly indicates the three positions: ON, OFF and TRIPPED.
d. In order to ensure suitability for isolation complying with IS 13947: 1993:

- the operating mechanism shall be designed such that the toggle or handle can only be in OFF position (O) if the power contacts are all actually separated
- in OFF position, the handle shall indicate the isolation position.

e. Isolation shall be provided by a double break on the main circuit.
f. MCCBs shall be able to receive a device for locking in the “isolated” position, with up to 3 padlocks, O8 maximum.
g. MCCBs shall be equipped with a “push to trip” button in front to test operation and the opening of the poles.
h. MCCB rating, “push to trip” button, performances and contact position indication must be clearly visible and accessible from the front, through the front panel or the door of the switchboard.

III. Current Limitation, Discrimination, Durability

a. All the MCCBs shall be equipped with a tripping unit type.
b. MCCBs shall comprise a device, designed to trip the circuit-breaker in the event of high-value (50 kA) short-circuit currents. This device shall be independent of the thermal-magnetic or electronic trip unit.

c. MCCBs, the current ratings of which are identical with the ratings of their trip units, shall ensure discrimination for any fault current up to at least 25 kA rms, with any downstream circuit-breaker having a current rating less or equal to 0.4 times that of the upstream circuit-breaker.
d. The electrical durability of MCCBs shall be as defined by IS 13947: 1993 standard.
e. MCCBs shall be equipped with a self-test of the connection between the electronic trip unit, the current transformers and the actuator, that will not cause the circuit breaker to trip. The self-test will be of positive logic and visible through the flashing of a green LED in case the self-test occurred correctly and the extinction of the LED in case the self-test failed.
f. The MCCB shall trip in case the environmental conditions of the circuit-breaker get out of their specified range. However, it will be possible to overrule this feature.

IV. Auxiliaries and Accessories

a. Closing shall take place in less than 80 ms.
b. Following tripping due to electrical faults (overload, short-circuit, earth fault if mentioned in SLD), remote reset shall be inhibited.
c. It shall however be possible if opening was initiated by a voltage release.
d. The operating mechanism shall be of the stored-energy type only
e. The addition of a motor mechanism or a rotary handle shall in no way affect circuit breaker characteristics:

- Only three stable tripping mechanism positions (ON, OFF and TRIPPED) shall be possible with the motor mechanism

f. MCCBs shall be designed to enable safe on-site installation of auxiliaries indication switches as follows:

i. They shall be separated from power circuits
ii. All electrical auxiliaries shall be of the snap-in type and fitted with terminal blocks

iii. All auxiliaries shall be common for the entire range
iv. Auxiliary function and terminals shall be permanently engraved on the case of the circuit breaker and the auxiliary itself.
v. The addition of auxiliaries shall not increase the volume of the circuit breaker.

g. The addition of a motor mechanism module or a rotary handle, etc., shall not mask or block device settings. It shall be possible to assemble earth fault protection moulded-case circuit breakers.

i. Be capable of working normally down to -25 °C ambient temperature
ii. ii. Operate without an auxiliary power supply, i.e. it shall be capable of operating normally on any 2-phase or 3-phase power network with a voltage between 200 V and 440 V, and of tripping the circuit-breaker even in the event of voltage dips down to 80 V

h. It shall be possible to equip MCCBs with devices indicating faults without tripping the circuit breaker

V. Protection Functions

A. General Recommendations

i. MCCBs with ratings up to 160 A shall be equipped with fully interchangeable trip units in order to ensure the protection against overload and short-circuit. The trip units shall be microprocessor-based release without earth fault / with external earth fault module, wherever specified in SLD / BOQ.
ii. MCCBs with ratings 160 A and above shall be equipped with microprocessor-based trip units with protection against overload and short-circuit & inbuilt earth fault and shall be plug in type.

B. Common Features

i. Electronic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorized access to the settings
ii. Electronic trip units shall comply with IS 13947: 1993 standard (measurement of rms current values, electromagnetic compatibility, etc.)
iii. Protection settings shall apply to all circuit breaker poles. The trip units shall not augment overall circuit breaker volume. All electronic components shall withstand temperatures up to 125 °C.

C. Characteristics

i. Long time protection (LT)
ii. Selectable Ir threshold settings from 40 % to 100 % of the trip unit rating
iii. Short time protection (ST)
iv. Isd threshold shall be adjustable from 1,5 to 10 times the thermal setting Ir,
v. The time delay shall be either adjustable or fixed at 40 ms,
vi. Instantaneous protection
vii. The threshold shall be either adjustable or fixed (starting from 1.5 times In and up to a value between 11 and 15 times In, depending on the rating)

D. Load Monitoring Function

- The following monitoring functions shall be integral parts of electronic trip units:

  a. LED for load indication, one lighted above 90 % of Ir, and one lighted above 105 % of Ir
  b. A test connector shall be installed for checks on electronic and tripping mechanism operation using an external device.

E. Thermal Memory

i. In the event of repeated overloads, the electronic trip unit shall optimize protection of cables and downstream devices by memorising temperature variations.

ii. Options:

a. It shall be possible to install all options for the electronic trip unit:

- High-threshold earth-fault protection,
- Auxiliary contact to indicate the cause of tripping (long time, short time, instantaneous, earth fault if requested),
- Data transmission via a BUS, in particular all the trip unit settings, current measurements for each phase, tripping causes, circuit breaker status alarms.

2.1.4 Miniature Circuit Breakers (MCB):

a. MCB's shall have quick make and break non-welding self-wiping silver alloy contacts for 10 / 16 kA short circuit both on the manual and automatic operation. Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip-free mechanism. In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common.

b. Electrical life and Mechanical life of the MCB shall be as per IS: 13947-2 / IEC-60974-2

c. Breakers must confirm to BS 3871 with facility for locking in OFF position. Pressure clamp terminals for stranded / solid conductor insertion are acceptable up to 4 sq.mm. Aluminum or 2.5 sq.mm. Copper and for higher ratings, the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements. The MCBs shall have following features in accordance with IEC 60364:

i. Protection against contact with live parts.

ii. Dual function terminals enabling simultaneous connection of bus bar and cable without any connection pieces.

iii. Positioning of MCBs on DIN rail.
iv. Padlocking and sealing facility for every pole in ON and OFF position.
v. Short circuit capacity of 10kA.

TECHNICAL SPECIFICATIONS FOR MAINTENANCE FREE EARTH FOR ELECTRICAL INSTALLATION

0	27-02-2021	**Issued for Approval**	**PBS**	**PBS**	**SKJ**	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

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FOREWORD

Earthing is essential in any electrical installation to provide safety. The conventional GI pipe earthing system employing charcoal & salts are provided for various applications as per IS:3043. Corrosion of metallic parts is comparatively fast besides maintenance by way of watering of earth pits and chiselling of corrosion prone parts & their replacement require monitoring which may not always be feasible in certain crowded and inaccessible areas.

This document is intended to provide guide lines for installation & testing of long lasting earthing system for various applications to meet requirement of rules 51, 61 of Indian Electricity Rule, 1956.

1.0 SCOPE

This specification covers components, enhancing material & jointing used and procedure for constructing the earth pit for maintenance free earthing system to ensure that the resistance to earth is near zero consistent throughout the year.

2.0 REFERENCES

This specification requires the reference to the following documents:

IS 3043-1987	Indian standard code of practice for earthing
IEEE 80	IEEE guide for safety in AC sub-station grounding
IEEE 837	Standard for qualifying permanent connections used in substation grounding.

Indian Electricity Rules 1956 with latest amendments

Wherever, reference to any specification appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

3.0 APPLICATIONS

Earthing systems covered in this document shall be for providing effective grounds for

i. Sub-Stations
ii. RTUs, supply control posts
iii. Transformer and Generator neutral earths
iv. Lightning arrester earths
v. Equipment earths including panels
vi. In applications for PRS, UTS, FOIS, COIS, ATMs and data processing centre etc.

4.0 SELECTION OF EARTH SYSTEM

S. N.	Installations / Current Capacity	IR Value Required	Soil Type / Resistivity	Earth System
1.	House hold earthing / 3 kA	8 ohm	Normal Soil / upto 50 ohm – mtr	Single Electrode
			Sandy Soil / between 50 to 2000 ohm - mtr	Single Electrode
			Rocky Soil / More than 2000 ohm - mtr	Multiple Electrodes
2.	Commercial premises Office buildings / 5 kA	2 ohm	Normal Soil / upto 50 ohm - mtr	Single Electrode
			Sandy Soil / upto 2000 ohm - mtr	Multiple Electrodes
			Rocky Soil / More than 2000 ohm - mtr	Multiple Electrodes
3	Transformers, substation earthing, LT line equipment / 15 kA	1 - 2 ohm	Normal Soil / upto 50 ohm - mtr	Single Electrode
			Sandy Soil / upto 2000 ohm - mtr	Multiple Electrodes
			Rocky Soil / More than 2000 ohm – mtr	Multiple Electrodes
4	Transformers, substation earthing, HT line equipment / 40 kA	less than 1 ohm	Normal Soil / upto 50 ohm - mtr	Single Electrode
			Sandy Soil / upto 2000 ohm - mtr	Multiple Electrodes
			Rocky Soil / More than 2000 ohm - mtr	Multiple Electrodes

S. N.	Installations / Current Capacity	IR Value Required	Soil Type / Resistivity	Earth System
5	Lightning arresters, extra high current applications etc. / 50 kA	less than 1 ohm	Normal Soil / upto 50 ohm - mtr	Single Electrode
			Sandy Soil / upto 2000 ohm - mtr	Multiple Electrodes
			Rocky Soil / More than 2000 ohm -mtr	Multiple Electrodes
6	PRS, UTS, RTUs, FOIS, COIS, ATMs and data processing centre etc. / 5 KA	less than 0.5 ohm	Normal Soil / upto 50 ohm - mtr	Single Electrode
			Sandy Soil / upto 2000 ohm - mtr	Multiple Electrodes
			Rocky Soil / More than 2000 ohm - mtr	Multiple Electrodes

Note: Single / multiple electrode in above earth system shall be either rod earth electrode or concentric pipe earth electrode as per clause 8.1.

5.0 TYPE OF SOILS

Soil can be classified in to various types, though based on the size of the particles it contains:

5.1 NORMAL SOIL

Black cotton soil, vegetable soil, garden soil, loamy garden, soil shallow black, soil medium black soil, deep black soil and marshy soil etc. having low soil resistivity value (up to 50-ohm meter)

5.2 SANDY SOIL

This type has the big particles and the size of the particles does determine the degree of aeration and drainage that the soil allows. It is granular and consists of rock and mineral particles that are very small. Therefore, the texture is gritty and sandy soil is formed by the disintegration and weathering of rocks such as limestone, granite,

quartz and shale, thus resulting in over-drainage. It warms very fast in the spring season. Coastal area, silt soil, red sandy soil, sandy clay and coastal alluvium etc having soil resistivity up to 2000 ohm-meter are considered as sandy soil.

5.3 ROCKY SOIL

The area containing rocks, pebbles, uneven hard surface laterite soil, lime stone, sand stone, gravel, granite and chalk etc having soil resistivity more than 2000 ohm-meter is considered as rocky soil. This type of soil does not absorb moisture and are extremely poor conductor.

6.0 LOCATION OF EARTH ELECTRODE

Where there is option, site should be chosen in one of the following types of soil in the order of preference given:

a. Wet marshy ground;
b. Clay, loamy soil, arable land.
c. Clay and loam mixed with varying proportions of sand, gravel and stones;
d. Damp and wet sand, peat.

Dry sand, gravel chalk, limestone, granite, very stony ground and all locations where virgin rock is very close to the surface should be avoided,

7.0 MEASUREMENT OF EARTH ELECTRODE RESISTANCE

The earth resistance shall be measured using fall of potential method as per para 37 of IS:3043.

8.0 EARTHING SYSTEM

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection

of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus.

8.1 EARTH ELECTRODE

The earth electrode is the main component of the earthing system which is in direct contact with the ground and thus provides a means of releasing or collecting any earth leakage currents. The material should have good electrical conductivity and should not corrode in a wide range of soil conditions. For an effective earthing system, two types of earth electrodes can be used as described here:

8.1.1 Rod earth electrode

8.1.1.1 High tensile-low carbon steel rod having diameter not less than 17mm complying with requirements of BS 4360 Grade 43A or EN10025:2-004 S275JR, molecularly bonded by 99.99% pure high conductivity copper on outer surface with copper coating thickness 250 micron or more, Length 3000 mm (minimum). Length of the electrode may be increased in multiple of 1 meter to reduce earth resistance if required. To increase the length, pieces of similar rod shall be either exothermally welded to basic 3-meter electrode or connected using socket of suitable size. These sockets shall also be molecularly bonded by 99.99% pure high conductivity copper on inner & outer surface with copper coating thickness 250 micron or more.

8.1.1.2 Copper bus bar of size 250 mm x 50 mm x 6 mm having electrical conductivity of 101% IACS, minimum 99.9% copper content shall be exothermically welded to rod with 4 holes of 12 mm dia. (2 on each side) for connecting earthing conductor.

8.1.1.3 Current carrying capacity: The design of the electrode should be such as to have more than 15 kA current carrying capacity for 1 second.

8.1.2 Concentric pipe earth electrode:

8.1.2.1 Primary conductor

MS pipe with 25 - 50 mm diameter, class B, ISI mark as per IS-1239, Length 2000 or 3000 mm as per table at para 8.1.2.7.

8.1.2.2 Secondary conductor

MS pipe with 40-100 mm diameter, class B, ISI mark as per IS-1239, Length 2000 or 3000 mm as per table at para 8.1.2.7.

8.1.2.3 Conductive mixture

For hermetically filling inside the cavity i.e. between secondary conductor & primary conductor, crystalline compound is to be injected in the electrode assembly. It is a combination of high conductivity metal alloys, copper & aluminium powder, conductive carbon / cement and bonding material etc. mixed in different proportion. The mixture is forced (pressurized) filled inside the earth electrode in the paste form and after solidification of the same, the end caps are welded. The metal alloys shall help in conducting the current and conductive carbon gives anti corrosive property. Bonding material should provide strength to the mixture. Resistivity of the mixture shall be less than 0.2 ohm-meter. Resistivity shall be tested by making a 20cm cube of the material and checking resistance across the opposite face of the cube.

8.1.2.4 Complete electrode shall be molecularly bonded by 99.99% pure, high conductivity copper on outer surface with copper coating thickness 300 micron or more.

8.1.2.5 Its surface shall be clean and free from any visible oxide layer or foreign material.

8.1.2.6 Copper bus bar of size 250 mm x 50 mm x 6 mm having electrical conductivity of 101% IACS, minimum 99.9% copper content shall preferably be exothermically welded to earth electrode or connected

with the help of two number stainless steel nut bolts of appropriate size having 4 holes of 12 mm dia. (2 on each side) for connecting earthing conductor.

8.1.2.7 Current carrying capacity: The design of the electrode should be such as to have more than following current carrying capacity in kA (for 1 second):

S. N.	Current Capacity	Primary Conductor Diameter	Electrode Dimensions (Dia. x Length)
1.	3 kA	25 mm	40 mm x 2000 mm
2.	5 kA	25 mm	40 mm x 3000 mm
3.	15 kA	25 mm	50 mm x 3000 mm
4.	40 kA	40 mm	80 mm x 3000 mm
5.	50 kA	50 mm	100 mm x 3000 mm

Note: For more than 50 KA applications, multiple electrodes of 50 KA capacity shall be installed and connected.

8.2 EARTH ENHANCEMENT MATERIAL:

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It may contain conductive cement, graphite, hydrous aluminium silicate, sodium montmorillonite etc. and shall not contain bentonite. It improves conductivity of the earth electrode and ground contact area. It shall have following characteristics-

i. It should have low resistivity preferably bellow 0.2 Ohm-meters. Resistivity shall be tested by making a 20 cm. cube of the material and checking resistance across the opposite face of the cube.
ii. It shall not depend on the continuous presence of water to maintain its conductivity.
iii. It should be a little alkaline in nature with pH value >7 but <9, test certificate from NABL approved laboratory to be provided for the composition so designed.

iv. It should have better hygroscopic properties to absorb moisture. It should absorb and release the moisture in dry weather condition and help in maintaining the moisture around the earth electrode.

v. It should have capacity to retain >10% moisture at 105 ºC. Test certificate from NABL approved lab to be submitted for the composition so designed.

vi. It should have water solubility < 5%. Test certificate from NABL approved lab be submitted for the composition so designed.

vii. It should be granular with granule size 0.1 mm to 3 mm.

viii. It should be non toxic, non reactive, non explosive & non corrosive.

ix. It shall be thermally stable between -10 degree centigrade to +60 degree centigrade ambient temperature.

x. It shall not decompose or leach out with time.

xi. It shall not pollute the soil or local water table and meets environmental friendly requirement for landfill.

xii. It should expand & swell considerably and removes entrapped air to create strong connection between earth electrode and soil.

xiii. It should be diffuses into soil pores and creates conductive roots enlarging conductive zone of earth pit.

xiv. It shall be permanent & maintenance free and in its “set form”, maintains constant earth resistance with time.

xv. It shall not require periodic charging treatment or replacement.

xvi. It shall be suitable for any kind of electrode and all kinds of soils of different resistivity.

xvii. It shall not cause burns, irritation to eye, skin etc.

xviii. Minimum quantity of earth enhancement material to be supplied:

For 5’ x 5’ x 10’ earth pit – Min. 75 kgs per pit

For 300 mm bore type earth pit – Min 50 kgs per pit

xix. The Earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer’s name or trade name, quantity, batch no & date of manufacture.

8.2.1 Backfill material

Normally the excavated soil shall be used if it is free from sand, gravel and stones. In case the excavated soil contains sand, gravel and stones these shall be removed by appropriate methods such as hand picking, sieving etc. Small proportion of sand in the soil may be permissible. Material like sand, salt, coke breeze, cinders and ash shall not be used because of its acidic and corrosive nature. If the excavated soil contains sand, gravel and stone in large proportion and it is not feasible to remove these economically, good quality soil from other place may be used for backfilling.

While backfilling the soil shall be thoroughly compacted with at least 5 kg compactor. In case the soil is dry, small quantity of water may be sprinkled only to make it moist enough suitable for compacting. Large quantity of water may make the soil muddy which is not suitable for compacting and after drying the soil may contain voids which may permanently increase earth resistance.

8.3 EQUIPOTENTIAL BUS & EARTHING CONDUCTOR

i. A copper bus bar of size 300 mm x 25 mm x 6 mm to be installed in the equipment room as equipotential bus and must be connected with preferably copper strip of 25 mm x 3 mm (suitable length) from instrument to the bus bar. The connecting terminal of the earth electrode to the bus bar must be connected by copper strip of 25 mm x 3 mm (suitable length) buried inside a trench of 300 mm width x 600 mm depth (from the earth pit to the nearest wall). It shall be duplicated. However, it shall be ensured that only minimum required length is used and any extra length is cut away to keep the earth impedance minimum.
ii. It shall be high conductivity copper having electrical conductivity of 101% IACS i.e. minimum 99.9% copper content The maximum specific resistance of the copper strip earthing conductor shall be 17.241 x 10^{-7} ohm cm at 20 ºC.
iii. At a temperature of 20 ºC, its density shall be 8.89 gm/cm³.
iv. Its surface shall be clean and free from any visible oxide layer or foreign materials.
v. It shall preferably be connected to earth electrode and earth bus bar with the help of exothermic welding or at least two number stainless steel nut bolts of appropriate size.

vi. Normally a single length of copper strip shall be used for each duplicate copper strip earthing conductor and no joint should be used. However, in situation requiring greater length one joint in each copper strip shall be permitted. The joints shall be made by exothermic welding of at least 10mm overlapping portion of the strips.

8.4 CONSTRUCTION OF UNIT EARTH.

i. Make 5 ft x 5 ft x 10 ft earth pit. If it is not possible to make such a pit due to non-availability of clear space at locations like ATM, High mast lighting tower, Passenger information systems, PRS etc. or in rocky soil, min. 300 mm bore up to 10 ft deep can be made using earth auger or any other method. Earth pit larger than specified size can be made, if required.
ii. Sleeve the soil digged and remove the gravels and stones. If soil quality is good (without Murum and rocks) then add some quantity of earth enhancement material in the soil for using as backfill.
iii. If the soil seems unusable (containing large quantity of gravel, stones, murum, sad etc.) then replace the soil with black cotton soil.
iv. Insert the electrode at the centre of the earth pit and arrange to keep it vertical in the pit.
v. Arrange for adequate quantity of water supply for the earth pit. (Approx. 600 litres)
vi. Fill the pit with the backfill and keep on adding the earth enhancement material surrounding the electrode and simultaneously watering the pit.
vii. With a steel bar or pipe, keep on poking the soil gel and stirring intermittently for removing the air pockets and proper settlement of the pit.
viii. The procedure to be repeated till completion of the filling of the earth pit along with the packing material and sufficient watering adequate ramming.
ix. The pit should be very compactly rammed and watering for 2-3 days and addition of soil if required be done.
x. Make trench of 600 mm (depth) x 300 mm (wide) from the earth pit to the nearest point of connection.
xi. Construct inspection chamber with cover for the installation.
xii. Measure the earth resistance as per IS 3043:1987 code of practice. Earth resistance value shall be less than 1 ohm in non-rocky/non-sandy surface by single electrode

Installation and in rocky surface by multiple electrode installation (not more than three electrodes & its individual earth pits). For earthing purpose, if solid rocky layer is found within 10 feet from ground level while digging the earth pit then it is considered rocky surface. Coastal area, silt soil, red sandy soil and sandy clay are considered as sandy surface.

xiii. If required resistance is lower than the resistance of single earth electrode then multiple earths can be constructed and interconnected.

8.4.1 Construction of ring earth by providing multiple earth pits

i. Wherever it is not possible to achieve required earth resistance with one earth electrode / pit due to difficult / rocky soil conditions, provision of ring earth consisting of more than one earth pit shall be done. The number of pits required shall be decided based on the resistance achieved for the earth pits already installed. The procedure mentioned above for one earth pit shall be repeated for other earth pits.

ii. The distance between two successive earth electrodes shall be min. 6 mtrs / and max. up to twice the length of the earth electrode.

iii. These earth pits shall then be inter linked using 25 X 3 mm copper strip or 50 x 6 mm GI strip to form a loop preferably using exothermic welding or with the help of at least two number of stainless steel nut bolts of appropriate size.

iv. The interconnecting strip shall be buried no less than 600 mm (0.6 m) below the ground level. This interconnecting strip shall also be covered with earth enhancing compound.

8.4.2 Inspection chamber

i. A 300 X 300 X 300 mm (inside dimension) concrete box (wall thickness min. 50 mm) with smooth cement plaster finish shall be provided on the top of the pit. A concrete lid 25 to 50 mm. thick, with pulling hooks, painted black shall be provided to cover the earth pit. PVC sleeve of appropriate size shall be provided in concrete wall to take out earthing connections.

ii. The masonry work shall be white washed inside and outside.

iii. Care shall be taken regarding level of the floor surrounding the earth so that the connector is not too deep in the masonry or projecting out of it.

iv. On backside of the cover, date of the testing and average resistance value shall be written with yellow paint on black background.

9.0 MARKING:

The marking shall be clear, distinct and visible to the naked eye from a distance of about 1 meter; the size of marking shall be of minimum 25 mm. Following information shall be legibly and indelibly marked on the packed sets:

a. Specification no.
b. Name of the manufacturer
c. Batch no. & Date of manufacturer
d. Current carrying capacity

10.0 TESTS-

Following tests shall be done on one sample-

10.1 Testing of copper coating shall be done as described below:-

i. The copper coating mentioned in clause 8.1 shall not be less than the prescribed thickness at any point and shall comply with the adherence requirement in para (ii) & (iii) below.

ii. Length of the electrode with one end cut to a 45 degree point shall be driven between two steel clamping plates or the jaws of a vise set 0.04 in (1.02 mm)

iii. less than the diameter of the electrode, so as to shear off sufficient metal to expose the bond between the copper coating and electrode. Peeling of the coating by the steel plates or the jaws of the vise is acceptable, but there shall be no other evidence of separation of the coating from the metal core.

iv. At room temperature, a length of the electrode is rigidly held in a clamp or vise and the free end is bent by applying a force normal to the electrode at a distance from the clamping device equal to 40 times the diameter. The magnitude of the force and the direction of application of force shall be such that the electrode is permanently bent through a 30-degree angle. While bending of the electrode there shall be no evidence of cracking of the copper coating.

10.2 Material composition of rod shall be tested as per standards mentioned in clause no. 8.1.1.1.

10.3 MS pipes shall be tested as per IS:1239.

10.4 Copper bus bars of shall be tested for percentage of copper as per IS:14644.

10.5 Current carrying capacity test on rod electrode shall be done as per clause no. 8.1.1.3 and for concentric pipe electrode as per 8.1.2.7.

10.6 Corrosion Test: As per IS:2119, salt spray test for analysis of effect of corrosion for the specific electrode shall be done through NABL approved testing lab, preferably for 500 hrs. or more.

10.7 Exothermic weld material shall be tested as per provisions of IEEE 837.

10.8 Electrical properties test on conductive mixture as per clause no. 8.1.2.3.

10.9 Physical, chemical & electrical properties test on earth enhancement material as per clause no. 8.2.

10.10 Toxic content tests for cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls (PBBs) & polybrominated diphenyl ethers (PBDEs) on conductive mixture & earth enhancement material.

Certificates from NABL approved laboratories shall be submitted with test results of above tests. Test certificates shall not be more than three years old.

For dimension, weight and specific resistance average of 3 readings shall be taken. Average value shall be within specified limits and individual values shall not go beyond double of tolerances.

11.0 ACCEPTANCE TESTS

11.1 Following shall constitute acceptance tests and shall be done on 100% sample basis for all the tests mentioned below except where otherwise indicated–

a. Physical check for earth electrode as per clause no. 8.1.1.1 for rod type electrode and as per clause no. 8.1.2.7 for concentric pipe type electrode.
b. Physical check for copper bus bar as per clause no. 8.1.1.2 for rod type electrode and as per clause no. 8.1.2.6 for concentric pipe type electrode.
c. Dimensional and construction feature tests of inspection chamber (Cl. no. 8.4.2)
d. Earth enhancement material as per clause no. 8.2(xviii) & 8.2(xix).
e. Earth resistance measurements as per clause no. 7.0.

11.2 REJECTION:

In case the any component tested and inspected in accordance with this specification, fail to pass the tests or comply with the requirement of the specification, another two component from the same lot shall be inspected in accordance with the specification

and if one of them also fail to pass the test, the whole lot of that component shall be rejected subject to the discretion of the purchaser or his nominee.

12.0 INSPECTION:

All the gauges / test & measuring instruments shall be under calibration control at the time of inspection and proof to this office shall be produced.

Inspection and testing shall be carried out by the inspecting authority nominated by the purchaser to ensure that all the requirements of this specification are complied with for the acceptance of the materials offered by the supplier for inspection.

The purchaser or his nominee shall have right of free access to the works of the manufacturer and to be present at all reasonable times and shall be given facilities by the manufacturer to inspect the manufacturing process at any stage of manufacture. He shall have the right to reject whole or part of any work or material that does not conform to the terms of this specification or any other specification or requirement applicable and may order the same to be removed / replaced or altered at the expense of the manufacturer. All reasonable / complete facilities considered necessary by the inspecting authorities for the inspection shall be supplied by the manufacturer free of cost.

The manufacturer shall at his own cost prepare and furnish the necessary test pieces and appliances for such testing as may be carried out at his own premises in accordance with the specification. Failing the existence of facilities at his own premises for the prescribed tests, the manufacturer shall bear the cost of carrying out the tests in an approved laboratory, workshop or test house.

13.0 COMPLETION REPORT & CERTIFICATION:

13.1 The last documents for the completion of the procedure will be submission of the work completion report to the concern Railway authority. After testing the earth values of the pits and proper recording in presence of Railway authority, certified

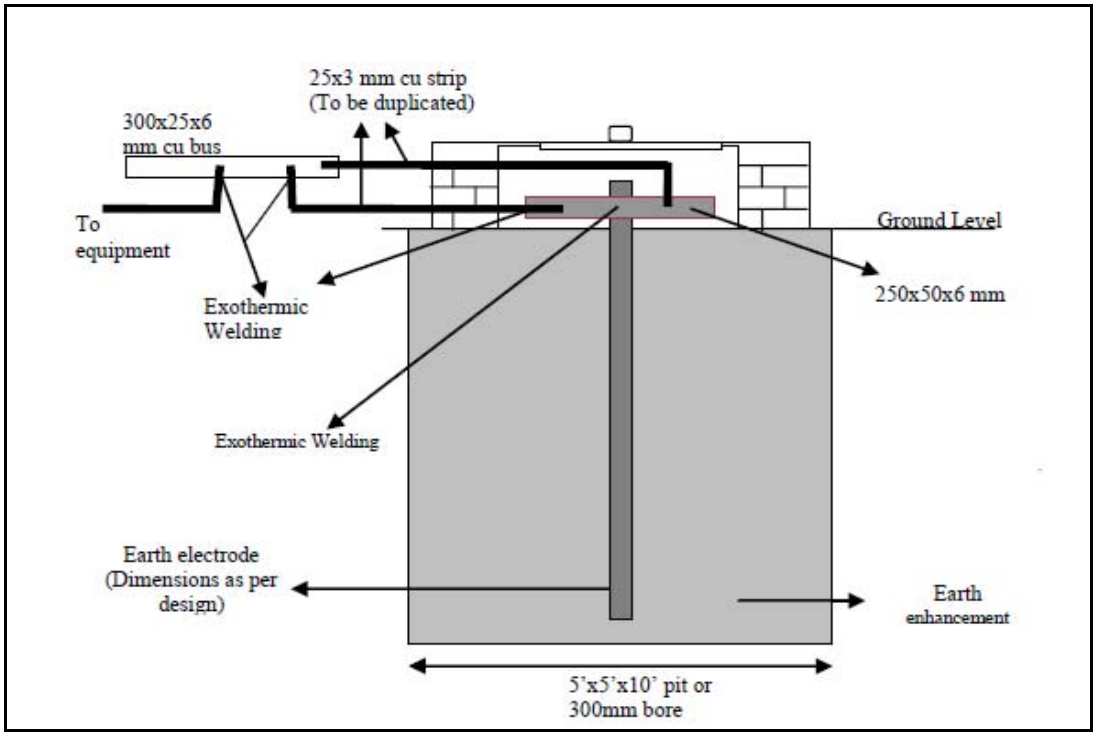
grounding self-adhesive certificate shall be provided for all installations and the same will be displayed / pasted at the place of installation.

13.2 The complete layout with dimensions of the earthing & bonding system shall be submitted by the supplier in appropriate size (in three copies) after commissioning showing commissioning date, earth resistance, specification no. and manufacturer's name.

14.0 ANNEXURE - A

General Arrangements for Earth System

ANNEXURE - A
GENERAL ARRANGEMENTS FOR EARTH SYSTEM



EARTH ELECTRODE INSTALLATION

LIST OF APPROVED MAKES / BRANDS

0	27-02-2022	Issued for Approval	PBS	SJ	SKJ	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

LIST OF SUGGESTED / RECOMMENDED MAKES(ELECTRICAL)

EQUIPMENT / COMPONENTS	SUGGESTED / RECOMMENDED MAKES / VENDORS
Aux. Board	Elecmech corporation, Globe electrical industries, Intrelec, Controls & switchgear co. ltd., Adhunic switchgears (p) ltd.,
Lighting Fixtures	Philips, Crompton Greaves, Havelles India Ltd., Wipro Ltg., Surya Roshni Ltd. / Bajaj Electricals / Osram
Switch	L & T / Siemens / ABB / GE Power
HRC Fuse / Fuse Switch unit	L & T / Siemens
MCB / MCCB / ELCB	Morarji Dorman Smith/ GEC Alsthom / Crompton Greaves / L & T / Siemens / F & G Datar /ABB
Signal Lamps / Indication Lamps (LED)	L & T / Siemens / Binay
LT POWER/Control Cables	KEI/Finolex/ Havells/ Polycab/Delton
Communication Cables	Finolex / Havels /Torrent / LAPP
Cable Gland (Weather Proof)	Power Engg. / Comet / Central Hardware Industries
Cable Gland (Flame Proof)	Baliga / R-Sthal / Flax-Pro / Sudhir / FCG-Flameproof Control Gears Ltd. / FCG–Power / FEPL
Cable Lugs	Dowel
Power Terminals / Control Terminals	Elmex / Connect well
Power & Control wires / Special Wire	Finolex / Polycab / KEI / Universal / Torrent / Delton / CCI / Radiant / Ravine
Insulating Supports / Busing	Baroda Bushing / Kusma Indu / Engineers & Contractors / Fibertech
GI pipes & conduits	Bharti Exports, Indian Tube Co. (TATA div of tubes & pipes), jindal pipes Ltd., Meghjyot enterprises, Steelcraft
PVC rigid conduit / PVC JB	Finolex / Supreme / Prince
Pre-fabricated Cable tray	Globe Electricals, Parekh engineering company, Indiana engg works pvt ltd

SPECIFICATION FOR LV CABLES

0	27-02-2021	Issued for Approval	PBS	SJ	SKJ	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

1. SCOPE

This specification covers the technical requirements for the design, manufacture, inspection and testing at vendor's works of XLPE insulated cables, suitable for 1.1kV voltage grade to be used in the Delhi Aviation Fuel Facility Private Limited

2. CODES AND STANDARDS

The design, manufacturing, testing and performance of equipment shall comply with all currently applicable statutory act, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be relieve vendor of his responsibility.

Unless otherwise specified. The Cable shall comply with the applicable relevant Indian Standards.

IS:7098-(PartI)	Specification for cross-linked Polyethylene insulated, PVC sheathed cables.(For working voltages upto and including 1100 volts)
IS: 6474	Specification for Polyethylene insulation and sheath of electric cables
IS: 8130	Conductors for insulated electric cables and flexible cords
IS: 10418	Drums for electric cables
IS:10810 (Pt 58)	Methods of test for cables: Part 58 Oxygen Index test
IS:10810 (Pt 61)	Methods of test for cables: Part 61 Flame retardant test
IS:10810 (Pt 62)	Methods of test for cables: Part 62 Flame retardant test for bunched cables
IS:3961-(Part4)	Recommended current ratings for Polyethylene insulated cables
IS: 3975	Mild steel wire, formed wires and tapes for armouring of cables
IS: 5831	Specification for PVC insulation and sheath of electric cables

In case of any contradiction between various referred standards/specifications and statutory regulations, the following order of priority shall be given: -

i) This Specification

ii) Codes & Standards

iii) Statutory regulations

The cables & accessories shall also confirm to the provisions of the latest revisions of Indian Electricity rules & any other statutory regulations currently in force.

3. AMBIENT CONDITIONS

The cables & accessories shall be suitable for operating in humid & corrosive atmosphere found in refineries, fertilizers, petrochemical & metallurgical plants. Service conditions shall be defined as

- Maximum ambient temperature: 42 °C.
- Minimum ambient temperature: 7 °C.
- Relative humidity: 70-80 %.
- Wind speed: 5 m/sec
- Elevation 14 mtr above MSL
-

4. GENERAL CONSTRUCTION AND MATERIAL OF CONSTRUCTION

1) The cables shall be suitable for laying trays, trenches, ducts and conduits and for underground-buried installation with uncontrolled backfill and possibility of flooding by water & chemicals.
2) Outer sheath of all XLPE insulated cables shall be black in color and minimum value of the oxygen index shall be 29 at 27+/-2 °C.In addition suitable chemicals shall be added in to the PVC compound of the outer sheath to protect the cable against rodent & termite attack.
3) In addition suitable chemicals shall be added to minimizing water treeing effect.
4) Sequential marking of the length of the cable in the meters shall be provided at every one meter. The embossing or engraving shall be legible or indelible.
5) The overall diameter of the cables shall be strictly as per the values declared by the manufacturer in the technical information subject to a maximum tolerance of +/- 2mm up to overall diameter up to 60mm and +/- 3mm for above 60mm.

4.1. XLPE insulated FRLS cables

All cables covered in this specification shall be gas / dry cured, flame retardant low smoke (FRLS) unless otherwise specified in the data sheetThe outer sheath of XLPE insulated cables shall possess flame propagation properties meeting requirements as per IS-10810 (Part-62) category AF.

4.2. Conductor

Conductor wire shall be uniform in size, shape and free from any defects. Max conductor resistance at 20 degC shall conform to table-2 of IS 8130.The cable conductor shall be of Cu or Al material as specified in cable quantity list. All the cables having cross section ≤4 sqmm shall have high conductivity annealed plain copper conductor and above 4 sqmm shall be electrolytic grade aluminium (H2 grade). Conductor shall be Class-2 stranded, compacted circular/compacted sector shaped

conforming to IS 8130. Max conductor temperature shall be 90 degC and Max short circuit temp shall be 250 degC. Laying up of cores shall be as per relevant standards.

4.3. Insulation

1) The insulation shall be cross-linked polyethylene, conforming to the relevant standards and shall be free from voids. It shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.
2) The insulation shall be so applied (by extrusion) that it fits closely on the conductor and it shall be possible to remove it without damaging the conductor.

4.4. Filler and inner sheath

1) The fillers and inner sheath shall be of,
    a. Vulcanized or unvulcanized rubber, or
    b. Thermoplastic materials.
2) Vulcanized or unvulcanized rubber or thermoplastic material used for inner sheath shall not be harder than XLPE and PVC used for insulation and outer sheath respectively. Fillers and Inner sheath materials shall be so chosen as to be compatible with the temperature ratings of the cable and shall have no deleterious effect on any other component of the cable.
3) The inner sheath shall be extruded PVC of uniform thickness and shall be applied over the laid up cores by extrusion. It shall conform to the requirements of Type ST2 compound as specified in IS: 5831.
4) The material shall have reduced flame propagation property and reduced emission of halogen gas fumes when overheated during fire.
5) Material used for inner sheath shall not be harder than XLPE used for insulation. PVC used for outer sheath, fillers and inner sheath materials shall be so chosen as to be compatible with the temperature ratings of the cable and shall have no harmful effect on any other component of the cable. Inner sheath shall be extruded type and of uniform thickness.

4.5. Armouring

1) Armoring shall be of,
    a. Galvanized round steel wire, or
    b. Galvanized steel strip, or
    c. Any metallic non-magnetic wire / strip
2) Armoring shall be applied over insulation / inner sheath for single / multicore cables respectively, as close as possible.
3) Where the cable diameter below armour does not exceed 13mm, the armour shall

consist of galvanized round steel wires and where the diameter below the armour is greater than 13mm, the armour shall consist of either galvanized steel strips.

4) In case of single core A.C. cables, the armouring shall be of hard drawn non-magnetic material i.e aluminium (H4 grade) as per IS 8130.
5) The joints (if applicable) in armour wires or strips shall be made by brazing or welding and any surface irregularity shall be removed.
6) Armouring coverage shall cover minimum 90% area.

4.6. Outer sheath

1) The outer sheath shall be of extruded poly-vinyl chloride (PVC) compound conforming to the requirements of type ST2 compound as specified in relevant standards and shall be of FRLS type only. The outer sheath of cable shall be black in colour and the minimum value of oxygen index shall be 29 at 27 + 2 ^{0} C. All the FRLS properties shall conform to relevant IEC and ASTM standards.
2) The outer sheath shall be applied by extrusion over the insulation or insulation screening or armour as applicable.
3) In case of FRLS cables, PVC compound used for the outer sheath shall have reduced flame propagation property, shall have reduced emission of halogen gas fumes etc., when severely overheated during fires.
4) Outer sheath materials shall be resistant to UV rays, oil, acid and alkali and Suitable additive compounds shall be added to prevent rodent and termite attack.

4.7. Dimensions / thickness of material

The thickness of insulation, inner sheath, outer sheath and dimensions of wire/strips used for armouring shall be as per relevant standards.

5. CORE IDENTIFICATION

1) Cores of cable shall be identified by colour coding of PVC insulation by adopting the following scheme.
   a. Single core — Red, black, yellow, blue or natural
   b. Two core — Red and Black
   c. Three core — Red, Yellow and Blue
   d. Three & Half core — Red, Yellow, Blue and Black
   e. Four core — Red, Yellow, Blue and Black

2) The core identification shall be done by printing numbers or by providing colored strips all along cores. The insulation of cores shall be of the same colour and numbered sequentially. The numbers shall be printed in Hindu-Arabic numerals on

the outer surface of cores. The numerals shall be legible. The numbers shall be repeated at regular intervals along the core and the spacing between consecutive numbers shall not exceed 50mm.

6. IDENTIFICATION OF CABLES

1) The cables shall be clearly and permanently marked with following information throughout the length of cable.
    a. Manufacturer's name or trade mark.
    b. Year of manufacture.
    c. Voltage grade.
    d. Cross sectional area of conductor and no. of cores.
    e. Type of Insulation
    f. FRLS
    g. ISI mark and IS reference number
    h. Cable Code
    i. Colour identification
    j. Batch No./Lot No.

7. CABLE DRUMS

1) Cables shall be supplied in non-returnable drums steel drums of suitable barrel diameter, securely battened, with take-off end fully protected against mechanical damage. Also, PVC / Rubber end caps shall be supplied free of cost for each drum with a minimum of eight per thousand meter length. While selecting cable drums, care should be taken to avoid joints.
2) The following information shall be marked on each drum
    a. Name of manufacturer, brand name or trademark.
    b. Nominal cross sectional area of conductor.
    c. Number of cores.
    d. Type of cable and voltage grade.
    e. Cable code
    f. Length of cable on the drum.
    g. Number of lengths on drum (if more than one).
    h. Drum number
    i. Direction of rotation of drum (by means of an arrow).
    j. Reference standard
    k. Approx. gross weight.

l. Job number
m. Country of manufacture
n. Year of manufacture.

3) A tolerance of +/- 3% shall be permissible for each drum. However, overall tolerance for each size of cable shall be limited to +/ - 2%. Offer with short / non-standard lengths are liable for rejection. If non- standard drum lengths are specified in the data sheet, then same shall be supplied.

8. TOTAL QUANTITY VARIATION

1) The bidder shall quote unit rates for all types of cables as indicated in the cable quantity list. The unit rate quoted by the bidder shall be valid in the event of addition/deletion of cable quantity.
2) Quantity shown in the Bill of Material annexed to this specification is for bid purpose only. The quantity shall be revised after placement of order as per actual requirement.
3) Bidder shall not start manufacturing unless written manufacturing clearance is obtained from the purchaser. Any manufacturing prior to approval shall be rejected.
4) NTP to manufacture cable shall be furnished in several lots in phases as per site progress and requirement.
5) Total supplied quantity shall not vary by more than + 2.5% of total quantity of NTP length for all types of cables without any negative tolerance. Unit rates for addition/deletion will be applicable for length upto +2.5%. Bidder can not claim for any quantity supplied above +2.5% of the NTP (notice to proceed) quantity, no payments will be made for extra quantity supplied above +2.5% of NTP quantity.

9. INSPECTION AND TESTS

1) Inspection and testing shall be carried out in accordance with relevant standards. Routine tests and acceptance test shall be witnessed by approved Third Party Inspection Agency. Vendor shall quote unit rate for witnessing such type test by TPI Agency.
2) Vendor shall submit blank formats where in the test results/readings are to be entered. This format shall give minimum acceptable value as per the relevant standards.
3) Vendor to confirm availability of Type test certificates along with offer. Type test certificates, for all types of cables being ordered, shall be furnished by vendor in the event of an order.

4) The inspector shall have free access to free access to the manufacturer's works for the purpose of inspecting the process of manufacture in all stages and he will have the power to reject any material which appears to him to be of unsuitable description or of unsatisfactory quality. The vendor shall give at least 2 weeks prior notice to the purchaser, regarding the date of testing to enable him or his representative to witness the tests.
5) All routine tests, acceptance tests, type tests & additional type tests for improved fire performance shall be carried out as listed in IS-7098 (Part-2).

9.1. ROUTINE TESTS

1) All routine tests, acceptance tests for improved fire performance shall be carried out as listed in IS-7098 (Part-1 & 2).
2) The finished cables shall be tested at manufacturer's works. Following routine tests for each and every length of cable and copy of test results shall be furnished for each length of cable along with supply. If specified, the cables shall be tested in presence of client's representative.

9.1.1. HIGH VOLTAGE TEST

The cables shall withstand without any failure, the test voltages given below, when applied for a period of five minutes for each test connection.

VOLTAGE GRADE	TEST VOLTAGE
kV	kV
1.1	3

9.1.2. CONDUCTOR RESISTANCE TEST:

The D.C. Resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20°C. to check the compliance with the values specified in IS 8130 - 1976.

9.1.3. MECHANICAL ROUTINE TEST

A mechanical Load of 20% in excess of the maximum working load of the insulator is applied after suspending the insulator for one minute .There shall be no mechanical failure of the insulator.

9.2. ACCEPTANCE AND SPECIAL TESTS

Acceptance tests as per IS-1554 Part-1 and IS-7098 Part-1 & 2 and the following special tests to be performed on the cables as per the sampling plan. These tests are to be witnessed by PMC/ Owner before the dispatch of cables. The type test certificate for conductor and insulator material shall be provided and it shall not be more than 7 years at the time of bid.

9.2.1. ACCELERATED WATER ABSORPTION TEST

Accelerated Water absorption test for insulation as per NEMA – WC-5 (For PVC insulated cables) and as per NEMA WC-7 (For XLPE insulated cables). Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by PMC before dispatch, clearance of cables. In case test certificates are not available, test is to be conducted by vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is carried out one for each order.

9.2.2. DIELECTRIC RETENTION TEST

The dielectric strength of the cable insulation tested in accordance with NEMA WC-5 at 75 ± 1°C shall not be less than 50% original dielectric strength. Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by PMC before dispatch, clearance of cables. In case test certificates are not available, test is to be conducted by vendor at his own cost in any recognized test laboratory or in-house testing laboratory, before dispatch clearance of cables. Sampling for this test is to carried out one for each order.

9.2.3. OXYGEN INDEX TEST

The test shall be carried out as per ASTM D2863 or applicable Indian Standard specifications. Oxygen index shall be more than 29%.

9.2.4. TEMPERATURE INDEX TEST

The test shall be carried out as per ASTM D2863 or applicable Indian Standard specifications. Temperature index shall be more than 250 °C.

9.2.5. SMOKE DENSITY TEST

The test shall be carried out as per ASTM D2843 or applicable Indian Standard specifications. Smoke density shall be more than 40%.

9.2.6. ACID GAS GENERATION TEST

The test shall be carried out as per IEC 754-1 or applicable Indian Standard specifications. It shall be less than 20%.

9.2.7. FLAMMABILITY TEST

1) The test shall be carried out on finished cable as per IS-10810 (part 61 & 62). Sampling for this test is to be carried out one for each order, provided the outer sheath remains the same. The acceptance criteria for tests conducted shall be as under:
   a. Part-61: The cable meets the specifications if there is no visible damage on the test specimen within 300 mm from its upper end.

b. Part-62: The maximum extent of charred portion measured on the test sample shall not have reached a height exceeding 2.5m above the bottom edge of the burner at the front of the ladder.

9.2.8. TYPE TEST

The following Type test certificate issued by Government approved laboratories like CPRI/ERDA/any other govt approved agency shall be submitted to the inspector before placement of order and before dispatch commencement at site.

1) Test for thickness of insulation and sheath
2) Physical tests for insulation.
   a. Tensile strength and elongation at break.
   b. Ageing in air oven.
   c. Hot test.
   d. Shrinkage test.
   e. Water absorption (Gravimetric)
3) Physical Test for outer sheath :
   a. Tensile Strength and elongation at break.
   b. Ageing in on even.
   c. Shrinkage Test.
   d. Hot deformation.

9.2.9. TEST FOR RODENT & TERMITE REPULSION PROPERTY

The vendor shall furnish details to analyze the property by chemical method. Sampling to be done for every offered lot / size as per the sampling plan.

9.2.10. CERTIFICATION

1) All offered equipments or equipment of similar design manufactured by same supplier:
   a. Shall have been type tested by an authority approved by the Company.
   b. Shall have been in continuous satisfactory service for a minimum period of two years.
   c. Shall be having current certification/approval listing by an approved agency.

10. TRANSPORT, SHIPMENT AND INSURANCE

Transport and shipment of items will be contractor's responsibility. Contractor need to follow the instructions for the same detailed under the 'Electrical scope of work' in bid package. Insurance charges may be separately quoted.

11. WARRANTY

Vendor shall have final and total responsibility for the design and performance of all the equipment supplied under this specification. The equipment and material shall be guaranteed for trouble-free operation for a period of 12 months from the date of commissioning. Any defect discovered during this period shall be rectified free of charge.

SPECIFICATION FOR CABLE TRAYS

0	27-02-2021	Issued for Approval	PBS	SJ	SKJ	
Rev	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**	**Client Review**

TABLE OF CONTENTS

1.0 INTRODUCTION

This standard covers the technical requirements of design, manufacture, testing at works and delivery in well packed condition of cable trays.

2.0 SCOPE OF WORK

This specification covers the general design, engineering and procurement of materials, fabrication and supply requirements of ladder type cable trays for electrical power cables and perforated type cable trays for electrical power / Control / Lighting cables.

2.1 STATUTORY REQUIREMENTS, CODES & STANDARDS

The design and the installation of the equipment shall be in accordance with established codes, good engineering practices and shall confirm to the statutory regulations applicable in the country.

The main codes, standards and statutory regulations considered as minimum requirements are as given below. Latest version of these shall be followed:

- International Electro-technical Commission (IEC)
- International standard organization (ISO)
- The Institute of Petroleum (IP)
- American Society for Testing and Materials (ASTM)
- Institute of electrical & electronics engineers (IEEE)

The design and terminology shall comply as a minimum with the latest editions of the engineering codes, standards and practices as below. However, system / equipment design shall be in line with latest of all applicable standards-

Codes	Description
ASTM A123	Zinc (hot-galvanized) coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips
ASTM A153	Standard Specification for Zinc coating (hot-dip) on iron and steel hardware
ASTM A446	Specifications for Steel Sheet Zinc Coated (Galvanized) by Hot Dipped Process
ASTM A490	Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints
ASTM A563	Carbon and Alloy Steel Nuts
IEC 60050	International Electro technical Vocabulary
IEC 61537	Cable management

Codes and standards shall be inclusive of all the amendments at the time of order.

The equipment shall also conform to the provisions of local Electricity rules and other statutory regulations currently in force in the country.

Any conflicts between the referenced documents shall be identified to BUYER in Writing for resolution. In general, the order of precedence shall be as follows:

- Statutory Regulations
- Technical Specifications
- Purchase Order
- Tender and any other documents forming part of the Contracts
- Electrical Design Basis
- Referenced Codes & Standards

2.2 GENERAL REQUIREMENTS

The offered equipment shall be brand new with state-of-the-art technology and proven field track record. No prototype equipment shall be offered.

Vendor to ensure availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply

Vendor shall be responsible for design, engineering and manufacturing of the equipment to fully meet the intent and requirements of this specification and data sheets.

All equipment and accessories required for completeness of the equipment, whether specifically mentioned or not, but considered essential for satisfactory performance shall be included as a part of the offered equipment.

3.0 ELECTRICAL DESIGN REQUIREMENTS

3.1 GENERAL TECHNICAL REQUIREMENTS

GI racks and Accessories shall have Zinc Coating of 610 gm/Sq.m applied by hot dip galvanizing process. Galvanizing shall be uniform, adherent, smooth and free from defects.

The finished rack accessories shall be free from sharp edges and corners, burrs and unevenness. Stepped arrangement of bending is not acceptable. The channel members in the bending shall have uniform curvature and shall be made out of single piece.

For terminal area, all cable trays and accessories shall be prefabricated, 2 mm thick hot dipped Galvanized sheet steel ladder trays with rungs at 300 mm interval.

Maximum width of trays will be 600 mm. Collar height will be 200 mm.

Support span 2000 mm for horizontal & 1500 mm for vertical tray supports. In addition to this, 105 kg concentrated load at Centre span shall be considered for horizontal trays. Cable tray installed vertically shall be fastened at intervals which will not allow sag in the cables or cause the damage. Nuts, bolts and any other hardware to be used in cable trays shall be stainless steel. Cable ladder routes shall be bonded to the earth grid via green / yellow PVC covered cables. Fastening of cables in cable ways shall be done with UV resistant (Black) PVC cable ties.

Coupler plate shall be fitted at each side runner at one end. The coupling plates shall be supplied with bolts, nuts and washers fitted at the other four holes for fixing to

adjoining member. Each side runner shall have two coupler plates (one on inside face and one on outside face). Coupling plates shall be designed to permit longitudinal adjustment up to +/-10 mm and skew up to 10°.The side runner shall have suitable holes at every meter for cleating earthing conductors.

All the bends, tees and junctions shall be pre-fabricated and shall be made sufficiently rigid by providing suitable Reinforcement on rungs as required.

Side Runner shall be 100 x 20/30 mm Channel as a minimum with the flanges facing inside. Rungs shall be 35 x 15 x 5 mm slotted Channel Type and provided at regular interval of maximum 300 mm along Tray Length.

Trays sections (3000 mm & 6000 mm long) will be installed on prefabricated support and will be bolted to the support in hazardous areas and welded to the support in safe areas.

Trays will be connected by expansion splice plates between their sections and fitted with expansion guide clamps at every 36 m to 40 m intervals. Tray will be connected at other junctions by standard splice plate and fitted with hold-on clamps.

The Cable Tray shall be supplied in standard length of 3000 mm & 6000 mm. The maximum allowable middle span deflection shall be 10 mm.

Cable trays used in the outdoor areas shall be provided with covers on top layer, for protection from rain water. The minimum thickness of the cover shall be 2mm. Cable Tray Cover shall be fabricated with Hot Dip Galvanized Sheet Steel with standard length of 3000 mm.

Tolerances in various dimensions shall be as follows:

- Length: ±5 mm
- Width: ±2 mm
- Height: ±1 mm
- Bend: ±1 mm
- Thickness: ±0.2 mm

Positive tolerance on total quantity, up to +5% is acceptable. However negative tolerance on total quantity is not acceptable.

3.2 LADDER TYPE CABLE TRAYS

Ladder type Cable Trays shall be of Prefabricated Hot Dip Galvanized Sheet Steel.

Two parallel 'I-beam' or 'H' type side rails linked together by rungs.

Ladder type Cable Trays standard dimensions are as follows:

- Width: 300, 600mm
- Length: 3000 mm & 6000 mm
- Side rail height: 100, 200 mm

Tray I-ladder coupling splice plates shall be expansion type. Tray hold down clamps of standard type shall be provided for one end and combination (expansion) type for other. Safety factor for ladder type cable tray is 1.5

Cable trays shall be supported at an interval of 2000 mm for horizontally and 1500 mm vertically. Galvanization thickness shall be as per ASTM A123 / A153.

Other Accessories: Couplers, Vertical Tee, Reducer, Tee, Cross, Vertical & Horizontal Bend (30 to 90), Horizontal bend Splice Plate, Horizontal & Vertical Adjust Plate, Tray Cover, Tray hold down clamps

3.3 PERFORATED TYPE CABLE TRAYS

Perforated cable trays shall be as per the specification given below:

- Width: 75,100, 150, and 300 mm
- Length: 2500 mm
- Material: Hot-dip galvanized steel
- Sheet thickness: 2.5 mm

- Height: 25 mm
- Steel: As per ASTM A36
- Galvanizing: As per ASTM A123 / A153.

Other Accessories: Couplers, Vertical Tee, Reducer, Tee, Cross, Vertical & Horizontal Bend (30 to 90), Horizontal bend Splice Plate, Horizontal & Vertical Adjust Plate, Tray Cover, Tray hold down clamps.

4.0 INSPECTION AND TESTING

During fabrication, the cable trays and other accessories shall be subject to inspection by Purchaser, or by an agency authorized by the purchaser, to assess the progress of work, as well as to ascertain that only proven raw material is used. The manufacturer shall furnish all necessary information / data concerning the supply to Purchaser's inspectors.

Testing and Inspection of cable trays shall be include but not be limited to the following:

a. Visual Inspection and dimension check shall be made to ensure that good workmanship and practice were maintained throughout the fabrication. Quantitative check shall be made to assure whether all items with accessories are pre- sent according to the order and the packing list.
b. Verification of galvanization thickness. Provide applicable test reports and certificates.
c. All tests shall be conducted as per relevant applicable standards.

5.0 PACKING AND DISPATCH

All the equipment shall be divided into several sections for protection and ease of handling during transportation. The equipment shall be properly packed for the selected mode of transportation, i.e. by ship / rail or trailer, and shall be wrapped in polythene sheets before being placed in crates / cases to prevent damage to finish.

The crates / cases shall have skid bottom for handling. Special notations such as 'Fragile', 'This side up', 'Center of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., shall be clearly marked on the packages together with other details as per purchase order. The equipment may be stored in a covered shed for long periods before installation. The packing should be suitable for such storage.

Annexure - C

Cable Schedule

GLOBAL CONSULTANTS

Electrical and Instrumentation works for Laying of Additional Receipt Header inside Fuel Farm Facility of DAFFPL.

CABLE SCHEDULE

SL.NO	Description	FROM	From Location	TO	To Location	Rating (kw)	VOLTAGE GRADE	Type of cable 1	POWER & CONTROL CABLE	Size (sq mm)	Type of cable 2	Route Length (Mtr)	total Length (Mtr)	OD
1	PDB	LT PANEL	OPP EXISTING CONTROL ROOM	PDB	EXISTING CONTROL ROOM	**630 A**	0.6/1.1	Power	3	3.5C X 185	FRLS/AI/XLPE	25	150	68
2	MOVDB PANEL	PDB	OPP EXISTING CONTROL ROOM	MOVDB PANEL	EXISTING CONTROL ROOM	63A	0.6/1.1	Power	1	3.5C X 35	FRLS/AI/XLPE	30	30	18
3	ROSOV -201	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -201	VF-201	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	145	145	15
4	ROSOV -202	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -202	VF-202	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	110	110	15
5	ROSOV -203	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -203	VF-203	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	160	160	15
6	ROSOV -204	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -204	VF-204	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	190	190	15
7	ROSOV -205	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -205	VF-205	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	230	230	15
8	ROSOV -206	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -206	VF-206	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	175	175	15
9	MOV -201	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -201	VF-201	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	145	145	15
10	MOV -202	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -202	VF-202	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	110	110	15
11	MOV -203	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -203	VF-203	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	160	160	15
12	MOV -204	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -204	VF-204	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	190	190	15
13	MOV -205	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -205	VF-205	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	230	230	15
14	MOV -206	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -206	VF-206	16A	0.6/1.1	Power	1	4C x 2.5	FRLS/Cu/XLPE	175	175	15
15	CONTROL JB-1	SAFETY PLC	NEW CONTROL ROOM	CONTROL JB-1	VF-201		0.6/1.1	Control	1	24C X 1.5	FRLS/Cu/XLPE	190	190	25
16	CONTROL JB-2	SAFETY PLC	NEW CONTROL ROOM	CONTROL JB-2	VF-202		0.6/1.1	Control	1	24C X 1.5	FRLS/Cu/XLPE	160	160	25
17	CONTROL JB-3	SAFETY PLC	NEW CONTROL ROOM	CONTROL JB-3	VF-203		0.6/1.1	Control	1	24C X 1.5	FRLS/Cu/XLPE	205	205	25
18	CONTROL JB-4	SAFETY PLC	NEW CONTROL ROOM	CONTROL JB-4	VF-204		0.6/1.1	Control	1	24C X 1.5	FRLS/Cu/XLPE	240	240	25
19	CONTROL JB-5	SAFETY PLC	NEW CONTROL ROOM	CONTROL JB-5	VF-205		0.6/1.1	Control	1	24C X 1.5	FRLS/Cu/XLPE	275	275	25
20	CONTROL JB-6	SAFETY PLC	NEW CONTROL ROOM	CONTROL JB-6	VF-206		0.6/1.1	Control	1	24C X 1.5	FRLS/Cu/XLPE	220	220	25
21	ROSOV -201LPBS	CONTROL JB-1	VF-201	ROSOV -201LPBS	VF-201			Control	1	12C X 1.5	FRLS/Cu/XLPE	10	10	18
22	ROSOV -201	ROSOV -201LPBS	VF-201	ROSOV -201	VF-201			Control	1	12C X 1.5	FRLS/Cu/XLPE	20	20	18
23	ROSOV -202 LPBS	CONTROL JB-2	VF-202	ROSOV -202 LPBS	VF-202			Control	1	12C X 1.5	FRLS/Cu/XLPE	10	10	18
24	ROSOV -202	ROSOV -202 LPBS	VF-202	ROSOV -202	VF-202			Control	1	12C X 1.5	FRLS/Cu/XLPE	20	20	18
25	ROSOV -203LPBS	CONTROL JB-3	VF-203	ROSOV -203LPBS	VF-203			Control	1	12C X 1.5	FRLS/Cu/XLPE	10	10	18
26	ROSOV -203	ROSOV -203LPBS	VF-203	ROSOV -203	VF-203			Control	1	12C X 1.5	FRLS/Cu/XLPE	20	20	18
27	ROSOV -204LPBS	CONTROL JB-4	VF-204	ROSOV -204LPBS	VF-204			Control	1	12C X 1.5	FRLS/Cu/XLPE	10	10	18
28	ROSOV -204	ROSOV -204LPBS	VF-204	ROSOV -204	VF-204			Control	1	12C X 1.5	FRLS/Cu/XLPE	20	20	18
29	ROSOV -205LPBS	CONTROL JB-5	VF-205	ROSOV -205LPBS	VF-205			Control	1	12C X 1.5	FRLS/Cu/XLPE	10	10	18
30	ROSOV -205	ROSOV -205LPBS	VF-205	ROSOV -205	VF-205			Control	1	12C X 1.5	FRLS/Cu/XLPE	20	20	18
31	ROSOV -206LPBS	CONTROL JB-6	VF-206	ROSOV -206LPBS	VF-206			Control	1	12C X 1.5	FRLS/Cu/XLPE	10	10	18
32	ROSOV -206	ROSOV -206LPBS	VF-206	ROSOV -206	VF-206			Control	1	12C X 1.5	FRLS/Cu/XLPE	20	20	18
33	ROSOV-VF-205	PROCESS PLC	NEW CONTROL ROOM	ROSOV-VF-205	VF-205			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	300	300	
34	ROSOV-VF-204	ROSOV-VF-205	VF-205	ROSOV-VF-204	VF-204			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	70	70	
35	ROSOV-VF-203	ROSOV-VF-204	VF-204	ROSOV-VF-203	VF-203			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	70	70	
36	ROSOV-VF-202	ROSOV-VF-203	VF-203	ROSOV-VF-202	VF-202			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	160	160	
37	ROSOV-VF-201	ROSOV-VF-202	VF-202	ROSOV-VF-201	VF-201			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	70	70	
38	ROSOV-VF-206	ROSOV-VF-201	VF-201	ROSOV-VF-206	VF-206			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	70	70	
39	PROCESS PLC	ROSOV-VF-206	VF-206	PROCESS PLC	NEW CONTROL ROOM			Signal	1	2P X 1.5 MODBUS CABLE	FRLS/Cu/XLPE	250	250	
40	MOV -VF-201	Safety PLC	NEW CONTROL ROOM	MOV -VF-201	VF-201 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	190	190	18
41	MOV -VF-202	Safety PLC	NEW CONTROL ROOM	MOV -VF-202	VF-202 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	160	160	18
42	MOV -VF-203	Safety PLC	NEW CONTROL ROOM	MOV -VF-203	VF-203 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	205	205	18
43	MOV -VF-204	Safety PLC	NEW CONTROL ROOM	MOV -VF-204	VF-204 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	240	240	18
44	MOV -VF-205	Safety PLC	NEW CONTROL ROOM	MOV -VF-205	VF-205 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	275	275	18

Electrical and Instrumentation works for Laying of Additional Receipt Header inside Fuel Farm Facility of DAFFPL.

CABLE SCHEDULE

45	MOV -VF-206	Safety PLC	NEW CONTROL ROOM	MOV -VF-206	VF-206 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	220	220	18
46	DI-DJB-001	Procss PLC	NEW CONTROL ROOM	DI-DJB-001	VF-201 DYKE			Control	1	24C X 1.5	FRLS/Cu/XLPE	190	190	24
47	DI-DJB-002	Procss PLC	NEW CONTROL ROOM	DI-DJB-002	VF-204 DYKE			Control	1	24C X 1.5	FRLS/Cu/XLPE	240	240	24
48	MOV -VF-201 TRIP	DI-DJB-001	VF-201 DYKE	MOV -VF-201 TRIP	VF-201 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	10	10	12
49	ROSOV -VF-201 TRIP	DI-DJB-001	VF-201 DYKE	ROSOV -VF-201 TRIP	VF-201			Control	1	2C X 1.5	FRLS/Cu/XLPE	20	20	12
50	MOV -VF-202 TRIP	DI-DJB-001	VF-201 DYKE	MOV -VF-202 TRIP	VF-202 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	45	45	12
51	ROSOV -VF-202 TRIP	DI-DJB-001	VF-201 DYKE	ROSOV -VF-202 TRIP	VF-202			Control	1	2C X 1.5	FRLS/Cu/XLPE	70	70	12
52	MOV -VF-206 TRIP	DI-DJB-001	VF-201 DYKE	MOV -VF-206 TRIP	VF-206 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	45	45	12
53	ROSOV -VF-206 TRIP	DI-DJB-001	VF-201 DYKE	ROSOV -VF-206 TRIP	VF-206			Control	1	2C X 1.5	FRLS/Cu/XLPE	70	70	12
54	MOV -VF-204 TRIP	DI-DJB-002	VF-204 DYKE	MOV -VF-204 TRIP	VF-204 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	10	10	12
55	ROSOV -VF-204 TRIP	DI-DJB-002	VF-204 DYKE	ROSOV -VF-204 TRIP	VF-204			Control	1	2C X 1.5	FRLS/Cu/XLPE	20	20	12
56	MOV -VF-203 TRIP	DI-DJB-002	VF-204 DYKE	MOV -VF-203 TRIP	VF-203 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	45	45	12
57	ROSOV -VF-203 TRIP	DI-DJB-002	VF-204 DYKE	ROSOV -VF-203 TRIP	VF-203			Control	1	2C X 1.5	FRLS/Cu/XLPE	70	70	12
58	MOV -VF-205 TRIP	DI-DJB-002	VF-204 DYKE	MOV -VF-203 TRIP	VF-205 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	45	45	12
59	ROSOV -VF-205 TRIP	DI-DJB-002	VF-204 DYKE	ROSOV -VF-203 TRIP	VF-205			Control	1	2C X 1.5	FRLS/Cu/XLPE	70	70	12
60	AI-AJB-001	SAFETY PLC	NEW CONTROL ROOM	AI-AJB-001	FWS AREA			Signal	1	12P x 1.5	FRLS/Cu/XLPE	220	220	
61	DPT-FWS101	AI-AJB-001	FWS AREA	DPT-FWS101	FWS AREA			Signal	1	1P x 1.5	FRLS/Cu/XLPE	15	15	
62	DPT-FWS102	AI-AJB-001	FWS AREA	DPT-FWS102	FWS AREA			Signal	1	1P x 1.5	FRLS/Cu/XLPE	30	30	
63	DPT-MF101	AI-AJB-001	FWS AREA	DPT-MF101	FWS AREA			Signal	1	1P x 1.5	FRLS/Cu/XLPE	15	15	
64	DPT-MF102	AI-AJB-001	FWS AREA	DPT-MF102	FWS AREA			Signal	1	1P x 1.5	FRLS/Cu/XLPE	30	30	

Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm														
CABLE SCHEDULE														
SL.NO	Description	FROM	From Location	TO	To Location	Rating (kw)	VOLTAGE GRADE	Type of cable	POWER & CONTROL CABLE	Size (sq mm)	Type of cable 2	Route Length (Mtr)	total Length (Mtr)	OD
1	ROSOV -VF-207A	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -VF-207A	VF-207		0.6/1.1	Power	1	4C x 4	FRLS/Cu/XLPE	300	300	14
2	ROSOV -VF-207B	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -VF-207B	VF-207		0.6/1.1	Power	1	4C x 4	FRLS/Cu/XLPE	305	305	14
3	ROSOV -VF-207C	ROSOVDB PANEL	EXISTING CONTROL ROOM	ROSOV -VF-207C	VF-207		0.6/1.1	Power	1	4C x 4	FRLS/Cu/XLPE	225	225	14
4	MOV -VF-207A	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -VF-207A	VF-207 DYKE		0.6/1.1	Power	1	4C x 4	FRLS/Cu/XLPE	300	300	14
5	MOV -VF-207B	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -VF-207B	VF-207 DYKE		0.6/1.1	Power	1	4C x 4	FRLS/Cu/XLPE	225	225	14
6	MOV -VF-207C	MOVDB PANEL	EXISTING CONTROL ROOM	MOV -VF-207C	VF-207 DYKE		0.6/1.1	Power	1	4C x 4	FRLS/Cu/XLPE	305	305	14
7	ROSOV -207A-LPBS	SAFETY PLC	NEW CONTROL ROOM	ROSOV -207A-LPBS	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	340	340	18
8	ROSOV-VF-207A	ROSOV -207A-LPBS	VF-207 DYKE	ROSOV-VF-207A	VF-207			Control	1	12C X 1.5	FRLS/Cu/XLPE	70	70	18
9	ROSOV -207B-LPBS	SAFETY PLC	NEW CONTROL ROOM	ROSOV -207B-LPBS	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	340	340	18
10	ROSOV-VF-207B	ROSOV -207B-LPBS	VF-207 DYKE	ROSOV-VF-207B	VF-207			Control	1	12C X 1.5	FRLS/Cu/XLPE	70	70	18
11	ROSOV -207C-LPBS	SAFETY PLC	NEW CONTROL ROOM	ROSOV -207C-LPBS	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	290	290	18
12	ROSOV-VF-207C	ROSOV -207C-LPBS	VF-207 DYKE	ROSOV-VF-207C	VF-207			Control	1	12C X 1.5	FRLS/Cu/XLPE	70	70	18
13	ROSOV-VF-207A	PROCESS PLC	NEW CONTROL ROOM	ROSOV-VF-207A	VF-207			Signal	1	2P X 1.5 MODBUS	FRLS/Cu/XLPE	410	410	
14	ROSOV-VF-207B	ROSOV-VF-207A	VF-207	ROSOV-VF-207B	VF-207			Signal	1	2P X 1.5 MODBUS	FRLS/Cu/XLPE	10	10	
15	ROSOV-VF-207C	ROSOV-VF-207B	VF-207	ROSOV-VF-207C	VF-207			Signal	1	2P X 1.5 MODBUS	FRLS/Cu/XLPE	110	110	
16	PROCESS PLC	ROSOV-VF-207C	VF-207	PROCESS PLC	VF-207			Signal	1	2P X 1.5 MODBUS	FRLS/Cu/XLPE	300	300	
17	MOV -VF-207A	Safety PLC	NEW CONTROL ROOM	MOV -VF-207A	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	380	380	18
18	MOV -VF-207B	Safety PLC	NEW CONTROL ROOM	MOV -VF-207B	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	290	290	18
19	MOV -VF-207C	Safety PLC	NEW CONTROL ROOM	MOV -VF-207C	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	380	380	18
20	DI-DJB-008	Procss PLC	NEW CONTROL ROOM	DI-DJB-008	VF-207 DYKE			Control	1	24C X 1.5	FRLS/Cu/XLPE	225	225	24
21	MOV -VF-207A TRIP	DI-DJB-008	VF-207 DYKE	MOV -VF-207A TRIP	VF-207 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	110	110	12
22	MOV -VF-207B TRIP	DI-DJB-008	VF-207 DYKE	MOV -VF-207B TRIP	VF-207 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	60	60	12
23	MOV -VF-207C TRIP	DI-DJB-008	VF-207 DYKE	MOV -VF-207C TRIP	VF-207 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	110	110	12
24	ROSOV -VF-207A TRIP	DI-DJB-008	VF-207 DYKE	ROSOV -VF-207A TRIP	VF-207 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	110	110	12
25	ROSOV -VF-207B TRIP	DI-DJB-008	VF-207 DYKE	ROSOV -VF-207B TRIP	VF-207 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	110	110	12
26	ROSOV -VF-207C TRIP	DI-DJB-008	VF-207 DYKE	ROSOV -VF-207C TRIP	VF-207 DYKE			Control	1	2C X 1.5	FRLS/Cu/XLPE	60	60	12
27	LT Radar Type Power ON	PDB	NEW CONTROL ROOM	LT Radar Type Power ON	VF-207		0.6/1.1	Power	1	3C x 2.5	FRLS/Cu/XLPE	480	480	14
28	LT Servo Type Poweer ON	PDB	NEW CONTROL ROOM	LT Servo Type Poweer ON	VF-207		0.6/1.1	Power	1	3C x 2.5	FRLS/Cu/XLPE	480	480	14
29	DI-DJB-007	Safety PLC	New Control Room	DI-DJB-007	VF-207 DYKE			Control	1	12C X 1.5	FRLS/Cu/XLPE	225	225	18
30	LT Radar Type Radar Level HI HI	DI-DJB-007	VF-207 DYKE	LT Radar Type Radar Level HI HI	VF-207			Control	1	2C X 1.5	FRLS/Cu/XLPE	85	85	12
31	Level Switch High Level Alarm	DI-DJB-007	VF-207 DYKE	Level Switch High Level Alarm	VF-207			Control	1	2C X 1.5	FRLS/Cu/XLPE	85	85	12
32	ESD Push Button	DI-DJB-007	VF-207 DYKE	ESD Push Button	VF-207			Control	1	2C X 1.5	FRLS/Cu/XLPE	90	90	12
33	TFMS SJB - 007	Procss PLC	New Control Room	TFMS SJB - 007	VF-207 DYKE			Signal	1	12P X 1.5	FRLS/Cu/XLPE	225	225	
34	LT Radar Type	TFMS SJB - 007	VF-207	LT Radar Type	VF-207			Signal	1	2P X 1.5	FRLS/Cu/XLPE	90	90	
35	LT Servo Type	TFMS SJB - 007	VF-207	LT Servo Type	VF-207			Signal	1	2P X 1.5	FRLS/Cu/XLPE	90	90	
36	PT - Density Measurement	LT Radar Gauge	VF-207	PT - Density Measurement	VF-207			Signal	1	1P X 1.5	FRLS/Cu/XLPE	90	90	
37	MST (Multi Point Temprature Sensor)	LT Radar Gauge	VF-207	MST (Multi Point Temprature Sensor)	VF-207			Signal	1	1P X 1.5	FRLS/Cu/XLPE	90	90	

Construction of 9000 KL Aboveground ATF Storage Tank at DAFFPL Fuel Farm														
CABLE SCHEDULE														
SL.NO	Description	FROM	From Location	TO	To Location	Rating (kw)	VOLTAGE GRADE	Type of cable	POWER & CONTROL CABLE	Size (sq mm)	Type of cable 2	Route Length (Mtr)	total Length (Mtr)	OD
38	LT Radar Type	TSI	VF-207	LT Radar Type	VF-207			Signal	1	2P X 1.5	FRLS/Cu/XLPE	110	110	
39	LT Servo Type	TSI	VF-207	LT Servo Type	VF-207			Signal	1	2P X 1.5	FRLS/Cu/XLPE	110	110	

Annexure - D

Drawings

GLOBAL CONSULTANTS

FROM CLIENT AC UPS (NEW CONTROL ROOM)

1R X 3.5C X 35Sq.mm. FRLS. Al. XLPE Armoured Cable.

ROSOV-DISTRIBUTION BOARD
LOC: INSIDE CONTROL ROOM

R Y B

INCOMMER
63A, TPN, 16kA, MCB.
With O/C, S/C Protection.

415V, 50 Hz, 3 Ph, 4 Wire, 63A, 10 kA for 1 sec. Al busbar

16A, TPN, 10kA, MCB. With O/C, S/C Protection. (Typ.)

Feeder No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Description	ROSOV – 201	ROSOV – 202	ROSOV – 203	ROSOV – 204	ROSOV – 205	ROSOV – 206	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
Location	TANK VF-201	TANK VF-202	TANK VF-203	TANK VF-204	TANK VF-205	TANK VF-206	–	–	–	–	–	–	–	–	–	–	–	–
Power Cable Size	4C X 2.5Sq.mm.																	

FROM CLIENT LT PANEL (EXISTING CONTROL ROOM)

2R X 3.5C X 70Sq.m. FRLS. Al CABLE

Main PDB
LOC: EXISTING CONTROL ROOM

R Y B

200/5A CL:1 15VA

6A MCB

ASS A (0-200A)

VSS V (0-500V)

INCOMMER 200A, TPN, MCCB. With O/C, S/C

ON OFF TRIP

415V, 50Hz, 200A, TPN, 50KA FOR 1 SEC. BUS.

63A, TPN, MCCB. With O/C, S/C

Feeder No.	01	02	03	04	05	06	07	08	09
Description	AC UPS	AC UPS	MOV-DB	Spare	Spare	Spare	Spare	Spare	Spare
Power Cable Cu. (FR) Size in Sq.mm.	1R X 3.5C X 35Sq.mm.	–	–	–	–	–	–	–	–

1R X 3.5C X 35Sq.mm. FRLS. Al. XLPE Armoured Cable.

MOV-DISTRIBUTION BOARD
LOC: INSIDE CONTROL ROOM

R Y B

INCOMMER 63A, TPN, 16kA, MCB. With O/C, S/C Protection.

415V, 50 Hz, 3 Ph, 4 Wire, 63A, 10 kA for 1 sec. Al busbar

16A, TPN, 10kA, MCB. With O/C, S/C Protection. (Typ.)

Feeder No.	01	02	03	04	05	06	07	08	09	10	11	12
Description	MOV – 201	MOV – 202	MOV – 203	MOV – 204	MOV – 205	MOV – 206	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
Location	TANK VF-201	TANK VF-202	TANK VF-203	TANK VF-204	TANK VF-205	TANK VF-206	–	–	–	–	–	–
Power Cable Size	4C X 2.5Sq.mm.											

LEGENDS :-

MCCB

INDICATING LAMP (COLOUR SHALL BE AS PER STD.).MCCB

MCB

REV.	DATE	DESCRIPTION	DRN BY	CHD BY	APPD. BY
0	21.05.2022	ISSUED FOR APPROVAL	AH	PS	SKJ

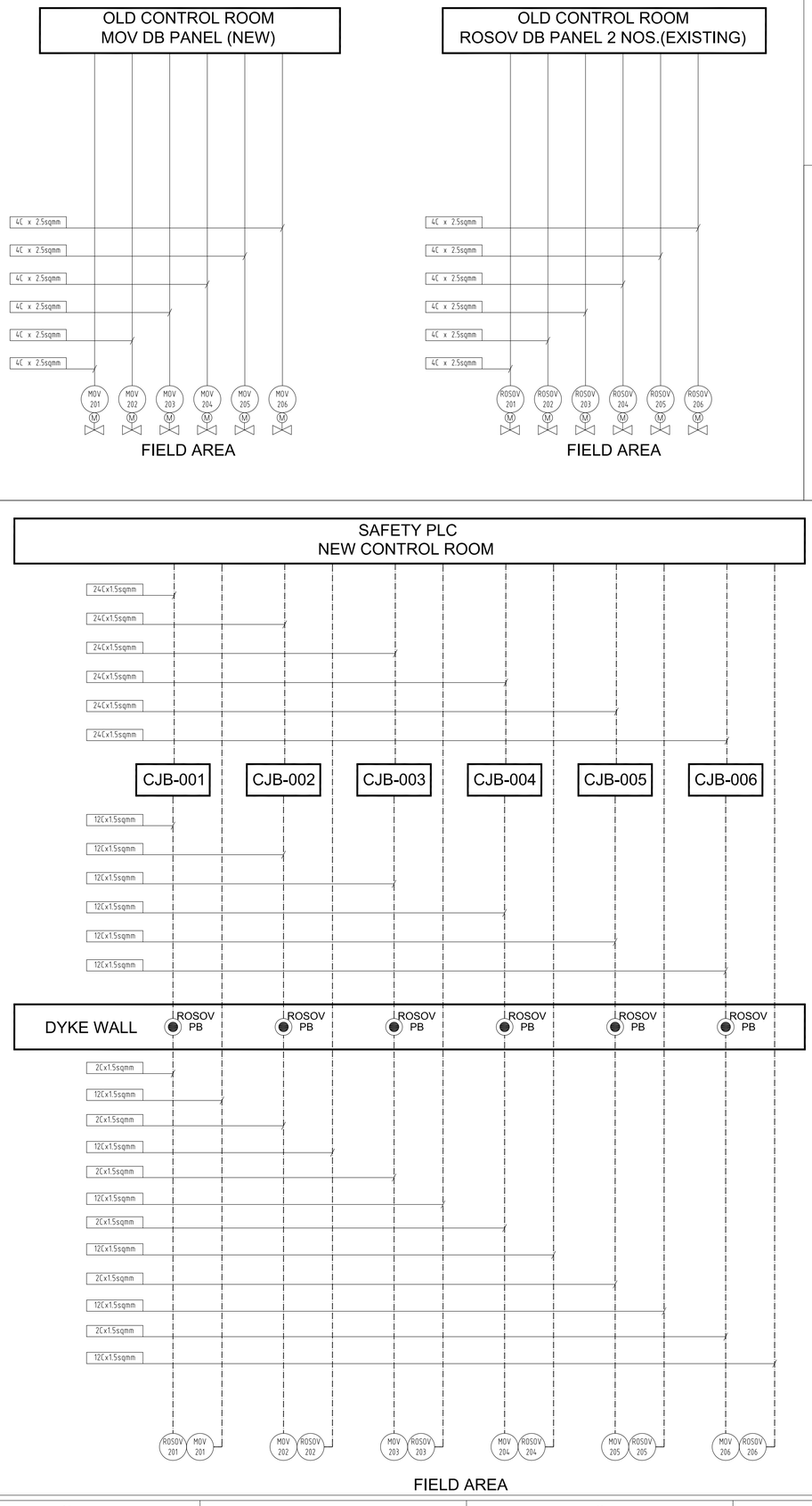
CLIENT : DELHI AVIATION FUEL FACILITY (P) LTD.

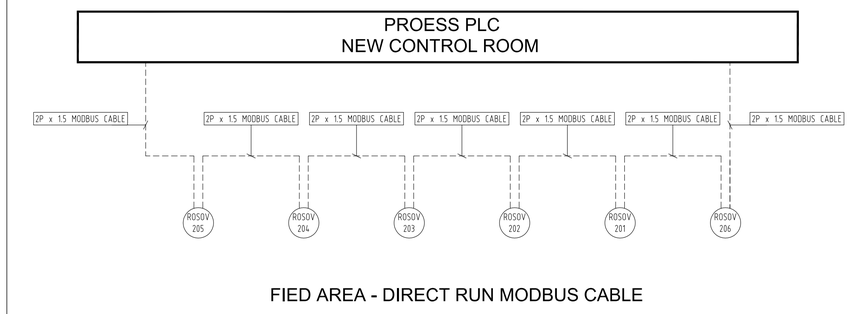
PROJECT : MODERNIZATION OF EXISTING FUEL FARM

EPCC : SAGA GLOBAL CONSULTANTS

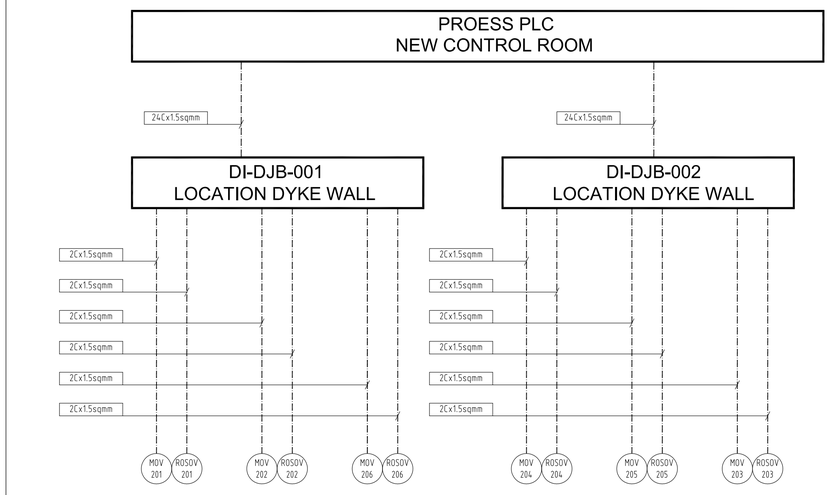
TITLE : OVER ALL SINGLE LINE DIAGRAM

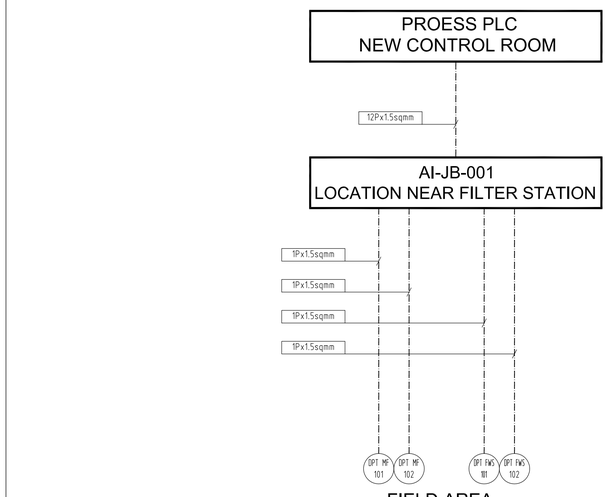
DRAWING No.: DAFFL-DELHI-EL-DR-106 | SHEET: 1/1 | REV. 0 | SCALE : N.T.S.





FIED AREA - DIRECT RUN MODBUS CABLE





REV.	DATE	DESCRIPTION	DRN BY	CHD BY	APPD. BY
0	17.06.2022	ISSUED FOR TENDER	AH	PS	SKJ

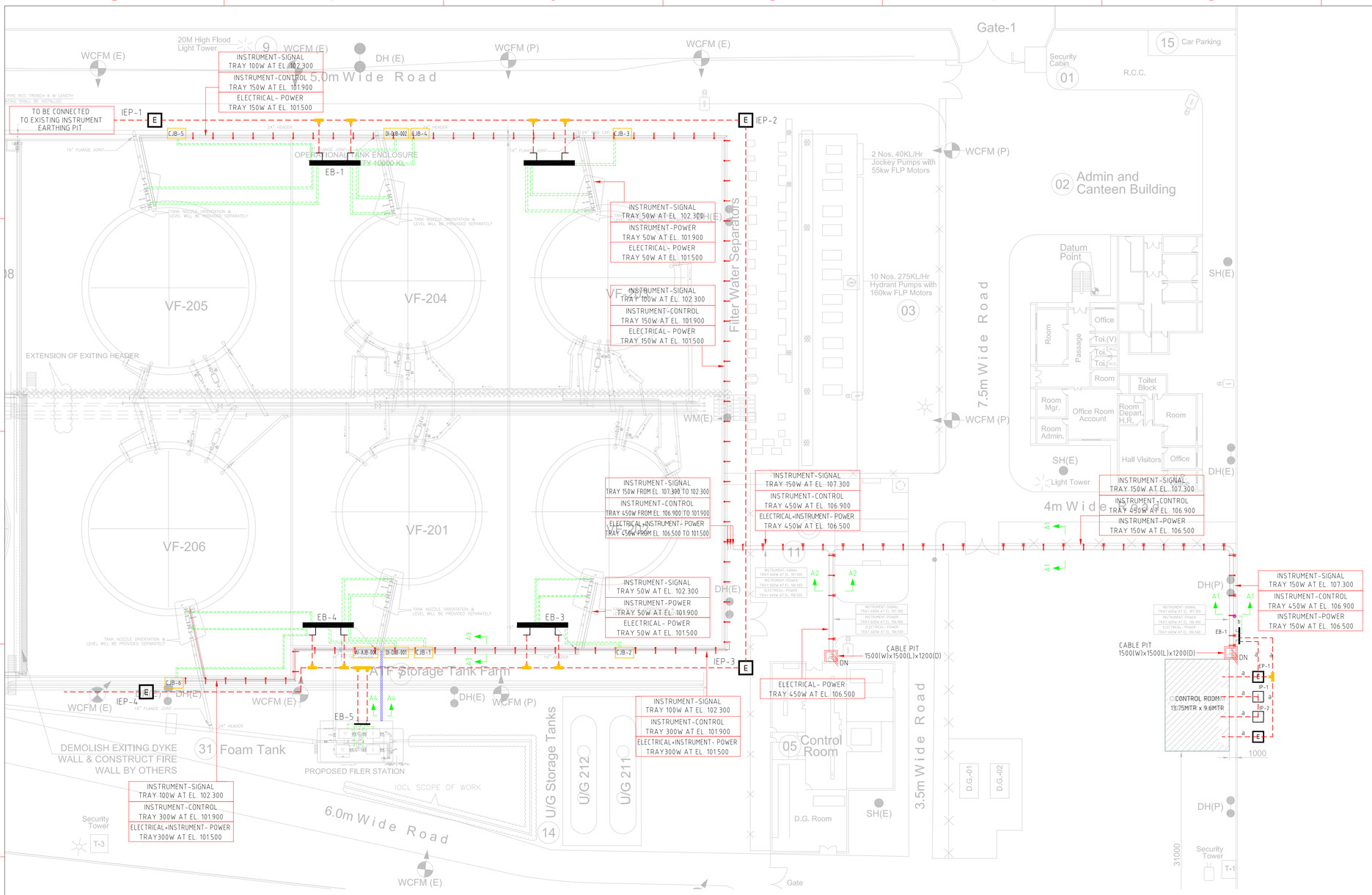
CLIENT : DELHI AVIATION FUEL FACILITY (P) LTD.

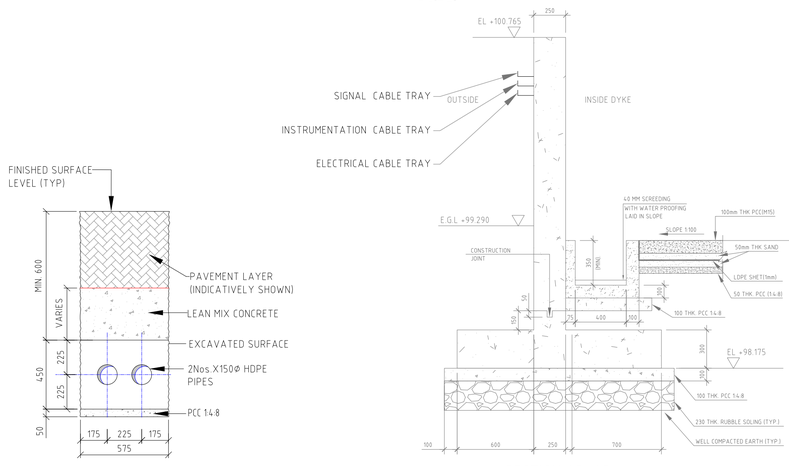
PROJECT : MODERNIZATION OF EXISTING FUEL FARM

EPCC : SAGA GLOBAL CONSULTANTS

TITLE : BLOCK DIAGRAM

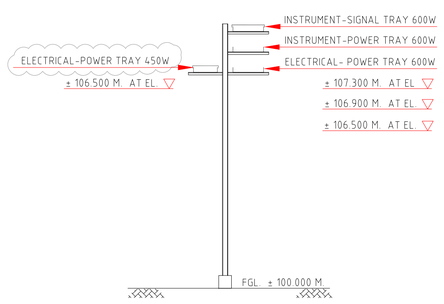
DRAWING No.: DAFFL-DELHI-EL-DR-107 | SHEET: 1/1 | REV. 0 | SCALE : AS SHOWN



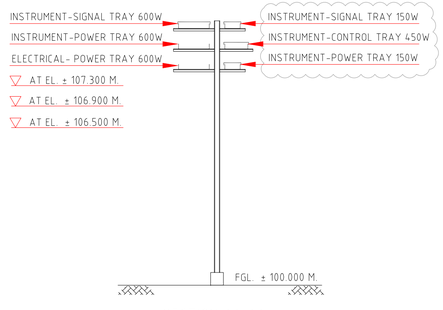


SECTION A3-A3
SCALE–NTS

SECTION A4-A4
SCALE–NTS

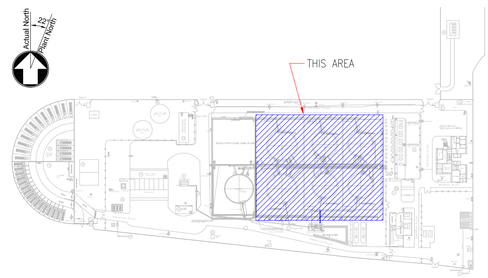


SECTION A2-A2
SCALE–NTS



SECTION A1-A1
SCALE–NTS

KEY PLAN



NOTES

1. LOCATION OF EARTHING PIT FOR ROSOV, MOV AND JBs SHALL BE TO SUIT AT SITE CONDITION
2. CABLE ROUTE SHALL BE TO SUIT AT SITE CONDITION SUBJECTED TO PRIOR APPROVAL OF ENGINEER INCHARGE.
3. 50MM CABLE TRAY SHOWN FROM AI-AJB-001 TO FWS/MF IS TENTATIVE & SAME SHALL BE MODIFIED BY CONTRACTOR TO SUIT AT SITE CONDITION.

LEGEND			
SR NO	SYMBOL	DESCRIPTION	PART-B
1		50 mm x6 mm GI Strip	415 Mtr
2		1C x 6 sqmm PVC Insulated Cable	650 Mtr
3		Earthing Bus Bar	5 NOS.
4		Earthing Lugs	40 NOS.
5	E	Instrument Equipment Earthing Pit	4 NOS.
6		Cable Tray	--
7		Cable Trench	12 Mtr

TRAY DETAILS		
SR NO	DESCRIPTION	QTY
1	Cable Tray 50mm Wide	270 Mtr
2	Cable Tray 100mm Wide	260 Mtr
3	Cable Tray 150mm Wide	490 Mtr
4	Cable Tray 300mm Wide	210 Mtr
5	Cable Tray 450mm Wide	140 Mtr.

INSTRUMENT SYMBOL			
SR. NO	SYMBOL	DESCRIPTION	QTY
01		REMOTE OPERATED SHUT OFF VALVE (ROSOV)	6 Nos.
02	M	MOTOR OPERATED VALVE	6 Nos.
03	DI-DJB	CONTROL JUNCTION BOX	8 Nos.

REV.	DATE	DESCRIPTION	DRN BY	CHD BY	APPD. BY
0	20.05.2022	ISSUED FOR TENDER	AH	PS	SKJ

CLIENT : DELHI AVIATION FUEL FACILITY (P) LTD.

PROJECT : MODERNIZATION OF EXISTING FUEL FARM

EPCC : SAGA GLOBAL CONSULTANTS

TITLE : ADDITIONAL RECEIPT HEADER LINE ELECTRICAL AND INSTRUMENTATION WORKS

DRAWING No.: DAFFL-DELHI-EL-DR-105 | SHEET: 1/1 | REV. 0 | SCALE :NTS

FROM CLIENT AC UPS (NEW CONTROL ROOM)

1R X 3.5C X 35Sq.mm. FRLS. Al. XLPE Armoured Cable.

ROSOV-DISTRIBUTION BOARD
LOC: INSIDE CONTROL ROOM

R Y B

INCOMMER
63A, TPN, 16kA, MCB.
With O/C, S/C Protection.

415V, 50 Hz, 3 Ph, 4 Wire, 63A, 10 kA for 1 sec. Al busbar

16A, TPN, 10kA, MCB. With O/C, S/C Protection. (Typ.)

Feeder No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Description	ROSOV – 201	ROSOV – 202	ROSOV – 203	ROSOV – 204	ROSOV – 205	ROSOV – 206	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
Location	TANK VF-201	TANK VF-202	TANK VF-203	TANK VF-204	TANK VF-205	TANK VF-206	–	–	–	–	–	–	–	–	–	–	–	–
Power Cable Size	4C X 2.5Sq.mm.																	

FROM CLIENT LT PANEL (EXISTING CONTROL ROOM)

2R X 3.5C X 70Sq.m. FRLS. Al CABLE

Main PDB
LOC: EXISTING CONTROL ROOM

R Y B

200/5A CL:1 15VA

6A MCB

ASS A (0-200A)

VSS V (0-500V)

INCOMMER 200A, TPN, MCCB. With O/C, S/C

ON OFF TRIP

415V, 50Hz, 200A, TPN, 50KA FOR 1 SEC. BUS.

63A, TPN, MCCB. With O/C, S/C

Feeder No.	01	02	03	04	05	06	07	08	09
Description	AC UPS	AC UPS	MOV-DB	Spare	Spare	Spare	Spare	Spare	Spare
Power Cable Cu. (FR) Size in Sq.mm.	1R X 3.5C X 35Sq.mm.	–	–	–	–	–	–	–	–

1R X 3.5C X 35Sq.mm. FRLS. Al. XLPE Armoured Cable.

MOV-DISTRIBUTION BOARD
LOC: INSIDE CONTROL ROOM

R Y B

INCOMMER 63A, TPN, 16kA, MCB. With O/C, S/C Protection.

415V, 50 Hz, 3 Ph, 4 Wire, 63A, 10 kA for 1 sec. Al busbar

16A, TPN, 10kA, MCB. With O/C, S/C Protection. (Typ.)

Feeder No.	01	02	03	04	05	06	07	08	09	10	11	12
Description	MOV – 201	MOV – 202	MOV – 203	MOV – 204	MOV – 205	MOV – 206	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
Location	TANK VF-201	TANK VF-202	TANK VF-203	TANK VF-204	TANK VF-205	TANK VF-206	–	–	–	–	–	–
Power Cable Size	4C X 2.5Sq.mm.											

LEGENDS :-

MCCB

INDICATING LAMP (COLOUR SHALL BE AS PER STD.).MCCB

MCB

REV.	DATE	DESCRIPTION	DRN BY	CHD BY	APPD. BY
0	21.05.2022	ISSUED FOR APPROVAL	AH	PS	SKJ

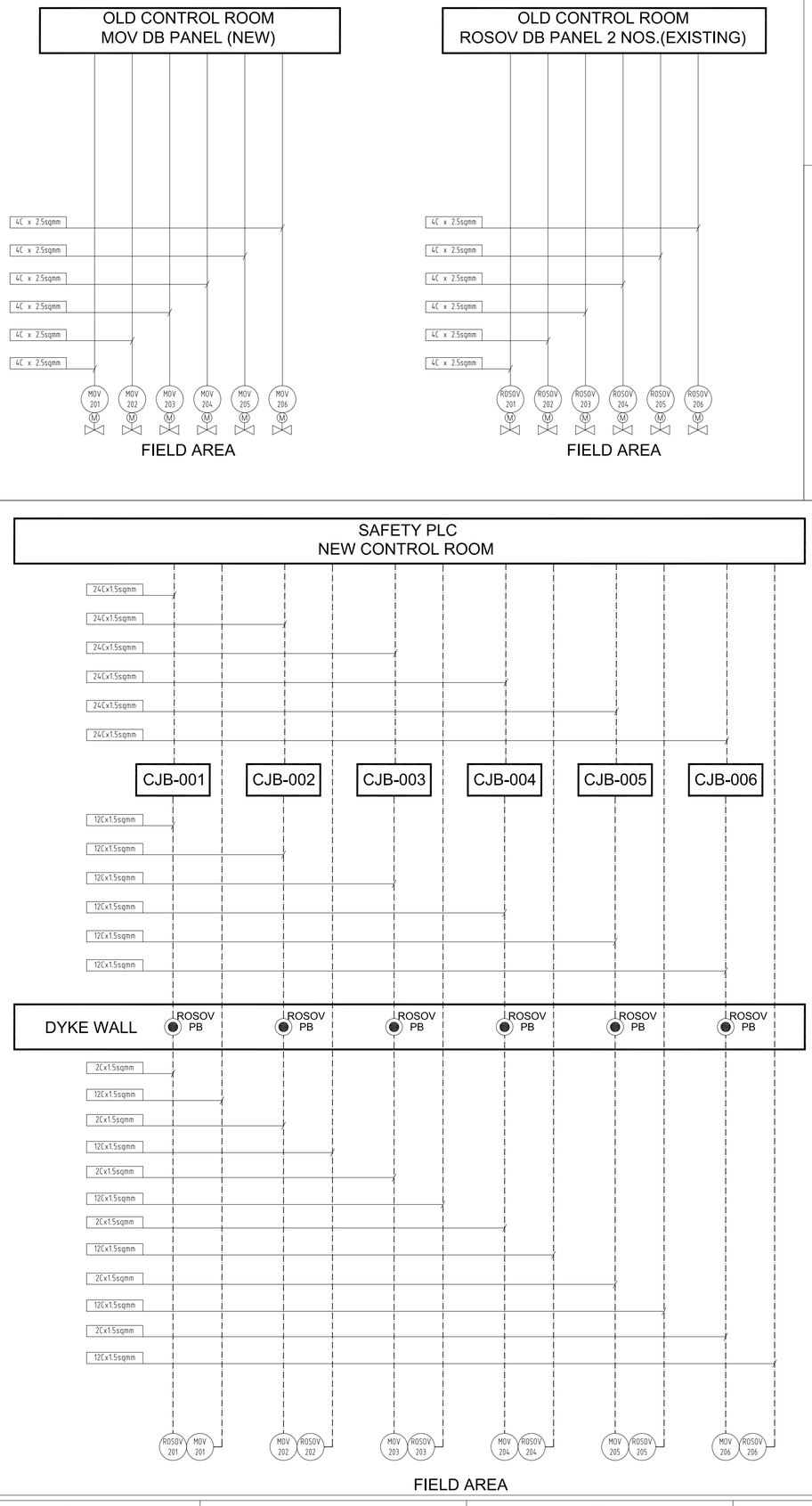
CLIENT : DELHI AVIATION FUEL FACILITY (P) LTD.

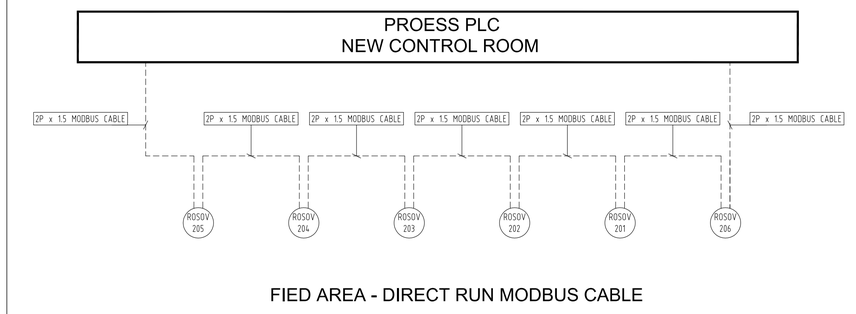
PROJECT : MODERNIZATION OF EXISTING FUEL FARM

EPCC : SAGA GLOBAL CONSULTANTS

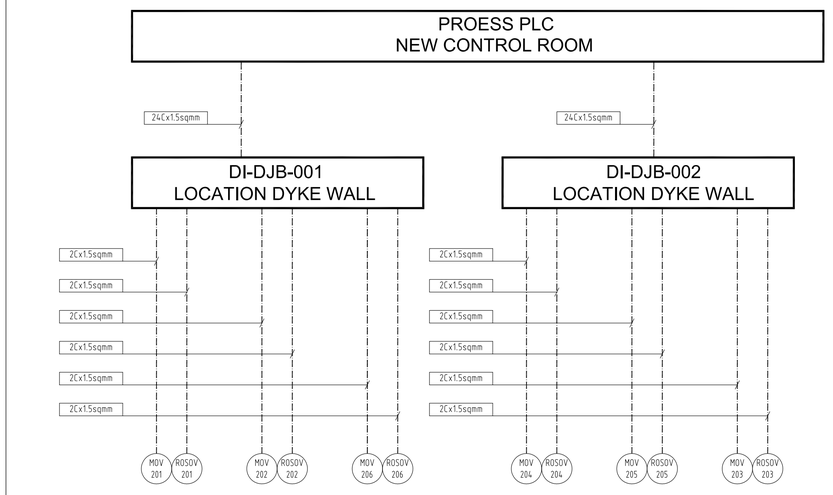
TITLE : OVER ALL SINGLE LINE DIAGRAM

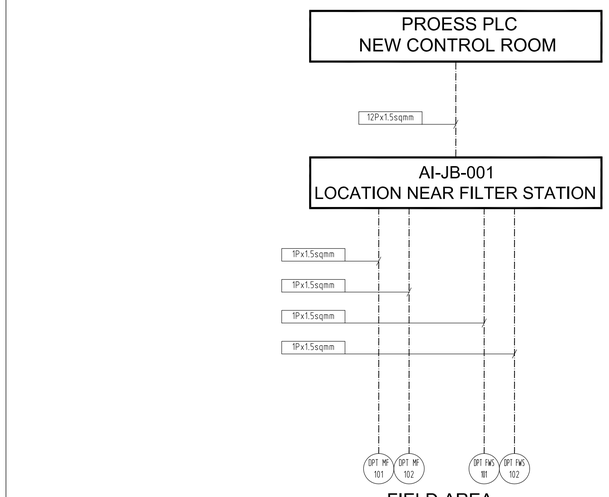
DRAWING No.: DAFFL-DELHI-EL-DR-106 | SHEET: 1/1 | REV. 0 | SCALE : N.T.S.





FIED AREA - DIRECT RUN MODBUS CABLE





REV.	DATE	DESCRIPTION	DRN BY	CHD BY	APPD. BY
0	17.06.2022	ISSUED FOR TENDER	AH	PS	SKJ

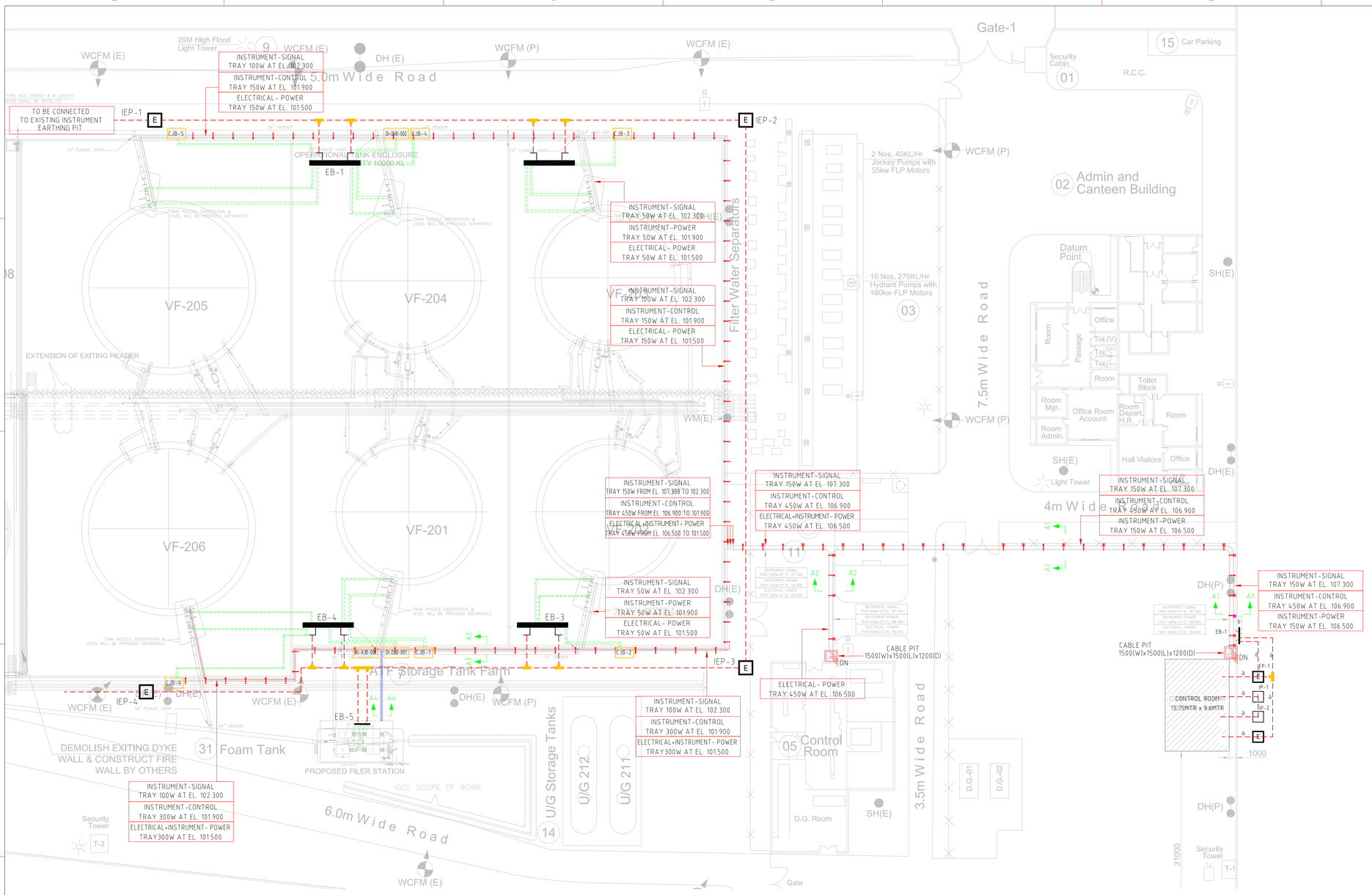
CLIENT : DELHI AVIATION FUEL FACILITY (P) LTD.

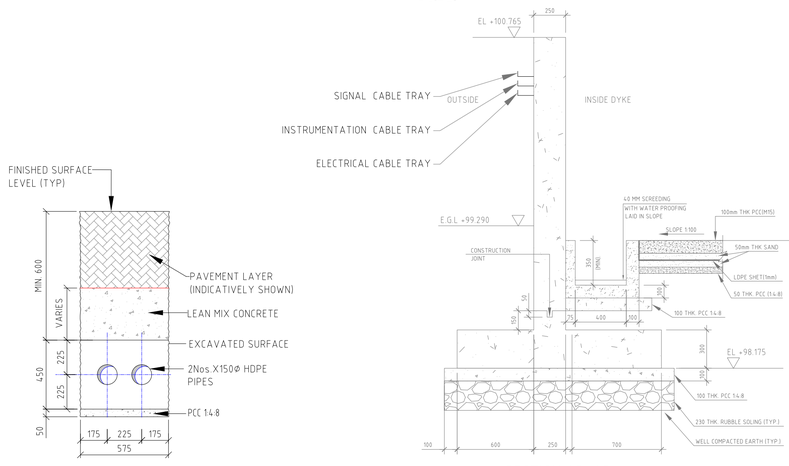
PROJECT : MODERNIZATION OF EXISTING FUEL FARM

EPCC : SAGA GLOBAL CONSULTANTS

TITLE : BLOCK DIAGRAM

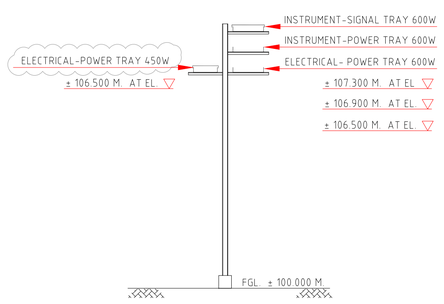
DRAWING No.: DAFFL-DELHI-EL-DR-107 | SHEET: 1/1 | REV. 0 | SCALE : AS SHOWN



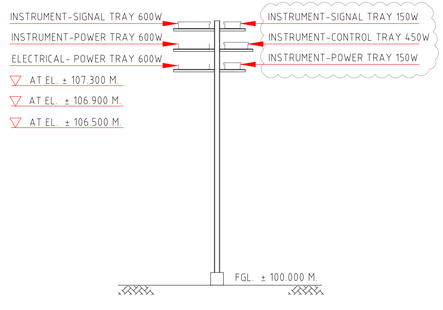


SECTION A3-A3
SCALE–NTS

SECTION A4-A4
SCALE–NTS

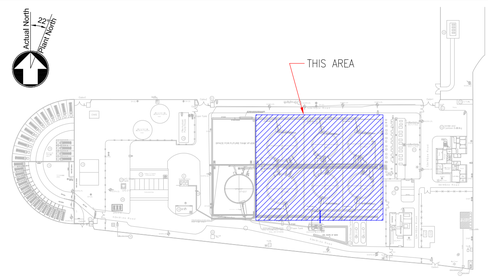


SECTION A2-A2
SCALE–NTS



SECTION A1-A1
SCALE–NTS

KEY PLAN



NOTES

1. LOCATION OF EARTHING PIT FOR ROSOV, MOV AND JBs SHALL BE TO SUIT AT SITE CONDITION
2. CABLE ROUTE SHALL BE TO SUIT AT SITE CONDITION SUBJECTED TO PRIOR APPROVAL OF ENGINEER INCHARGE.
3. 50MM CABLE TRAY SHOWN FROM AI-AJB-001 TO FWS/MF IS TENTATIVE & SAME SHALL BE MODIFIED BY CONTRACTOR TO SUIT AT SITE CONDITION.

LEGEND			
SR NO	SYMBOL	DESCRIPTION	PART-B
1		50 mm x6 mm GI Strip	415 Mtr
2		1C x 6 sqmm PVC Insulated Cable	650 Mtr
3		Earthing Bus Bar	5 NOS.
4		Earthing Lugs	40 NOS.
5	E	Instrument Equipment Earthing Pit	4 NOS.
6		Cable Tray	--
7		Cable Trench	12 Mtr

TRAY DETAILS		
SR NO	DESCRIPTION	QTY
1	Cable Tray 50mm Wide	270 Mtr
2	Cable Tray 100mm Wide	260 Mtr
3	Cable Tray 150mm Wide	490 Mtr
4	Cable Tray 300mm Wide	210 Mtr
5	Cable Tray 450mm Wide	140 Mtr.

INSTRUMENT SYMBOL			
SR. NO	SYMBOL	DESCRIPTION	QTY
01		REMOTE OPERATED SHUT OFF VALVE (ROSOV)	6 Nos.
02	M	MOTOR OPERATED VALVE	6 Nos.
03	DI-DJB	CONTROL JUNCTION BOX	8 Nos.

REV.	DATE	DESCRIPTION	DRN BY	CHD BY	APPD. BY
0	20.05.2022	ISSUED FOR TENDER	AH	PS	SKJ

CLIENT : DELHI AVIATION FUEL FACILITY (P) LTD.

PROJECT : MODERNIZATION OF EXISTING FUEL FARM

EPCC : SAGA GLOBAL CONSULTANTS

TITLE : ADDITIONAL RECEIPT HEADER LINE ELECTRICAL AND INSTRUMENTATION WORKS

DRAWING No.: DAFFL-DELHI-EL-DR-105 | SHEET: 1/1 | REV. 0 | SCALE :NTS

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

ANNEXURE I – 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 II – DECLARATION SHEET

Date:

DECLARATION

We, M/s hereby, unconditionally accept all terms & conditions of TENDER NO.: DAFFPL/FF/2022-23/07 (JOB: TENDER FOR ELECTRICAL & INSTRUMENTATION WORKS FOR NEW RECIEPT HEADER & NEW 9000KL AG TANK) 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-III

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-IV

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 dispute or disputes have been raised by the said M/s. ----------

_____
Sign & Stamp of Bidder

--------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- V

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 VI

DECLARATION to be submitted along with Technical Bid

(M/s.) hereby declare / clarify that we have not been banned or delisted by IOCL/BPCL/DIAL or any government or quasi Government agencies or Public Sector Undertakings.

Stamp & Signature of the bidder

NOTE: If a bidder has been banned by IOCL/BPCL/DIAL or 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

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

ANNEXURE VII

STATEMENT OF CREDENTIALS

(A)

1. NAME AND CORRESPONDENCE ADDRESS OF THE TENDERER

_____

_____

_____

PERMANENT ADDRESS OF THE TENDERER

_____

_____

_____

2. TELEPHONE NO. _____

MOBILE NO. _____

3. NAME OF CONTACT PERSON(s): _____

4. NAME OF THE AUTHORISED SIGNATORY: _____

5. E Mail ID: _____

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

(B) **TYPE OF BUSINESS ENTITY:**

1. YEAR OF ESTABLISHMENT OF THE FIRM: _____

2. SOLE PROPRIETORSHIP: - _____

(Give Name of the Proprietor)

OR

3. PARTNERSHIP FIRM?

(Give names of the Partners and enclose scan copy of Partnership deed)

1. _____

2. _____

3. _____

4. _____

OR

4. PRIVATE OR PUBLIC LIMITED COMPANY?

(Attach list of Directors and copy of Certificate of Incorporation as defined in "Other Mandatory Documents")

(C) **Details of Completed Purchase Orders of minimum value as per Pre-qualification criteria (PQC/BQC) during last SEVEN years as specified in PQC/BQC of the tender.**

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

Sl. No	Particulars	1	2	3
a	Party's Name to whom supplied, Clear Postal Address, Telephone/Fax Nos and E-Mail Address.			
b	**Purchase Order Details-**			
	PO Reference No.			
	PO Date			
	PO Value (Rs. in Lakhs)			
c	**Quantity & place of supply**			
d	**Scheduled time of completion as per PO**			
e	**Date of commencement of supply**			
f	**Date of completion of supply**			
g	**Completion certificate reference and date**			

Note: a. Tenderer should furnish copy of the above-referred orders (as defined under PQC documents) and

b. Enclose a separate statement if space is not sufficient.

(D) **Annual Turnover (as per Audited Balance Sheet) in following last THREE financial years**

SL No.	Financial Year	Value (Rs. In Lakhs)
1	2019-2020	
2	2020-2021	
3	2021-2022	

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

Note : Tenderer should furnish copy of audited accounts as proof of turnover (as defined under tender documents)**.**

(E) **INCOME TAX DETAILS:**

i. Income Tax Returns Filed:

ASSESSMENT YEAR	DATE	ACKNOWLEDGEMENT NO
2019-2020		
2020-2021		
2021-2022		

Note: Tenderer should furnish copy of the Income Tax Return filed.

ii. Income Tax Assessment Orders for following three financial years:

ASSESSMENT YEAR	ASSESSMENT ORDER & DATE	REMARKS
2019-2020		
2020-2021		
2021-2022		

Copies of Income Tax assessment orders / return filed / acknowledgement order for the three years as indicated above.

(F) GST Registration Details:

GST Registration no	

Note: Tenderer should furnish copies of above Tax Registration Certificates.

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

(G) **Mode of EMD (Online EMD or BG):**

i. If paid Online:

AMOUNT	Rs.
(RTGS/NEFT/NET BANKING)	
Transaction Detail	

ii. If Bank Guarantee submitted (following details to be given) :

Name of the Issuing Bank and Branch Address	Bank Guarantee No and Date	BG Amount Rs.	Date of issuance	Valid Upto

(H) **Production Capacity Details: (in case of manufacturer)**

S. N	Item	Factory/ Location	Installed/ Capacity	Already Committed Capacity (For current Purchase orders in hand)	Spare Capacity, If Any	Capacity Committed to DAFFPL against this tender
			A	B	C=A-B	

_____

Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

Factory License and Address Details:

_____

_____

_____

(J) **In case the bidder is not a manufacturer, the bidder should submit an undertaking on Letter Head that the bidder is capable of supplying the material / equipment as per tender requirement.**

(K) **Pan Card Details**

Relation of Pan Holder to Tenderer
(PROP./PARTNER/COMPANY ETC.)
(Tenderer is required to upload copy of PAN card as detailed in "Other Mandatory documents")

(L) **Details of Documents uploaded along with Tender documents in technical bid and confirmation required to be furnished by tenderer.**

_____
Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

PAYMENT TO VENDORS THROUGH ELECTRONIC MODE

Tenderers are requested to submit their Consent Letter as per the format given below along with the enclosures as required:

Dated:

To,
M/s DAFFPL.

Dear Sir,
With reference to your advice, we hereby agree to accept the payment of our bills through "RTGS/NEFT/Electronic Mode". The desired bank account details are given below:

1.	Name of Beneficiary	
2.	Name of the Beneficiary's Bank	
3.	Address of the Beneficiary's Bank Branch	
4.	Contact details of Branch with STD Code	
5.	Beneficiary's Bank Account No. (as per cheque copy)	
6.	Beneficiary's Account Type (SB/CC/CA)	
7.	Beneficiary's Bank IFSC Code (11 Digit)	
8.	Mobile No of Beneficiary (One Number only)	
9.	E-Mail Id of Beneficiary (One Mail Id only)	

A blank cancelled cheque leaf relating to the above bank account is enclosed for verifying the accuracy of the bank account details.
I hereby declare that the particulars given above are correct and complete.

(Signature of Account Holder)
Seal of the Vendor

Encl: Cancelled Cheque

_____
Sign & Stamp of Bidder

PRICE BID - Electrical and Instrumentation Works (DAFFPL/FF/2022-23/07)

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
	Part 1A - Bill of Quantity - Supply Items - Electrical and Instrumentation works for Additional Receipt Header inside Fuel Farm Facility of DAFFPL.							
1A.1	**PDB**							
	Design & Supply of weatherproof 630A, (PDB) , 415V , 3 ph, sheet steel enclosure flush/surface mounted Power distribution board as per attached specification of this tender Incomer : 1 No.630A, TPN MCCB Outgoing :1 No. 200 A, TPN MCCB 3 Nos. 100 A, TPN MCCB & 6 Nos. 63A, TPN MCCB	1.00	EA		-			-
1A.2	**MOVDB PANEL**				-			-
1A.2.1	Design & Supply of 415V, 63A, 10 kA for 1 sec. Al busbar, IP-65, Indoor Type, wall mounted Sub Distribution Board as per attached specification of this tender. (MOVDB) Incomer : 1 No. 63A, 4P MCCB Outgoing : 12 Nos. 16A. TPN MCBs	1.00	EA		-			-
1A.3	**Cables**				-			-
	Signal , Control & Power Cable				-			-
	Supply of Power, Control, Signal Cable as per tender specifications.				-			-
1A.3.1	Multicore copper conductor, GI round wire armoured, FRPVC outer sheathed.(FRLS) -				-			-
1A.3.1.1	24 C x 1.5 sqmm	1720	RM		-			-
1A.3.1.2	12 C x 1.5 sqmm	1470	RM		-			-
1A.3.2	Power Cable of plain annealed aluminum conductor as per IS 8130/1984 armoured FR-PVC insulated cable (FRLS) -				-			-
1A.3.2.1	3.5 C x 35 sqmm	30.00	RM		-			-
1A.3.2.2	3.5 C x 185 sqmm	150.00	RM		-			-
1A.3.2.3	3.5 C x 120 sqmm	Unit Rate	RM		-			-
1A.3.2.4	3.5 C x 70 sqmm	Unit Rate	RM		-			-
1A.3.3	Power Cable of multi stranded annealed tinned copper as per IS 8130/1984 armoured FR-PVC insulated cable (FRLS) -				-			-
1A.3.3.1	4C x 2.5 sqmm	2020	RM		-			-
1A.3.4	Control cable two core copper conductor, steel wire armoured, FR-PVC outer sheathed.(FRLS) -2C X 1.5 SQ mm	520	RM		-			-
1A.3.5	Supply of Modbus 2 Pair communication cables	1000	RM		-			-
1A.3.6	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded - 12P x 1.5 sqmm	220	RM		-			-
1A.3.7	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded - 1P x 1.5 sq mm	100	RM		-			-
1A.3.8	Supply of 1C x 6 Sq. mm Copper PVC insulated flexible wires (Green with yellow mark) for earthing instruments and junction boxes etc complete a as per specification and tender document	650	RM		-			-
1A.4	Cable Trays				-			-
1A.4.1	Supply of FRP Cable Tray with Cover, bends, fittings and associated accessories, FRP cable trays (2.5mm Thick and 25mm edge height), tray covers (1.5mm Thick and 10 mm edge height) Complete as per specifications / tender documents.				-			-
1A.4.1.1	50mm	270.00	RM		-			-
1A.4.1.2	100mm	260.00	RM		-			-
1A.4.1.3	150 mm	490.00	RM		-			-
1A.4.1.4	300 mm	210.00	RM		-			-
1A.4.1.5	450mm	140.00	RM		-			-
1A.5	**Junction Boxes**				-			-
1A.5.1	Supply of Exd/FLP Junction Box (Power/Control/Signal JB) with IP 65 as per specification suitable for hazardous area of zone 1, group IIA/IIB, T3 or better having CCOE/CMRI approval. It shall be complete in all respect. Accessories like certified double compression cable glands with PVC shrouds & plugs for excess entries, SS 316 engraved tag plate, mounting clamp & SS 316 fasteners to be provided along with JBs Complete as per specification / tender documents.				-			-
1A.5.1.1	4 ways JB with1 No Incoming cable entry of 24C x 1.5sq mm FRLS cable and 2nos of Outgoing 12C x 1.5 FRLS cable	6.00	EA		-			-
1A.5.1.2	12ways JB with1 No Incoming cable entry of 24C x 1.5sq mm FRLS cable and 12nos of Outgoing 2C x 1.5 FRLS cable	2.00	EA		-			-
1A.5.2	**CABLE GLANDS & LUGS**				-			-
	Supplying of Flame proof & weather proof Brass double Compression Type Nickle Plated Cable Glands and lugs for Terminations of following sizes.				-			-
1A.5.2.1	3.5C X 35 sq mm	2.00	EA		-			-
1A.5.2.2	3.5C X 70 sq mm	Unit Rate	EA		-			-
1A.5.2.3	3.5C X 120 sq mm	Unit Rate	EA		-			-
1A.5.2.4	3.5C X 185 sq mm	6.00	EA		-			-
1A.5.2.5	4C x 2.5 sqmm	24.00	EA		-			-
1A.5.2.6	12 C x 1.5 sqmm	36.00	EA		-			-
1A.5.2.7	24 C x 1.5 sqmm	16.00	EA		-			-
1A.5.2.8	2C x 1.5 sqmm	24.00	EA		-			-
1A.5.2.9	2P X 1.5 MODBUS CABLE	14.00	EA		-			-
1A.5.2.10	12P x 1.5 sqmm	2.00	EA		-			-
1A.5.2.11	1P x 1.5 sqmm	8.00	EA		-			-
1A.6	**Earth Pit**				-			-
1A.6.1	Supply of Maintenance Free CPRI approved Earth pit (Ashlok /Equivalent make) as per IS : 3043 with 80 mm outer dia and 40 mm inner dia., of minimum 3mtr length safe earthing electrode with Pipe-in-pipe technology consisting of two mild steel pipes one inside the other, hot dip galvanized(80-100 microns), filled with high conductive & corrosion resistance crystalline mixture (Minimum 20Kg) and backfilling compound around electrode,25 mm dia G.I. watering pipe with funnel, test link, brick masonry earth pit including plastering in CM 1:4, 600x600 mm C.I. Manhole chamber including providing suitable earth bus for interconnection etc. Equivalent make shall be approved by client / consultants.Procedure recommended by chemical earth supplier and IS code to be finally adopted. Item also includes provision of earth station flags / Indication Plate with pit nos and date of inspection and the next due date of inspection. Job also includes provision of test certificate of earthing station from a licensed electrician as per the format of the Corporation.All Instruments, JBs, Equipments in Field shall be earthed by 6 mm2 PVC insulated copper cable to nearest Insulated copper Earth Bus bar (minimum size 25 mm x 6 mm) and this earth bar shall be connected to earth pit by redundant Multi stranded copper cable (Min 25 mm2).	4.00	EA		-			-
1A.7	**EARTHING STRIP**				-			-

PRICE BID - Electrical and Instrumentation Works (DAFFPL/FF/2022-23/07)

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
1A.7.1	Supply of hot dip GI earth strip (50 X 6) within earth station. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all fabrication.	415.00	RM		-			-
1A.7.2	Supply of hot dip GI earth strip (25 mm X 6 mm Thk.) within earth station for relocated earth pits. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all fabrication.	80.00	RM		-			-
1A.8	Supply of fabricated steel structural to erection site, surface treatment of steel structural works including surface cleaning, supply & one coat of epoxy based primer & one coats of epoxy based finish paint, all work, labour and materials complete as per drawings, specifications, standards and instructions / directions of ENGINEER IN CHARGE.				-			-
1A.8.1	ISMC 100 / ISA 75x75x8 L / Any other size of Structural steel material and Anchor Fastners	2	TON		-			-
1A.9	Supply, for HDPE duct pipe or corrugated ducts with MDPE couplers of 100 mm dia. size. Supplied HDPE ducts shall conform to IS: 7328, IS: 4984 Et ASTM: D-1963	50	m		-			-
TOTAL SUPPLY COST OF ELECTRICAL & INSTRUMENTATION WORKS PACKAGE- PART 1A					**-**		**-**	**-**

PRICE BID - Electrical and Instrumentation Works (DAFFPL/FF/2022-23/07)

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
	Part 1B - Bill of Quantity - Installation, Testing and commisiong Works - Electrical and Instrumentation works for Additional Receipt Header inside Fuel Farm Facility of DAFFPL.							
Sr. No.	**Item Description**	**Quantity**	**Unit**	**Unit Rate (INR)**	**Total Amount in INR**	**Tax%**	**Tax Amount in INR**	**Amount including taxes in INR**
1B.1	**PDB**							
	Installation of weatherproof 630 A, (PDB) , 415V , 3ph, sheet steel enclosure flush/surface mounted Power disrition oard as per attached specification of this tender Incomer : 1 No.200A, TPN MCCB Outgoing :1 No. 200 A, TPN MCCB 3 Nos. 100 A, TPN MCCB & 6 Nos. 63A, TPN MCCB	1.00	EA		-			-
1B.2	**MOVDB PANEL**				-			-
1B.2.1	Installation of 415V, 32A, 10 kA for 1 sec. Al busbar, IP-65, Indoor Type, wall mounted Sub Distribution Board as per attached specification of this tender. (MOVDB) Incomer : 1 No. 63A, 4P MCCB Outgoing : 12 Nos. 16A, TPN MCBs	1.00	EA		-			-
1B.2.2	Relocation of Local Push Button Stations, Emergency Button station, Tank side Indicators for all existing 6 Nos. Tank / Tank Equipment / Instrument including civil works for support foundation and installation of structural steel support works etc.				-			-
	Existing Local Push Buttons, emergency button stations, Tank side Indicators etc shall be relocated in site premises as per direction of Engineer In charge. The scope includes removal of Local Push Button stations, emergency button stations, Civil Works like excavation for Footing, backfilling by earth, Concrete Footing, including Painting of Structural steel members of Support etc complte in all respect and the same shall be installed at designated place as per direction of Engineer Incharge. Requisite support for these shall have a separate Rate in items Strutural steel in Sr. No. 8.1.	1.00	LS		-			-
1B.3	**Cables**				-			-
	Signal , Control & Power Cable				-			-
	Laying, Glanding, Ferulling and termination of Power, Control, Signal Cable as per tender specifications.				-			-
1B.3.1	Multicore copper conductor, GI round wire armoured, FRPVC outer sheathed.(FRLS) -				-			-
1B.3.1.1	24 C x 1.5 sqmm	1720	RM		-			-
1B.3.1.2	12 C x 1.5 sqmm	1470	RM		-			-
1B.3.2	Power Cable of plain annealed aluminum conductor as per IS 8130/1984 armoured FR-PVC insulated cable (FRLS) -				-			-
1B.3.2.1	3.5C x 35 sqmm	30.00	RM		-			-
1B.3.2.2	3.5 C x 185 sqmm	150.00	RM		-			-
1B.3.2.3	3.5 C x 120 sqmm	Unit Rate	RM		-			-
1B.3.2.4	3.5 C x 70 sqmm	Unit Rate	RM		-			-
1B.3.3	Power Cable of multi stranded annealed tinned copper as per IS 8130/1984 armoured FR-PVC insulated cable (FRLS) -				-			-
1B.3.3.1	4C x 2.5 sqmm	2020.00	RM		-			-
1B.3.4	Control cable two core copper conductor, steel wire armoured, FR-PVC outer sheathed.(FRLS) -2C X 1.5 SQ mm	520.00	RM		-			-
1B.3.5	Supply of Modbus 2 Pair communication cables	1000.00	RM		-			-
1B.3.6	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded - 12P x 1.5 sqmm	220	RM		-			-
1B.3.7	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded - 1P x 1.5 sq mm	100.00	RM		-			-
1B.3.8	1C x 6 Sq. mm Copper PVC insulated flexible wires (Green with yellow mark) for earthing instruments and junction boxes etc complete along with earthing lug termination as per specification and tender document	650.00	RM		-			-
1B.4	**Cable Trays**				-			-
1B.4.1	Installation of FRP Cable Tray with Cover, bends, fittings and associated accessories, FRP cable trays (2.5mm Thick and 25mm edge height), tray covers (1.5mm Thick and 10 mm edge height) along with structural steel for mounting of the cable tray. Complete as per specifications / tender documents.				-			-
1B.4.1.1	50mm	270.00	RM		-			-
1B.4.1.2	100mm	260.00	RM		-			-
1B.4.1.3	150 mm	490.00	RM		-			-
1B.4.1.4	300 mm	210.00	RM		-			-
1B.4.1.5	450mm	140.00	RM		-			-

PRICE BID - Electrical and Instrumentation Works (DAFFPL/FF/2022-23/07)

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
1B.5	**Junction Boxes**				-			-
1B.5.1	Installation of of Exd/FLP Junction Box (Power/Control/Signal JB) with IP 65 as per specification suitable for hazardous area of zone 1, group IIA/IIB, T3 or better having CCOE/CMRI approval. It shall be complete in all respect. Accessories like certified double compression cable glands with PVC shrouds & plugs for excess entries, SS 316 engraved tag plate, mounting clamp & SS 316 fasteners to be provided along with JBs Complete as per specification / tender documents.				-			-
1B.5.1.1	4 ways JB with1 No Incoming cable entry of 24C x 1.5sq mm FRLS cable and 2nos of Outgoing 12C x 1.5 FRLS cable	6.00	EA		-			-
1B.5.1.2	12ways JB with1 No Incoming cable entry of 24C x 1.5sq mm FRLS cable and 12nos of Outgoing 2C x 1.5 FRLS cable	2.00	EA		-			-
1B.6	**Earth Pit**				-			-
1B.6.1	Supply of Maintenance Free CPRI approved Earth pit (Ashlok /Equivalent make) as per IS : 3043 with 80 mm outer dia and 40 mm inner dia., of minimum 3mtr length safe earthing electrode with Pipe-in-pipe technology consisting of two mild steel pipes one inside the other, hot dip galvanized(80-100 microns), filled with high conductive & corrosion resistance crystalline mixture (Minimum 20Kg) and backfilling compound around electrode,25 mm dia G.I. watering pipe with funnel, test link, brick masonry earth pit including plastering in CM 1:4, 600x600 mm C.I. Manhole chamber including providing suitable earth bus for interconnection etc. Equivalent make shall be approved by client / consultants.Procedure recommended by chemical earth supplier and IS code to be finally adopted. Item also includes provision of earth station flags / Indication Plate with pit nos and date of inspection and the next due date of inspection. Job also includes provision of test certificate of earthing station from a licensed electrician as per the format of the Corporation.All Instruments, JBs, Equipments in Field shall be earthed by 6 mm2 PVC insulated copper cable to nearest Insulated copper Earth Bus bar (minimum size 25 mm x 6 mm) and this earth bar shall	4.00	EA		-			-
1B.7	**EARTHING STRIP**				-			-
1B.7.1	Installation of hot dip GI earth strip (50 X 6) within earth station. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all fabrication.	415.00	RM		-			-
1B.7.2	Installation of hot dip GI earth strip (25 mm X 6 mm Thk.) within earth station for relocated earth pits. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all fabrication.	80.00	RM		-			-
1B.7.2	**CABLE GLANDS & LUGS**				-			-
	Installation of Flame proof & weather proof Brass double Compression Type Nickle Plated Cable Glands and lugs for Terminations of following sizes.				-			-
1B.7.2.1	3.5C X 35 sq mm	2.00	EA		-			-
1B.7.2.2	3.5C X 70 sq mm	Unit Rate	EA		-			-
1B.7.2.3	3.5C X 120 sq mm	Unit Rate	EA		-			-
1B.7.2.4	3.5C X 185 sq mm	6.00	EA		-			-
1B.7.2.5	4C x 2.5 sqmm	24.00	EA		-			-
1B.7.2.6	12 C x 1.5 sqmm	36.00	EA		-			-
1B.7.2.7	24 C x 1.5 sqmm	16.00	EA		-			-
1B.7.2.8	2C x 1.5 sqmm	24.00	EA		-			-
1B.7.2.9	2P X 1.5 MODBUS CABLE	14.00	EA		-			-
1B.7.2.10	12P x 1.5 sqmm	2.00	EA		-			-
1B.7.2.11	1P x 1.5 sqmm	8.00	EA		-			-
1B.8	**PUSH BUTTONS FOR ROSOV**				-			-
1B.8.1	Installation, Integration, Testing and Commissioning of Exd/FLP Local Push button station cum indication lamp outside tank farm dyke wall for open and close of – ROSOV, along with mounting structure etc complete as per tender document.	6.00	EA		-			-
1B.9	Receiving from owner's store, transporting to erection site including handling, inspection, cutting to required shape & size, providing supporting arrangements grinding, welding, drilling holes etc. for fabrication work, transporting the fabricated steel structural to erection site, installation in position on floors, walls, ceilings, roofs, columns, existing structures, on towers, vessels, in ready made trenches, in floor sites etc. by hoisting, welding, bolting (Including Ancho Fastners supply and Grouting), riveting, grouting etc., minor repair / denting, as required, breaking of walls / floors / ceilings / columns & making good the same by cement plastering, supply of nuts, bolts, washers, screws, fasteners, civil masonary materials, fabrication & installation of FRP cable tray, cable rack supports, risers, hangers, base frames of Junction Boxes, Panels supports, brackets, pedestals, frameworks etc. made out of channels, angles, flats, plates, rods, etc. for cables, pipes, electrical equipment, lighting fittings & their accessories, earthing materials, cable trays etc., surface treatment of steel structural works including surface cleaning, supply & one coat of epoxy based primer & one coats of epoxy based finish paint, all work, labour and materials complete as per drawings, specifications, standards and instructions / directions of ENGINEER IN CHARGE	.						-
1B.9.1	ISMC 100 / ISA 75x75x8 L / Any other size of Structural steel material	2	TON		-			-

PRICE BID - Electrical and Instrumentation Works (DAFFPL/FF/2022-23/07)

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
1B.10	Earth work in excavation at any depth by manual means over areas including Back Filling (excluding rock)in foundation trenches, pole foundation, cable tray supports structures, etc.. in layers not exceeding 20cm in depth, consolidation each deposited layer by ramming and watering and disposal of excavated earth within and outside site to unobjectionable place, disposed earth to be levelled and neatly dressed. For all Lift and Lead. All kinds of soil including ordinary rock.	36.16	m^3		-			-
1B.11	Supplying and filling local sand within the grading zone IV of fine aggregates ,in plinth,under floors etc. in layers not exceeding 20cm in depth, each deposited layer to be compacted by ramming watering	10	m^3		-			-
1B.12	Supply, receiving, handling, loading, unloading, unpacking, transporting equipment / accessories from storage point or any other location within the project site, alignment, assembling, connection a other associated works and installation under the supervision of Engineer-in-charge (or designate) for HDPE duct pipe or corrugated ducts with MDPE couplers of 100 mm dia. size. Supplied HDPE ducts shall conform to IS: 7328, IS: 4984 Et ASTM: D-1963	50	m		-			-
1B.13	RCC: Ready Mix Concrete For M30 Grade Concrete With Water Proofing Admixtures & Hydraulic Testing Of Leaks Wherever Required For Below Ground Works For Paving, Footings/Foundations, Plinth Beams, Pedestals, Trenches, Pit, Culverts, Drains, Sumps, Pits , Encasing Of Pipes Etc At Depth Below And Upto Plinth Level/Top Of Pedestal. **Note:** (1) The Rate Also Includes Cost Of Providing Offsets, Cutouts, Curved & Straight Formwork, Making Holes In Or Cutting Formwork For Taking Out Pipes Hacking The Exposed Surfaces To Receive Plaster As Necessary. (2) Rate Of Supply And Fixing Reinforcement Steel And Any Other Embedded Items Shall Be inclusive of Rate. (3) Rate Shall Be Inclusive Of Supply & Laying/Applying 100 Micron Of Black Bituminous Paint As Per Requirement	5	m^3		-			-
1B.14	PCC : Plain Cement Concrete - providing and laying plain cement for all depths below and up to plinth level in foundations, fillings, ramps, etc. Including shuttering, tamping, ramming, vibrating, curing, shuttering, etc.All as specified in any shape, position, thickness and finishing the top surface rough or smooth or as specified and directed with 40mm and down size graded crushed stone aggregates with minimum cement and maximum water cement ratio as per IS-456 latest revision. Note 1: rate shall be inclusive of supply a laying 1000 gauge polythene sheet as per requirement	5	m^3		-			-
1B.15	Cutting and disposal of concrete /bitumen surfaces in paved areas, Roads, pedestals etc., carting away the debris and disposal in an unobjectionable area outside the premises including arrangement of all necessary tools & tackles, machinery, consumables, manpower etc. all complete as per the approved drawings, tender terms a conditions, conditions of Permits inside Tank Farm and directions of Engineer-In-Charge	5	m^3		-			-
1B.16	Integration & Modification of ROSOV, MOV, DPT and other instruments of additional receipt header line controls and logic with existing system including visit of OEM, survey for existing system for logic and control features and design of the new logic and control to include ROSOV, MOV, DPT and other instruments of additional receipt header line. All necessary Hardware, Software, Licenses, Certificates new or modification to existing hardware, software including amendment in license / certificate is in the scope of the Contractor. All required manpower and OEM person visit charges, consultancy work charges are in the scope of the Contractor Supply, Installation & Integration of New ROSOV and MOV's Panels / Signals with existing Process PLC and Safety PLC including required software and Hardware Liecences along with Alarm Management,User Friendly Graphics Generation, OPC Server etc complete in all respect.	1	LS		-			-
TOTAL INSTALLATION COST OF ELECTRICAL and INSTRUMENTATION WORKS PACKAGE - PART 1B					-		-	-
TOTAL SUPPLY & INSTALLATION COST OF ELECTRICAL & INSTRUMENTATION WORKS PACKAGE (PART 1A + PART 1B)					-		-	-

PRICE BID - Electrical and Instrumentation Works (DAFFPL/FF/2022-23/07)

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
.								
Part 2 : Electrical and Instrumentation Construction of 9000 KL ATF Storage Tank at DAFFPL Fuel Farm								
Part 2A: Supply of Material								
Sr. No.	**Item Description**	**Quantity**	**Unit**	**Unit Rate (INR)**	**Total Amount in INR**	**Tax%**	**Tax Amount in INR**	**Amount including taxes in INR**
2A.1	**Signal , Control & Power Cable**							
	Supply of Cable as per tender specifications.							
2A.1.1	Multicore copper conductor, GI round wire armoured, FRPVC outer sheathed.(FRLS) -							
2A.1.1.1	24 C x 1.5 sqmm	225	RM		-			-
2A.1.1.2	12 C x 1.5 sqmm	2455	RM		-			-
2A.1.2	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded - 12P x 1.5 sqmm	225	RM		-			-
2A.1.3	Power Cable of multi stranded annealed tinned copper as per IS 8130/1984 armoured FR-PVC insulated cable (FRLS) -							-
2A.1.3.1	4C x 4 sqmm	1660	RM		-			-
2A.1.3.2	3C x 2.5 sqmm	960	RM		-			-
2A.1.4	Control cable two core copper conductor, steel wire armoured, FR-PVC outer sheathed.(FRLS) -2C X 1.5 SQ mm	820	RM		-			-
2A.1.5	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded -							-
2A.1.5.1	1P x 1.5 sq mm	180.00	RM		-			-
2A.1.5.2	2P x 1.5 sq mm	400.00	RM		-			-
2A.1.6	Armored signal cable wt over all shielded for Temp. Element (FRLS)	75	RM		-			-
2A.2	Supply of Modbus 2 Pair communication cables	830	RM		-			-
2A.3	Supply of 1C x 6 Sq. mm Copper PVC insulated flexible wires (Green with yellow mark) for earthing instruments and junction boxes etc complete along with earthing lug termination as per specification and tender document.	600.00	RM		-			-
2A.4	**Cable Trays**				-			-
2A.4.1	Supply of FRP Cable Tray with Cover, bends, fittings and associated accessories, FRP cable trays (2.5mm Thick and 25mm edge height), tray covers (1.5mm Thick and 10 mm edge height) along with structural steel for mounting of the cable tray. Complete as per specifications / tender documents.							-
2A.4.2	100mm	365.00	RM		-			-
2A.4.3	150mm	210.00	RM		-			-
2A.4.4	200mm	160.00	RM		-			-
2A.5	**Junction Boxes**							-
2A.5.1	Supply of Exd/FLP Junction Box (Power/Control/Signal JB) with IP 65 as per specification suitable for hazardous area of zone 1, group IIA/IIB, T3 or better having CCOE/CMRI approval. It shall be complete in all respect. Accessories like certified double compression cable glands with PVC shrouds & plugs for excess entries, SS 316 engraved tag plate, mounting clamp & SS 316 fasteners to be provided along with JBs Complete as per specification / tender documents.							-
2A.5.2	6ways JB with1 No Incoming cable entry of 12C x 1.5sq mm FRLS cable and 6nos of Outgoing 2C x 1.5 FRLSS cable	1.00	EA		-			-
2A.5.3	12ways JB with1 No Incoming cable entry of 24C x 1.5sq mm FRLS cable and 12nos of Outgoing 2C x 1.5 FRLS cable	1.00	EA		-			-
2A.5.4	6ways JB with1 No Incoming cable entry of 12P x 1.5sq mm FRLS cable and 6nos of Outgoing 2Px 1.5 FRLS cable	1.00	EA		-			-
2A.6	**Earth Pit**							-
2A.6.1	Supply of Maintenance Free CPRI approved Earth pit as per IS : 3043 with 80 mm outer dia / 40 mm inner dia of minimum 3 m length safe earthing electrode with Pipe-in-pipe technology consisting of two mild steel pipes one inside the other, hot dip galvanized(80-100 microns), filled with high conductive & corrosion resistance crystalline mixture (Minimum 20 Kg) and backfilling compound around electrode,25 mm dia G.I. watering pipe with funnel, test, link, brick masonry earth pit including plastering in CM 1:4, 600x600 mm C.I. Manhole chamber etc. Equivalent make shall be approved by client / consultants.Procedure recommended by chemical earth supplier and IS code to be finally adopted. Item also includes provision of earth station flags / Indication Plate with pit nos and date of inspection and the next due date of inspection. Job also includes provision of test certificate of earthing station from a licensed electrician as per the format of the Corporation.All Instruments, JBs, Equipments in Field shall be earthed by 6 mm2 PVC insulated copper cable to nearest Insulated copper Earth Bus bar	5.00	EA		-			-
2A.7	**EARTHING STRIP**							-
2A.7.1	Supply of hot dip GI earth strip (50 X 6) within earth station. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all	240.00	RM		-			-
2A.8	**CABLE GLANDS & LUGS**							-
2A.8.1	Supplying of Heavy Duty and Flame Proof and Weather Proof Brass Double Compression Type Nickle Plated Cable Glands and lugs for Terminations of following sizes.							-
2A.8.1.1	12C X1.5 sqmm	22.00	EA					-
2A.8.1.2	24C X1.5 sqmm	2.00	EA					-
2A.8.1.3	12P X1.5 sqmm	2.00	EA					-
2A.8.1.4	4C X 4 sqmm	10.00	EA					-
2A.8.1.5	3C X 2.5 sqmm	4.00	EA					-
2A.8.1.6	2C X1.5 sqmm	26.00	EA					-
2A.8.1.7	1P X1.5 sqmm	4.00	EA					-
2A.8.1.8	2P X 1.5 MODBUS CABLE	8.00	EA					-
2A.9	Operator Interface Consoles(OIC) with operator work station -Console type -Dual Display at control room,Size 21 " with PDB,Fan,Filters etc.	1.00	LS		-			-

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Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
2A.10	**Supply of Instruments**							-
2A.10.1	Supply of multi point (8 point) temperature element complete as per specification and tender document	1.00	LS		-			-
2A.10.2	Supply pressure transmitter with integral display unit, interface with Primary Radar gauge for density measurement to TFM system along with one no. 50mm Fire Safe isolation ball valves (Heavy Grade), flushing ring, nipples, drain valve and cap etc as per specifications and tender document.	1.00	LS		-			-
2A.10.3	Supply of Level Switch Vibrating Fork Type as per Specification and Tender document	1.00	LS		-			-
2A.10.4	Supply of Level Transmitter - Radar type with Tank side Indicator as per Specification and Tender document	1.00	LS		-			-
2A.10.5	Supply of Level Transmitter - Servo type with Tank side Indicator as per Specification and Tender document	1.00	LS		-			-
2A.11	**Supply of Instruments Hook Up Accessories**							-
2A.11.1	Nipple - 1/2" x 100mm	1.00	No.		-			-
2A.11.2	15NB Coupling (Scrd.)	1.00	No.		-			-
2A.11.3	Male Connector, 1/2" NPT x 1/2" O/D	2.00	Nos.		-			-
2A.11.4	Seamless Tube, 1/2" OD x 0.049" Thk.	6.00	m		-			-
2A.11.5	MS Base Plate, 150 x 150 x 6 mm thk.	1.00	No.		-			-
2A.11.6	2" Gi Pipe for Support - 1.2 m Long	1.00	No.		-			-
2A.11.7	Anchor Fastners, M12 x 125mm Long - MS	4.00	Nos.		-			-
2A.11.8	8" Adapter Plate for Radar Guage	2.00	Nos,		-			-
2A.11.9	6" Calibration chamber for servo guage	1.00	No.		-			-
2A.11.10	2" Adapter Plate for MST	1.00	No.		-			-
2A.11.11	Anchor Weight for MST	1.00	No.		-			-
2A.11.12	Nipple (SS316)	4.00	Nos.		-			-
2A	**Total Part 2A Supply of Material**				**₹ -**		**₹ -**	**₹ -**

Part 2B: Installation, termination and commissioning of Material

Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
2B.1	**Laying of Signal , Control & Power Cable**							
2B.1.1	Laying, Glanding, Ferulling and termination of Power, Control, Signal Cable as per tender specifications.							
2B.1.2	Multicore copper conductor, GI round wire armoured, FRPVC outer sheathed.(FRLS) -							
2B.1.3	24 C x 1.5 sqmm	225	RM		-			-
2B.1.4	12 C x 1.5 sqmm	2455	RM		-			-
2B.1.2	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded - 12P x 1.5 sqmm	225	RM		-			-
2B.1.3	Power Cable of multi stranded annealed tinned copper as per IS 8130/1984 armoured FR-PVC insulated cable (FRLS) -							-
2B.1.3.1	4C x 4 sqmm	1660	RM		-			-
2B.1.3.2	3C x 2.5 sqmm	960	RM		-			-
2B.1.4	Control cable two core copper conductor, steel wire armoured, FR-PVC outer sheathed.(FRLS) -2C X 1.5 SQ mm	820	RM		-			-
2B.1.5	Instrument Signal Cable Single pair plain annealed stranded copper conductor, PE insulated, metallic screened, PE bedded, steel wire armoured, FR-PVC outer sheathed(FRLS CABLE) with shielded -							-
2B.1.5.1	1P x 1.5 sq mm	180.00	RM		-			-
2B.1.5.2	2P x 1.5 sq mm	400.00	RM		-			-
2B.1.6	Armored signal cable wt over all shielded for Temp. Element (FRLS)	75	RM		-			-
2B.2	Supply of Modbus 2 Pair communication cables	830	RM		-			-
2B.3	Supply of 1C x 6 Sq. mm Copper PVC insulated flexible wires (Green with yellow mark) for earthing instruments and junction boxes etc complete along with earthing lug termination as per specification and tender document	420.00	RM		-			-
2B.4	**Cable Trays**							-
	Installation of Perforated Cable Tray with Cover, bends, fittings and associated accessories, FRP cable trays (2.5mm Thick and 25mm edge height), tray covers (1.5mm Thick and 10 mm edge height) along with structural steel for mounting of the cable tray. Complete as per specifications / tender documents.							-
2B.4.1	100mm	365.00	RM		-			-
2B.4.3	150mm	280.00	RM		-			-
2B.4.4	200mm	400.00	RM		-			-
2B.5	**Junction Boxes**							-
	Installation of Exd/FLP Junction Box (Power/Control/Signal JB) with IP 65 as per specification suitable for hazardous area of zone 1, group IIA/IIB, T3 or better having CCOE/CMRI approval. It shall be complete in all respect. Accessories like certified double compression cable glands with PVC shrouds & plugs for excess entries, SS 316 engraved tag plate, mounting clamp & SS 316 fasteners. Complete as per specification / tender documents.							-
2B.5.1	6ways JB with1 No Incoming cable entry of 12C x 1.5sq mm FRLS cable and 6nos of Outgoing 2C x 1.5 FRLSS cable	1.00	EA		-			-
2B.5.2	12ways JB with1 No Incoming cable entry of 24C x 1.5sq mm FRLS cable and 12nos of Outgoing 2C x 1.5 FRLS cable	1.00	EA		-			-
2B.5.3	6ways JB with1 No Incoming cable entry of 12P x 1.5sq mm FRLS cable and 6nos of Outgoing 2Px 1.5 FRLS cable	1.00	EA		-			-
2B.6	**Earth Pit**							-

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Sr. No.	Item Description	Quantity	Unit	Unit Rate (INR)	Total Amount in INR	Tax%	Tax Amount in INR	Amount including taxes in INR
2B.6.1	Installation of Maintenance Free CPRI approved Earth pit as per IS : 3043 with 80 mm outer dia / 40 mm inner dia of minimum 3mtr length safe earthing electrode with Pipe-in-pipe technology consisting of two mild steel pipes one inside the other, hot dip galvanized(80-100 microns), filled with high conductive & corrosion resistance crystalline mixture (Minimum 20 Kg) and backfilling compound around electrode,25 mm dia G.I. watering pipe with funnel, test, link, brick masonry earth pit including plastering in CM 1:4, 600x600 mm C.I. Manhole chamber etc. Equivalent make shall be approved by client / consultants.Procedure recommended by chemical earth supplier and IS code to be finally adopted. Item also includes provision of earth station flags / Indication Plate with pit nos and date of inspection and the next due date of inspection. Job also includes provision of test certificate of earthing station from a licensed electrician as per the format of the Corporation.	5.00	EA		-			-
2B.7	**EARTHING STRIP**							-
2B.7.1	Installation of hot dip GI earth strip (50 X 6) within earth station. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all fabrication.	210.00	RM		-			-
2B.7.2	Installation of hot dip GI earth strip (40 X5) within earth station. Hot dip galvanizing (800 gm/m2 as per IS 4759) shall be done after all fabrication.	55.00	RM		-			-
2B.7.3	**CABLE GLANDS & LUGS**							-
	Installation of Heavy Duty and Flame Proof and Weather Proof Brass Double Compression Type Nickle Plated Cable Glands and lugs for Terminations of following sizes.							-
2A.7.3.1	12C X1.5 sqmm	22.00	EA					-
2A.7.3.2	24C X1.5 sqmm	2.00	EA					-
2A.7.3.3	12P X1.5 sqmm	2.00	EA					-
2A.7.3.4	4C X 4 sqmm	10.00	EA					-
2A.7.3.5	3C X 2.5 sqmm	4.00	EA					-
2A.7.3.6	2C X1.5 sqmm	26.00	EA					-
2A.7.3.7	1P X1.5 sqmm	4.00	EA					-
2A.7.3.8	2P X 1.5 MODBUS CABLE	8.00	EA					-
2B.8	**PUSH BUTTONS FOR ROSOV**							-
2B.8.1	Installation, Integration, Testing and Commissioning of Exd/FLP Local Push button station cum indication lamp outside tank farm dyke wall for open and close of - ROSOV, along with mounting structure etc complete as per tender document.	3.00	EA		-			-
2B.9	Integration all necessary Power, Signal and Control Cables with Existing PLC ssytem, System commisisoning, Trial Runs etc complete in all respect.	1	LS		-			-
2B.10	**Instruments**							-
2B.10.1	Installation, testing & commissioning of multi point (8 point) temperature element complete as per specification and tender document	1.00	LS		-			-
2B.10.2	Installation, testing & commissioning pressure transmitter with integral display unit, interface with Primary Radar gauge for density measurement to TFM system along with one no. 50mm Fire Safe isolation ball valves (Heavy Grade), flushing ring, nipples, drain valve and cap etc as per specifications and tender document.	1.00	LS		-			-
2B.10.3	Installation testing & commissioning of Level Switch Vibrating Fork Type as per Specification and Tender document	1.00	LS		-			-
2B.10.4	Installation, testing & commissioning of Level Transmitter - Radar type with Tank side Indicator as per Specification and Tender document	1.00	LS		-			-
2B.10.5	Installation, testing & commissioning of Level Transmitter - Servo type with Tank side Indicator as per Specification and Tender document	1.00	LS		-			-
2B.11	**Installation of Instruments Hook Up Accessories including skilled / unskilled Manpower complete in all respect.**							-
2B.11.1	Nipple - 1/2" x 100mm	1.00	No.		-			-
2B.11.2	15NB Coupling (Scrd.)	1.00	No.		-			-
2B.11.3	Male Connector, 1/2" NPT x 1/2" O/D	2.00	Nos.		-			-
2B.11.4	Seamless Tube, 1/2" OD x 0.049" Thk.	6.00	m		-			-
2B.11.5	MS Base Plate, 150 x 150 x 6 mm thk.	1.00	No.		-			-
2B.11.6	2" Gi Pipe for Support - 1.2 m Long	1.00	No.		-			-
2B.11.7	Anchor Fastners, M12 x 125mm Long - MS	4.00	Nos.		-			-
2B.11.8	8" Adapter Plate for Radar Guage	2.00	Nos,		-			-
2B.11.9	6" Calibration chamber for servo guage	1.00	No.		-			-
2B.11.10	2" Adapter Plate for MST	1.00	No.		-			-
2B.11.11	Anchor Weight for MST	1.00	No.		-			-
2B.11.12	Nipple (SS316)	4.00	Nos.		-			-
2B.12	Development, Interfacing and Integration of new Tank VF 207 all equipment / instruments, controls, graphics and logic with existing system. Work includes any visits of OEM, manpower, consultancy charges, survey for existing system for logic and control features and design of the new logic and it's generation, existing logic modification, development of new Logic and Graphic and it's interfacing with existing logic and Graphic and control to include additional Tank VF 207. Supply and erection of all necessary Hardware, Software, Licenses, Certificates new or modification to existing hardware, software, PLC Panel, Graphics / PDB including all applicable amendment in license / certificate is in the scope of the Contractor. Supply and erection / installation of all material, consumables is in the scope of Contractor and shall be quoted accordingly in the rate.	1.00	LS		-			-
2B	**Total Part 2B Installation, Termination of Material**				₹ -		₹ -	₹ -
	Total (Part 2A Supply of Material + Part 2B Installation, Termination of Material)				₹ -		₹ -	₹ -

Grand Total (Part1A+Part1B+Part2A+Part2B)	₹ -