BHAGYANAGAR GAS LIMITED

(A JOINT VENTURE OF HPCL & GAIL)

BID DOCUMENT FOR

Tender for Annual Rate Contract for Maintenance of Cathodic Protection (CP) and associated systems at City Gas Distribution project at Hyderabad, Vijayawada and Kakinada GA's for the period of 02 Year

UNDER OPEN DOMESTIC COMPETITIVE BIDDING

Bid Document No.: BGL/725/2026-27

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SPECIAL CONDITIONS OF CONTRACT (SCC)

1. GENERAL

1.1. Bhagyanagar Gas Limited has been authorized to lay, operate or expand City Gas Distribution Network in the authorized geographical area of Hyderabad, Vijayawada and Kakinada under PNGRB Regulation 2008.

1.2. BGL has laid several kilometres of Steel & MDPE pipelines in the geographical area of Hyderabad, Vijayawada and Kakinada. These pipelines shall be supplying Piped Natural Gas (PNG) to various Industrial, Commercial & Domestic consumers. The CGD network in these areas shall be expanding continuously and infrastructure to supply PNG to various consumers along with CNG stations shall be augmented periodically.

1.3. The main objective of Bhagyanagar Gas Limited operations is to supply uninterruptable gas to its esteemed customers and maintain the CGD network in healthy condition so that it is available for operation always with minimum possible break down time.

1.4. The contract for Cathodic Protection Works of CGD Network Hyderabad, Vijayawada and Kakinada will be executed on Hiring of Services basis.

1.5. Special Conditions Contract (SCC) shall be read in conjunction with the General Conditions of Contract (GCC), Schedule of Prices, specifications of work, drawings and any other document forming part of this Contract wherever the context so requires.

1.6. Notwithstanding the sub-division of the document into these separate sections and volumes, every part of each shall be deemed to be supplementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.

1.7. Where any portion of the GCC is repugnant to or at variance with any provisions of the Special Conditions of Contract, then unless a different intention appears, the provisions(s) of the Special Conditions of Contract shall be to deemed override the provision(s) of GCC, only to the extent that such repugnancies of variations in the Special Conditions of Contract are not possible of being reconciled with the provisions of GCC.

1.8. Wherever it is mentioned in the specifications that the contractor shall perform certain work or provide certain facilities, it is understood that the contractor shall do so at his cost and the value of contract shall be deemed to have included cost of such performance and provisions, so mentioned.

1.9. The materials, design, and workmanship shall satisfy the relevant Indian Standards, the job specifications contained here-in and codes referred to. Where the job specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.

1.10. In the absence of standards/ specifications/ code of practice for detailed specifications covering any part of the work covered in this Bidding Document, the instructions / directions of Engineer-in-Charge will be binding on the contractor.

1.11. Quantity shown in the Schedule of Rates is indicative only. The bidder shall not seek any revision in the price quoted on account of any such variation in the quantity.

1.12. Bidder is advised to visit the site and familiarize himself of the existing facilities and environment and shall collect all other information which he may require for preparing and submitting the bid and entering into the contract. Claims and objection due to Ignorance of the existing conditions or inadequacy of information will not be considered after submission of the bid and during implementation.

1.13. The bidder has to make own arrangements for food, transportation and accommodation for the manpower deployed by him during the period of the contract.

1.14. Bhagyanagar Gas Limited reserves the right to reject any one or all the personal employed by the bidder on the basis of their performance, conduct and discipline.

1.15. Contractors' personnel, who would carry out the works, shall strictly follow all safety rules, discipline and regulations. They should be conversant with the safety precautions to be followed inside premises. The contractor shall abide by the advice and guidance of the safety officer in the plant. In addition, the bidder shall follow the safety codes framed from time to time. Smoking and tobacco/pan chewing inside the premises is strictly prohibited. No contractor's men are allowed to possess match boxes, lighters, cigarettes, transistors or any other material near the Gas installations, which may cause fire hazard.

1.16. Bhagyanagar Gas Limited is not responsible for any accident/damage caused to the men and materials of the contractor during the course of attending the job.

1.17. The bidder shall execute the whole work in respect to workmanship and materials otherwise in every aspect in strict accordance with the specifications. The bidder shall also confirm exactly and faithfully to the designs, drawings and instructions in writing in respect of the work assigned by the Engineer-In-Charge (EIC).

1.18. Whenever any claim against the bidder for payment of a sum of money arises out of or under the contract, Bhagyanagar Gas Limited shall be entitled to recover such sum by appropriating, in part or whole part of the security. In the event of security being insufficient or if no security has been taken from the bidder, then the balance or the total sum recoverable, as the case may be, shall be deducted from any sum then due or which at any time thereafter may become due from the contractor under this or any other contract with the company should this sum be not sufficient to cover the full amount recoverable, the contractor shall pay to the Bhagyanagar Gas Limited on demand the balance remaining due.

2. INTERPRETATION OF DOCUMENTS:

In partial modification to Clause No 1.2 of GCC the following shall apply. In case of contradiction between Indian Standard, General Conditions of Contract, Special Conditions of Contract, Specifications, Schedule of Rates, the following shall prevail in order of precedence:

a) Letter of acceptance along with statement of Agreed variations.
b) Letter of Intent / Fax of Acceptance
c) Schedule of Rates, Scope of Work as enclosures to letter of acceptance
d) Job Specifications

e) Drawings
f) Technical / Material Specifications
g) Special Conditions of Contract
h) General Conditions of Contract
i) Indian Standards
j) Other Applicable Standards

3. MEASUREMENT OF WORKS:

Payment will be made on the basis of joint measurements jointly carried out by the contractor and Bhagyanagar Gas Limited, duly certified by Nominated Site-In-Charge / EIC. Linear measurements will be in hours and converted to days. Indian Standard Method of measurement (IS:1200) as last amended, shall be referred for measurement purposes wherever applicable.

4. INCOME TAX:

Income tax at the prevailing rates as applicable from time to time shall be deducted from contractor's bill as per income tax act and quoted rates shall be deemed to be including this. Contractor has to enclose PAN card.

5. PROVIDENT FUND ACT:

Contractor shall strictly comply with the provisions of Employees Provident Fund Act. In case the RPFC"s challan / receipt, as above, is not furnished, Owner shall deduct suitably of the payable amount from contractor's running bill and retain the same as a deposit. Such retaining amounts shall be refunded to Contractor on production of RPFC challan / receipt for the period covered by the related running bill.

6. REGISTRATION UNDER GOODS AND SERVICE TAX (GST):

6.1. Attested copy of certificate for registration under applicable provisions of GST must accompany the tender.

6.2. In case any unregistered bidder is submitting their bid, their prices will be loaded with applicable GST (CGST & SGST / UTGST or IGST) during evaluation of bid. Wherever Bhagyanagar gas Limited (BGL)is entitled for input credit of GST (CGST & SGST / UTGST or IGST), the same will be considered during evaluation as per evaluation methodology of tender document.

7. SECURITY DEPOSIT/ CPBG:

The Contractor shall furnish to the Employer, within 30 days from the date of notification of award, a security in the sum of 7.5% of the annualized order value (excluding taxes and duties) or 5% of Contract/Order value and balance to be deducted against each RA bills till balance 2.5% is deducted in the form of Bank draft/ Banker's cheque or Bank Guarantee (as per proforma) as Contract Performance Security which will be valid for 90 days beyond the contract expiry date shall be refunded within 3 months after expiry of Contract Period. GCC clauses related Contract Performance Security is also applicable.

8. ESCALATION:

The unit rates quoted shall be kept firm till completion of work, and no price escalation shall be paid.

9. COMPLETE SCOPE OF WORK:

The scope of work is mentioned in Tender document under "Special Conditions of Contract –Technical".

10. BID REJECTION CRITERIA:

Bidders have to quote for entire quantity of Scope of Work and all the SOR items. Failing to do so, the bid shall be rejected.

11. MOBILIZATION / DEMOBILIZATION:

11.1. All expenses towards mobilization at site and de-mobilization of equipment, workforce, material and clearing the site etc. shall be deemed to be included in the price quoted by the contractor and no extra payment on such expenses shall be entertained.

11.2. The contractor shall make his own arrangement for removal of old as well as unused material from work site to the place indicated by the EIC, after completion of work.

12. MOBILIZATION ADVANCE:

No mobilization advance is payable to contractor for the said work.

13. MOBILIZATION PERIOD:

Mobilization period shall be of 01 week from Date of notification of award and no mobilization advance shall be paid to the successful bidder. Delay in the start of monitoring jobs after mobilization period of 01 week shall be considered on contractor's account and a penalty of Rs. 10,000/- per week shall be imposed for such delay.

14. TERMS OF PAYMENT:

14.1. Contractor shall submit the RA bill for the Executed value of works as per SOR in the GST Invoice Format to the Engineer In-Charge along with Copies of Joint Measurement Sheets, Copy of Duly Filled CP Monitoring & Maintenance Formats, reviewed / certified Quarterly CP Health reports for certification and release of payment.

14.2. Upon verification of the Joint Measurement sheets signed by the SIC & Contractor, EIC shall further process RA Bill. The payment will be made through e-banking system (i.e. through RTGS/NEFT) only. The contractor has to submit GST Invoice Only.

14.3. Bills shall be only paid along with submission of necessary measurement sheet, necessary reports etc., if any as per Contract Requirement (Refer SCC-Technical)

14.4. The Contractor is required to raise his RA Bill on Monthly basis without failure for both monitoring and maintenance activities.

14.5. 100% Payment for CP Monitoring works, excluding any deductions, taxes, shall be made for the R.A Bills after scrutinizing the joint measurement sheets for executed quantities on Quarterly basis.

14.6. 100% Payment for CP maintenance works, excluding any deductions, taxes, shall be made for the R.A Bills after scrutinizing the joint measurement sheets for executed quantities on quarterly basis. The gap between the two RA bills shall not be less than one month.

14.7. The contractor will submit Bills in triplicate (three copies) in approved proforma to the EIC, giving abstract and detailed measurements for the various items executed.

14.8. Payment shall be released within 30 days on receipt of invoices/bills duly certified by EIC.

14.9. The Bidder Must Submit the CP Filled Formats & CP Health Reports as per SCC-Technical along with the Joint Measurement Sheet to the SIC.

15. DURATION OF CONTRACT & DEPLOYMENT OF RESOURCES:

15.1. Time Period for the contract is 24 months from the date of notification of award and The Contract period may be extended by 06 (six) months in spell of months at the sole discretion of Bhagyanagar Gas Ltd, depending upon the satisfactory performance of the Contractor and requirement of the OWNER. There will not be any price escalation of the accepted SOR for the extended period of the works and various terms & conditions as per the existing Contract shall remain unaltered.

15.2. Tenderer should be in a position to deploy sufficient manpower, equipment and other resources to operate the work. Tenderer shall be required to furnish a resource-based network indicating therein the details of resources viz. men, material and equipment which shall be mobilized/ deployed for execution of work within the specified time schedule.

15.3. Successful bidder must deploy adequate resources and teams.

15.4. Monitoring Job shall be carried out timely and the required transportation shall be provided by the Contractor for facilitating ease in Movement.

16. WORK SPECIFICATIONS AND STANDARDS:

16.1. All the specifications for the work shall be as per "Scope of Work & Technical Specifications" & "SOR", which are self-explanatory. However, wherever required, concerned Bureau of Indian Standards shall be referred and the decision of the EIC shall be final and binding on the contractor.

16.2. The job shall conform to the Indian Electricity Rules-1956, Indian Electricity (Supply Act) calculations for the Electrical Buildings-1959 of the Insurance Association, Indian Electricity Act, relevant Indian Standard Specifications, and Codes of Practice, as modified till date, & CPWD Specifications, CP standards, NACE Specifications, NACE Guidelines as applicable. Any other Standard not mentioned above, but

considered necessary for the satisfactory performance of the job shall also be applicable.

16.3. Whenever it is mentioned in the specification that the contractor shall perform and execute the certain work or provide certain facilities, it is understood that the contractor shall do at his own cost and the Contract price shall be deemed to have included cost of such performances and provisions, so mentioned.

16.4. All the Supply Material shall be from the approved vendor's list only. The Approved Vendor List is attached. Any supply material must confirm to the applicable Indian Standards.

17. CONTRACTOR'S SCOPE OF SUPPLY:

17.1. Contractor shall provide to their staff appropriate tools, tackles, measuring instruments for proper execution of the job, as detailed in the Scope of Work -Technical of the tender document. It shall be the contractor's responsibility to provide and maintain all the tools & tackles in good working condition.

17.2. The contractor shall also remain in touch with the EIC for knowing the requirement of jobs, and will accordingly arrange for deployment of personnel as per the requirement.

17.3. Contractor should follow all security rules and regulations of Bhagyanagar Gas Limited

17.4. Contractor shall provide all safety gears for safe working to his personnel such as safety shoes, helmets, gloves etc. at his own cost. Contract personnel without wearing safety shoes shall not be allowed to work at site and penalty of Rs.5000/- per instance shall be imposed to ensure the HSE/ safety compliance.

18. RULES & REGULATIONS:

Contractor shall observe in addition to the specified and respective specifications all the local laws, ordinances, rules and regulations and legislations pertaining to the work and shall be responsible for extra costs arising from violations of the same.

19. PERMISSIONS:

While doing the work, it is the responsibility of the contractor to take the all the necessary permissions.

20. LODGING, BOARDING & TRANSPORTATION:

Lodging, Boarding & Transportation of the contractor's personnel during execution of the job under the Contract shall be provided by the contractor at his own cost. No additional payment will be made for the same.

21. SCHEDULE OF RATES (SOR):

21.1. The "SOR" shall be read in conjunction with "SCC –Technical & SCC- Commercial", "GCC", and any other document forming a part of this Contract. The quantities

indicated in the "SOR" for the various items are only approximate/ indicative, and are subject to variations on both ways, as per the stipulation made in "GCC".

21.2. BGL will not give guarantee to the execution of supply items mentioned in the SOR.

21.3. In case quantity exceeds contractor should supply material as per the requirement on the same rates quoted in SOR

21.4. All items of work in the "SOR" shall be carried out as per the specifications, relevant codes, drawings and instructions of the EIC and the quoted rates are deemed to be inclusive of all materials, consumables, labour, supervision, tools & tackles, cost of various tests, inspections as well as preparatory, incidental, intermediate /auxiliary / ancillary or enabling works.

21.5. In case of Urgency / Breakdowns of Equipment related to CP System, EIC can direct the contractor to procure and install spares / other services for bringing the systems to normalcy. In case such spares / services are not covered in the SOR item, payment shall be made at the market rates / Invoice Value from the Equipment Manufacturer + additional 10% as administrative charges.

22. DAMAGE OF EXISTING SYSTEM AND PERSONNEL:

22.1. The Job must be carried with utmost safety and Bhagyanagar Gas Limited equipment should not get disturbed / affected due to execution of jobs by the Contractor. Care should be taken for the existing system. In case of damage to any existing system or equipment resulting out of the execution of the jobs under this contract, contractor would be held responsible and the affected equipment / system must be restored to normalcy by the contractor. BGL reserves the right to get the job done by other agencies at the risk and cost of the contractor if he fails to take corrective actions for the damaged /affected systems and shall deduct necessary amount from contractor's bills for such rectification jobs.

22.2. Contractor is totally responsible for the safety of his personnel and BGL shall not pay/accountable for any compensation in this regard in the event of any un-safe acts / practices etc.

23. DEFECT LIABILITY PERIOD (DLP):

23.1. "Defect Liability Period (DLP)" for the work under the Contract shall be 03 (Three) Months from the date of completion of the contract. Any defect or damage discovered / observed in the work done / material supplied by the contractor within this period due to poor workmanship / material shall be rectified / replaced by the contractor free of cost or in case of default BGL may get the same rectified / replaced by other agency and the expenses so incurred shall be deducted from the contractor's Bills / Security Deposit. The decision of the EIC shall be final and binding in this regard.

23.2. CPBG shall be release after expiry of the "DLP".

23.3. "Defect Liability Period (DLP)" shall commence from the date of completion as mentioned in Completion Certificate.

24. PENALTY AND DEDUCTIONS:

Sl.NO.	DESCRIPTION	TIME PERIOD	PENALTY + GST
1	Non completion of any maintenance Job from the date of Intimation	Beyond 3 days	10% of SOR value per each Job Per Week
2	Non-completion Monitoring Job	Beyond 7 days	25% of SOR value
3	Non-Submission of Reports	Beyond 5 days of completion of Job	10% of SOR value per each Job Per Week
4	Non deployment of Site Co-coordinator	Per Day	Rs.1,000/- per day in case of non-deployment in any month for a period of more than 5 days
5	Non-Submission of RA bill by 15th of subsequent month will attract a penalty. Same will be deducted from the running bills.	Beyond 15 days	Rs. 10,000/- per instance and Rs. 100/- per day beyond 15 days of stipulated time for the applicable date of bill submission

- The maximum penalty shall not exceed by 20% of the monthly RA bill value.

25. RECOVERY:

25.1. Cost of any damage / loss of the property of Bhagyanagar Gas Limited by the contractor shall be recovered from the Bills / Security Deposit of the contractor & the decision of Bhagyanagar Gas Limited in this regard shall be final, binding and conclusive.

25.2. If the contractor fails to provide safety gears to his personnel within 15 days from the date of start of work, Bhagyanagar Gas Limited shall provide the same, the cost of which, including the overheads as decided by BGL, shall be recovered from the contractor's Bills.

26. UNSATISFACTORY SERVICE:

If at any moment BGL feels that the services provided is not satisfactory Bhagyanagar Gas Limited reserves the right to De-hire the services immediately and in that case the Contractor will not be paid any Compensation and his Security Deposit will be forfeited.

27. OTHER STATUTORY APPROVALS:

27.1. Contractor shall also be responsible for obtaining approval/clearances from statutory authorities like Village Panchayat authorities, Mandal Revenue authorities, Municipal Corporation Authorities, Electricity Department, Electrical Inspectorate, Pollution control board and any other concerned authority as required and necessitated by the job.

27.2. All associated charges for the approvals and clearances referred above shall be borne by the contractor.

27.3. Inspection and acceptance of the work by statutory authorities shall not relieve the contractor from any of his responsibilities under this contract.

27.4. Any changes/additions required to be made to meet the requirements of statutory authorities, shall be carried out by the contractor, within the contract price, and at no additional cost to Owner.

28. INSURANCE & LIABILITIES:

28.1. Contractor shall accept full and exclusive liability for the compliance with all obligations imposed and further agrees to defend , indemnify and hold Owner harmless for any liability or penalty which may be imposed by the Central, State, Local authority also from all claims, suits or proceedings that may be brought against the Owner arising under growing out of or by reason of the work provided for may by this contract whether brought by employee of the contractor by third parties or by Central Government , State Government of Local authority for the following acts and liabilities

i. Workmen compensation & Employer's insurance.
ii. Accident or injury to workmen.
iii. Damage to Bhagyanagar Gas Limited property or to any person or third party.
iv. Payment of wages act.
v. Any other insurance required law or regulations.

28.2. Contractor must indemnify Bhagyanagar Gas Limited / Bhagyanagar Gas Limited's employees against any liquidated damages incurred as the principal employer for any failure of contractor to honour various central / state / local self-body laws / enactments in this respect.

28.3. Contractor himself shall be fully and exclusively responsible for any damage to the equipment or any personal injury to operator or any other person in the employment of the contractor, occupant or any property.

28.4. Contractor will be solely responsible for any consequences under laws arising out of any accidents caused to property / persons. The contractor shall also be responsible for any claim / compensation that arises due to damage / cause of injuries / disabilities / death etc. during the contract period Bhagyanagar Gas Limited will not be responsible for any claim / compensation that arises due to damages / injuries under any circumstances in which the equipment is engaged for Bhagyanagar Gas Limited duty.

29. ABNORMALLY HIGH RATED ITEMS (AHR):

In the rate contract/item rate portion of contract, where the contractors quoted rate for the items exceeds 50% of the estimated rate such rates will be considered as abnormally High Rates (AHR) and payment of AHR items beyond the SOR quantities shall be made as Per GCC.

30. FINAL BILL:

No Claim Certificate, No Dues Certificate, Indemnity Bond, GST settlement shall be submitted by the contractor along with the Final Bill.

31. DEPLOYMENT OF RESOURCES FOR JOB EXECUTION:

31.1. Contractor shall furnish a detailed Organogram regarding deployment of resources for the entire duration of the Contract in Bhagyanagar Gas Limited. Contractor shall maintain a minimum Monitoring and Maintenance Crew along with site coordinator and Monitoring & Maintenance Teams.

31.2. Monitoring Job must be carried out timely and the Bhagyanagar Gas Limited Executive/Technician/representative may accompany the Contractor's Monitoring & Maintenance Crew for CP Jobs.

32. ADHERENCE TO SAFETY REGULATIONS:

32.1. All the contractor's personnel, who would be deployed inside the premises, should strictly follow all safety rules & regulations. They should be well-conversant with the safety precautions to be followed.

32.2. The contractor shall abide by the advice & guidance of the Safety Officer. In addition, the contractor shall follow all safety codes framed from time to time. Smoking inside the premises is strictly prohibited. No contractor's personnel are allowed to possess match boxes, lighters, cigarettes, biddies, transistors, or any other material which may cause fire hazards.

32.3. Contractor shall also ensure that all existing and amended Fire & Safety Rules / Policies of Bhagyanagar Gas Limited are strictly observed in the services rendered by him. Contractor has to strictly adhere to guidance, instructions issued from time to time in this regard. Any violation on this account shall be the contractor's responsibility and Bhagyanagar Gas Limited will be immured to all its consequences, whatsoever it may be.

32.4. Bhagyanagar Gas Limited will not be responsible for any accident / mishap with the contractor's employees. The contractor shall take necessary action for his employees in case of any incidents.

32.5. Bhagyanagar Gas Limited shall not provide any medical assistance & shall have no other liability whatsoever except as expressly provided under the Contract.

33. SAFETY CODE

General:

33.1. Contractor shall adhere to safe operation and maintenance practice and guard against hazardous and unsafe working conditions and shall comply with OWNERS safety rules as set forth herein.

33.2. **Safety Regulations:**

a) In respect of all labour, directly or indirectly employed in the work for the performance of Contractors part of this agreement, the contractor shall at his own expense arrange for all the safety provisions as per safety codes of

b) C.P.W.D. Indian Standard Institution. The Electricity Act, IE rules, The Mines Act and such other acts as applicable.
c) The contractor shall observe and abide by all fire and safety regulations of the owner. Before starting maintenance, work contractor shall take necessary work Permits etc.
d) The work is to be carried out with operation and maintenance, Contractor has to follow all Safety Rules, Regulations etc.
e) The Contractor is liable for any Loss/ Damage of the Owners property due to Fire/ other incidents due to the wrong works.
f) Contractor has to provide all requisite PPEs to all workmen and it is contractors duty to enforce the use of PPEs by them.
g) All requisite PPEs and equipment required for taking safety precautions as instructed by EIC / safety in charge would fall in the scope of the contractor.

33.3. **First aid and Industrial injuries:**

Contractor shall maintain first aid facilities for his employees and also for employees of their Sub Contractor. All critical industrial injuries shall be reported promptly to owner, and a copy of Contractors report covering each personnel injury requiring the attention of a physician shall be furnished to the owner.

33.4. **General rules:**

a) Smoking within the Factory / Plant area, plant premises, stores and offices is strictly prohibited violators of the no smoking rules shall be discharged immediately.
b) Police verification of the deputed personnel/employees to be done.

33.5. **Contractor's barricades:**

a) Contractor shall erect and maintain barricades required in connection with his operation to guard or protect.
b) Excavation Hoisting Areas
c) Areas adjudged hazardous by contractors or owners Engineers.
d) OWNERs existing property subject to damage by contractor's Operations.
e) Contractor's employees and those of his Sub-Contractors shall become acquainted with OWNERs barricading practice and shall respect the provisions thereof.

33.6. **Precautions:**

The CONTRACTOR will have to take all safety precautions during the work.

33.7. **Explosives:**

Explosives shall not be stored or used on the WORK or on the SITE by the CONTRACTOR. Complete responsibilities lies with the CONTRACTOR and the CONTRACTOR shall indemnify the OWNER against any loss or damage resulting directly or indirectly thereof.

33.8. **Preservation of Place:**

The CONTRACTOR shall take requisite precautions and use his best endeavour's to prevent any riotous or unlawful behaviour by or amongst his workmen and others employed on the works and for the preservation of peace and protection of the inhabitants and security of property in the neighbourhood of the WORK. In the event of the OWNER requiring the maintenance of a Special Police Force at or in the vicinity

of the site during the tenure of works, the expenses thereof shall be borne by the CONTRACTOR and if paid by the OWNER shall be recoverable from the CONTRACTOR.

33.9 **ACCESS TO SITE:** The contractor shall make his own arrangement/ approach road for transportation of all required resources including labour, material, machinery, consumables, equipment etc. at the actual work place without any extra cost to Bhagyanagar Gas Ltd. No separate item for jungle clearance is payable which is included on overall contract and bidders shall make a note of it before quoting their rates.

34. QUALIFICATION & EXPERIENCE

The Personnel deployed for Monitoring and Maintenance Activities must be Cathodic protection Qualified and should have a minimum experience of 3 (Three) years in Cathodic Protection jobs related to underground pipe lines. The Qualification and Experience details of the Personnel proposed to be deployed for execution of SOR Items including that of Coordinator shall be furnished by the contractor to Engineer-In-Charge at the time of Kick-Off Meeting.

35. COORDINATION WITH OTHER AGENCIES

Contractor shall be responsible for proper coordination with other agencies operating at the site of work so that work may be carried out concurrently, if necessary, without any hindrance. The EIC shall resolve disputes, if any, in this regard, and his decision shall be final and binding.

SPECIAL CONDITIONS OF CONTRACT (SCC) - TECHNICAL

1. SITE INFORMATION:

It is understood that before quoting the rates, the bidder has visited the work site at his own cost and has acquainted himself fully with the nature and quantum of job to be carried out by him in case of Award. Ignorance of this will not be considered after the award of Contract. The contractor will be responsible to execute / complete the entire job in all respects, including any other work necessary to complete the job satisfactorily, though specifically not covered in the "Special Conditions of Contract – Technical"

2. GENERAL:

Bhagyanagar Gas Limited has laid around approx.70 km of Steel pipelines for City as Distribution in the geographical area of Hyderabad, approx.45 Km in Vijayawada and approx.45 km in Kakinada GA covering Rural & Urban Areas. These pipelines shall be expanding continuously and infrastructure to supply PNG to various consumers along with CNG stations shall be augmented periodically. Bhagyanagar Gas Limited Intends to put in place a two Years for Annual Rate Contract (ARC) for maintenance of Cathodic Protection and associated systems of City Gas Distribution network in Hyderabad, Vijayawada and Kakinada.

3. WORK TENDERED:

Two Year Annual Rate Contract (ARC) for maintenance of Cathodic Protection and associated systems of City Gas Distribution network in Hyderabad, Vijayawada and Kakinada.

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4. DETAILS OF THE WORK:

The scope of work would be in general and not limited to the following.

4.1. Complete details (As on tender issue date) of pipelines for Cathodic Protection Monitoring and Maintenance works is as per the Annexure-2.

4.2. To Monitor the Cathodic Protection System of BGL City Gas Distribution Pipe Line Network as per the terms and conditions of the contract in line with the Maintenance Practices being followed in BGL.

4.3. To maintain a polarized OFF PSP of Minimum -0.95 volts w.r.t Copper/ Copper Sulphate Electrode along all the Pipe Line Sections. (Though a Pipe Line is considered adequately protected when a minimum polarized potential of -0.85 volts wrt CSE is achieved as per NACE CP Criteria)

4.4. To maintain and achieve a Polarized PSP in the range of -0.95 to -1.2 Volts among all the pipe line sections. (In case -0.95 Volts OFF PSP is not attainable, a polarized PSP more negative than -0.85Volts wrt CSE must be obtained.

4.5. To Carry out Preventive Maintenance / Breakdown Maintenance of ICCP / Sacrificial Anode Cathodic Protection Systems of BGL City Gas Distribution Pipe Line Network in Hyderabad, Vijayawada and Kakinada or network in respective GA as per the terms and conditions of the contract and as per the instructions of the Engineer In-Charge (EIC) / Site In-Charge (SIC)

4.6. To suggest remedial measures promptly in case of observing any discrepancies in

performance of the Cathodic Protection System during the Monitoring / Maintenance.

4.7. Submit all the Monitoring / Maintenance Formats in-time. Successful Contractor shall submit a report on Monthly Basis.

4.8. Provide sufficient resources for carrying out the Monitoring and Maintenance Jobs as per Bhagyanagar Gas Limited Maintenance Schedule and as per the terms and conditions of the contract.

4.9. For any Extra Job not mentioned in the SOR, the rates shall be derived as per GCC Conditions / prevailing procedure in Bhagyanagar Gas Limited.

4.10. Bhagyanagar Gas Limited General Conditions of Contract – Services shall be applicable for this contract.

4.11. All the lesioning work with Land Owners /Statutory Authorities etc. for getting the required consent for successfully carrying out the Installation jobs is in the scope of the contractor. Bhagyanagar Gas Limited shall not pay any additional amount other than the SOR Item rate for such lesioning work. Contract price is deemed to be inclusive of all such charges.

4.12. No Maintenance Job shall be left un-attended for want of clearance / front from the farmers / land-owners /Statutory Authorities for more than fifteen days after intimation. In case the job is not attended, Bhagyanagar Gas Limited reserves the right to execute the job through other agency at the Risk and Cost of the Contractor with an additional 25% as overhead charges.

4.13. Supply of required hardware items such as bolts, nuts, lugs, washers, glands, cable sealing compound, Civil Construction material, labour for civil works, excavation and backfilling jobs is in the scope of the Contractor. The SOR Item rate is deemed to be inclusive of such charges.

4.14. Transportation and shifting of removed equipment / spares / Consumables etc. to Bhagyanagar Gas Limited Identified Location. Debris Removal at work site and safe disposal of the same.

4.15. All the supply items in the Scope of Work (SOW) and Schedule of Rates (SOR) are tentative only and to be supplied only after obtaining clear communication from Engineer In-Charge (EIC) / Site In-Charge (SIC).

4.16. All the Supply Items shall be IS marked and from the approved vendor list. Test Certificates, Guarantee / Warranty shall be furnished for all the supply items.

4.17. All the filled formats with Monitoring and Maintenance data in Soft Copies and Hard Copies shall be furnished to Engineer In-Charge (EIC) / Site In-Charge (SIC).

4.18. Contractor shall maintain a Monitoring and Maintenance team along with all resources.

4.19. All the PSP Measurements must be carried out in-line with NACE Standard Practice TM0497-2002 or the latest revision.

4.20. The Digital Multimeter, Data Logger, Clamp Meter, Earth Resistance Tester, Insulation Tester, RF IJ Tester being used shall have proper range & calibration certificate shall be valid at all the times and same shall be submitted on demand.

4.21. Additionally, Contractor shall furnish detailed Cathodic Protection Health Report on

monthly basis along with the measurement sheets, and a copy to Bhagyanagar Gas Limited Hyderabad office containing the following data.

4.21.1. PSP Data as per frequency.
4.21.2. Polarization Cell Monitoring & Maintenance details as per frequency.
4.21.3. IJ Monitoring & Maintenance details as per frequency.
4.21.4. Cased Crossings Monitoring & Maintenance details as per frequency.
4.21.5. HT Crossings AC Induced Voltage
4.21.6. Missing Details of test stations & Spark Gap Arresters etc.
4.21.7. Earthing Status of Zinc Grounding Cells / Spark Gap Arresters

4.22. Contractor shall ensure complete rectification of all the maintenance jobs immediately after completion of the job. Identified problems are not attended shall attract penalty as mentioned in SCC - Commercial. In case of Priority, the EIC / SIC can instruct the contractor to execute the maintenance jobs within shortest possible time as well.

4.23. Contractor shall furnish the Formats and Reports as mentioned in the Reports and Formats section. Non-compliance to the time schedule in submission of Formats and Reports shall attract penalty as mentioned in SCC - Commercial.

4.24. Above mentioned points are general in nature and are applicable to each SOR item individually as per site requirements.

4.25. Loading, Unloading, Transportation of requisite materials at site is in the scope of contractor. Removal of debris and backfilling of the area surrounding the test station foundation is in the scope of the contractor.

4.26. Carrying out necessary lesioning with the land owners/farmers/statutory bodies and others for obtaining the consent for carrying out the job at site. Other than SOR Item Rate, Bhagyanagar Gas Limited will not pay any compensation related to this job.

4.27. Necessary tools tackles, labour etc. required for carrying out this job shall be borne by the contractor at his cost & risk. No additional payment will be made for the same.

SECTION-8
Scope of Work (SOW)

SCOPE OF WORK

1. **Introduction**:

Bhagyanagar Gas Limited has their City Gas Pipeline Network under various GA's as per authorisation of PNGRB in various districts / States.

The Brief Details of the assets in each GA / CGD Authorised Area / section for Hyderabad, Vijayawada and Kakinada are as given below:

Sr. No	GA/ Area	Steel pipeline in Km (aaprox.)	TR units (Nos.)	Manual test stations (MTS) (approx.)	No. of SV stations.	Remarks
1	Hyderabad	100	3	150	50	
2	Vijayawada	45	2	60	21	
3	Kakinada	45	1	60	15	

Note:

1) There can be some change in the pipeline network length and associated facilities due to ongoing expending activities in CGD networks.

2) Further details of the locations where TR Units installed are existing is given below:

Details of the TR units installed are as follows:

Item: Auto/Manual Controlled Automatic C.P. Rectifier

1. TR Units Details

- AC Input-240 V+/-10%VAC, 1-phase, 1000 VA
- Frequency-50Hz
- Output DC-25Volts & 25Amps.
- Ref Cell-AS3(Cu/CuSo4) Type
- Make-Kristron System
- Location: APSRTC DEPOT, Governorpet

2. TR Units Details

- AC Input-240 V+/-10%VAC, 4000VA
- Frequency-50Hz
- Output DC-50Volts & 50Amps.
- Ref. Cell-Cu/CuSo4-zinc
- Make-Raychem RPG Ltd
- Type: TRA7
- 1-phase, 4000 VA
- Location: APSRTC Depot, Vidyadhara Puram

3. TR Units Details

- AC Input-240 V+/-10%VAC.

- Frequency-50Hz
- Output DC-25 Volts & 25 Amps.
- Ref. Cell-Cu/CuSo4
- Make-Raychem RPG (P) Ltd
- Type: TRA2
- 1-phase, 1250VA
- Location: BGL Mother station, Shamirpet

4. TR Units Details

- AC Input-240 V+/-10%VAC.
- Frequency-50Hz
- Output DC-25 Volts & 25 Amps.
- Ref. Cell-Cu/CuSo4-Zinc
- Make-Raychem RPG Ltd
- Type: TRA7
- 1-phase, 1000VA
- Location's depot, Medchal

5. TR Units Details

- AC Input-230 V+/-10%VAC.
- Frequency-50Hz
- Output DC-48Volts & 25Amps.
- Ref Cell-AS3 Cu/CuSo4 Type
- Make-Kristron System
- 1-phase, 2000 VA
- Location: BGL Mother station, Kakinada

The said underground natural gas pipelines are passing through city and urban areas and are provided with either Impressed Current Cathodic Protection (ICCP) System or Galvanic Current Cathodic Protection system to protect from external corrosion as a supplementary system in addition to external coating of the pipelines of different diameters and length. The power source for ICCP system, in case of isolated pipelines is using either solar panels or Transformer Rectifier units with conventional type ground beds. Test Stations have been installed at an interval of around 1 Km in order to monitor the health of the pipeline and performance of the CP systems.

The system is to be maintained so as to achieve the following protection criteria: -

a) The Pipe to soil potential measurements of steel structures in soil will be between (-Ve) 0.85 and (-Ve) 1.50 Volts in case of isolated pipelines with respect of Copper/Copper Sulphate reference electrode.

b) The pipeline will be considered protected when minimum (-Ve) 300 Millivolt potential shift has been achieved from the initial-native potential to the "ON" potential.

c) A minimum polarization shift of (-Ve) 100 Millivolt will indicate adequate level of Cathodic Protection of the pipeline.

2. **Brief Details Of Sor Items:**
The intent of this document is to get executed the monitoring and maintenance of Galvanic Anode System and ICCP System in accordance with established codes and standards, accepted engineering practices, manufacturer's recommendations and to confirm to the local statutory regulations. The contractor is to provide all skilled and unskilled Human Resources (labours), tools and tackles (Including Pipeline Locator) test equipment's and instruments consumables required for monitoring and maintenance of the CP system. The brief/ indicative Scope of Work is given below against the respective SOR items. Further, the detailed specifications, requirement, procedures applicable for various SOR items has been given in tender document below after brief details of SOR items. For appropriate assessment of work, contractor may refer the complete tender document and visit the respective Site Offices / CP installations / Pipeline Network / SV Stations at respective sites personally before quoting the prices.

3. **Supply & Installation Of Manual Test Station:** Supply & Installation of Manual Test Station complete with lower bend and with PCC foundation including terminal plate, diagram plate, locks, cable identification ferrules and proper cable termination with lugs, painting & numbering of Test Station etc. as per drawing specification (with IP55) complete in all respect in line with tender provisions and as per instruction of EIC.

4. **Supply & Installation Of Metallic Type Manual Test Station:** Supply & Installation of Manual Test Station without lower bend & without PCC foundation including terminal plate, diagram plate, cable identification ferrules and proper cable termination with lugs, numbering of Test Station etc. as per drawing and specification with IP55) complete in all respect and per instruction of EIC.

5. **Shifting of Manual Test Station along with foundation and cable to suitable location:** The scope of work shall include installation of MTS along with foundation with supply and replacement of foundation bolts, minor repairing of foundation including labour, tools, tackles, consumables, like MS/Brass nuts, bolts, washers, insulation tape, cement, brick, sand, aggregates etc. complete in all respect as per approved drawings, specifications and direction of the EIC/SIC.

6. **Repairing of Manual Test Stations:** Repairing of Manual Test Stations foundation with supply and replacement of foundation bolts and nuts including labour, tools, tackles consumables like cement, sand aggregates etc complete in all respect as per scope of work, specifications and direction of EIC.
7. **Repairing of Manual Test Stations:** Repairing of Manual Test Stations including supply and replacement of damaged door, door locks, terminal plate ,diagram plate, neoprene gasket, brass links cable identification ferrules etc in Manual Test Station with proper cable termination, cable jointing, lugs with numbering of Test Station complete in all respect including labour, tools, tackles, consumables like MS /brass bolts, nuts, washers, insulation tape etc.as per scope of work, specifications and the direction of EIC.

8. **Supply & replacement of damaged/missing locks in Manual Test Station:** Supply & replacement of damaged/missing locks in Manual Test Station including labour, consumables, tools & tackles as per drawings, specifications & instructions of EIC.

8.1. Contractor shall identify the Test Stations where the Door Locks found missing / damaged and require replacement. Contractor shall carry out the job as per site requirement and as per instructions of EIC/SIC. Shifting and handing over of the removed damaged door locks to Bhagyanagar Gas Limited is in the scope of contractor.

8.2. Contractor shall carry out supply and replacement of only damaged locks of approved make for all types of test stations. Door Locks shall be of castle lock/ Allen key lock depending on the type of existing door locks.

9. **Supply & replacement of damaged/missing doors in Manual Test Station:** Supply & replacement of damaged/missing doors in Manual Test Station including lock, neoprene gasket, diagram plate labour, consumables , tools & tackles as per drawings, specifications and instructions of EIC.
10. **Supply & installation of damaged/missing terminal plates:** Supply & installation of damaged/missing terminal plates (all types) with M10 brass studs, washers, links, lugs & nuts, tools & tackles and consumables including labour as per instruction of EIC.
11. **Supply and fixing of diagram plate in the existing test station:** Supply and Fixing of diagram plate in the existing test station of all types complete in all respect including labour, tools, tackles, consumables etc. as per scope of work specifications and the direction of EIC.
12. **Supply, installation, testing and commissioning of Anode Lead Junction Box (ALJB):** Supply, installation, testing and commissioning of Anode Lead Junction Box (ALJB) including required backelite plate brass nut bolts, port type resistor & shunt arrangement, civil works with materials as per EIC.
13. **Repairing of ALJB:** Repairing of ALJB including supply of new locks and latch for the outer enclosure, shunt, variable resistance, brass links, ALJB doors including welding mechanical, fittings, hinges, labour, tools tackles, consumables like lugs, MS/Brass nuts, bolts, washers, insulation tape etc complete in all respect as per approved drawings, specification and as per direction of EIC.
14. **Supply of 660/1100V grade single core**, stranded tinned copper conductor cables, XLPE insulated, PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC. **Size: 1C X 4 sq mm Cable**.
15. **Supply of 660/1100V grade single core**, stranded tinned copper conductor cables, XLPE insulated, PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC. Size: **1C X 6 sq mm Cable.**
16. **Supply of 660/1100V grade single core,** stranded tinned copper conductor cables, XLPE insulated, PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC. Size: **1C X 10 sq mm Cable.**
17. **Supply of 660/1100V grade single core,** stranded tinned copper conductor cables, XLPE insulated, PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC. Size: **1C X 16 sq mm Cable.**

18. **Supply of 660/1100V grade single core,** stranded tinned copper conductor cables, XLPE insulated, PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC. Size: **1C X 25 sq mm Cable.**
19. **Supply of 660/1100V grade single core,** stranded tinned copper conductor cables, XLPE insulated, PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC. Size**: 1C X 35 sq mm Cable.**
20. **Cable laying:** Cable laying of various sizes (XLPE armoured cable) inside the test station / over ground & underground/inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables as per scope of work, specifications and the direction of EIC. Size: 1 C x 4 SQ MM
21. **Cable laying** of given Size (XLPE armoured cable) inside the test station /over ground & underground/ inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables as per scope of work, specifications and the direction of EIC: Size : 1 C x 6 SQ MM
22. **Cable laying** of given Size (XLPE armoured cable) inside the test station / over ground & underground/ inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables as per scope of work, specifications and the direction of EIC: Size : 1 C x 10 SQ MM
23. **Cable laying** of given Size (XLPE armoured cable) inside the test station / over ground & underground/ inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables as per scope of work, specifications and the direction of EIC : Size : 1 C x 16 SQ MM
24. **Cable laying** of given Size (XLPE armoured cable) inside the test station / over ground & underground/ inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables as per scope of work, specifications and the direction of EIC: Size: 1 C x 25 SQ MM
25. **Cable laying** of given Size (XLPE armoured cable) inside the test station / over ground & underground/ inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables as per scope of work, specifications and the direction of EIC: Size : 1 C x 35 SQ MM
26. **Cable Jointing**: Cable jointing/ repairing of underground cable as per approved procedure including excavation and backfilling, cable jointing by cable jointing kit (Raychem/equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrink sleeves, ferol etc. for given Cable Size XLPE armoured Cu cable as per scope of work, specifications and directions of EIC. Size: 1 C x 4 sq mm

27. **Cable jointing/ repairing** of underground cable as per approved procedure including excavation and backfilling, cable jointing by cable jointing kit (Raychem/equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrink sleeves, ferol etc. for given Cable Size XLPE armoured Cu cable as per scope of work, specifications and directions of EIC. Size: 1 C x 6 sq mm
28. **Cable jointing/ repairing** of underground cable as per approved procedure including excavation and backfilling, cable jointing by cable jointing kit (Raychem/equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrink sleeves, ferol etc. for given Cable Size XLPE armoured Cu cable as per scope of work, specifications and directions of EIC. Size: 1 C x 10 sq mm
29. **Cable jointing/ repairing** of underground cable as per approved procedure including excavation and backfilling, cable jointing by cable jointing kit (Raychem/equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrink sleeves, ferol etc. for given Cable Size XLPE armoured Cu cable as per scope of work, specifications and directions of EIC. Size: 1 C x 16 sq mm
30. **Cable jointing/ repairing** of underground cable as per approved procedure including excavation and backfilling, cable jointing by cable jointing kit (Raychem/equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrink sleeves, ferol etc. for given Cable Size XLPE armoured Cu cable as per scope of work, specifications and directions of EIC. Size: 1 C x 25 sq mm
31. **Cable jointing/ repairing** of underground cable as per approved procedure including excavation and backfilling, cable jointing by cable jointing kit (Raychem/equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrink sleeves, ferol etc. for given Cable Size XLPE armoured Cu cable as per scope of work, specifications and directions of EIC. Size: 1 C x 35 sq mm
32. Making of Pipe to cable connection as per approved procedure, of all types of cable including excavation and backfilling, surface preparation, pipe to cable connection by means of pin brazing its encapsulation, holiday testing of the exposed section, labour, tools, tackles etc as per scope of work, specifications and direction of EIC.
33. Painting of Manual Test station including removing of old paint, rust etc, surface preparation to get the smooth level surface, supply and application of 01 coat of ready- mix red oxide primer of approved make, 02 coats of ready mixed first quality paint of approved brand. (Final dry paint thickness not less than 100 micron), Numbering of Test Station as per scope of work, specification and as per direction of EIC.
34. Painting of Anode Lead Junction Box (ALJB)including removing of old paint, rust etc, surface preparation to get the smooth level surface, supply and application of 01 coat of ready-mix red oxide primer of approved make, 02 coats of ready mixed first quality paint of approved brand. (Final dry paint thickness not less than 100 micron), Numbering of Test Station as per scope of work, specification and as per direction of EIC.

35. Painting of TR Units including removing of old paint, rust etc, surface preparation to get the smooth level surface, supply and application of 01 coat of ready-mix red oxide primer of approved make, 02 coats of ready mixed first quality paint of approved brand. (Final dry paint thickness not less than 100 micron), Numbering of Test Station as per scope of work, specification and as per direction of EIC.

36. Supply & replacement of copper-copper sulphate or AS3 Cu/Cuso4 permanent reference cells: Supply & replacement of copper-copper sulphate or AS3 Cu/Cuso4 permanent reference cells (Make Mc Miller/ Tinker & Rasor/ Caproco) necessary backfill material including excavation /backfilling cable laying, cable identification ferrules, labour, tools, tackles, consumables like sand, brick, lug, Brass washers, insulation tape etc, complete in all respects as per scope of work drawings, specification and direction of EIC.

37. Supply of portable Cu-CuSO4 Half cell for measuring of PSP (Pipe to Soil Potential) of Pipeline.

38. Supply & installation of explosion proof spark gap arrestors make across insulating joints at SV/ IP/ RR/ terminals including required cable, lugs, nuts & bolts, labour, tools & tackles, and sundry consumables.

39. Supply, Installation and Commissioning of Polarization Cell: Supply, Installation and Commissioning of Polarization Cell along with the enclosure suitable for housing of Polarization Cells in all respect as per specification & directions of Engineer In charge. (Supply of cable, cable laying upto the test station, Cable Joint to pipe & Zn anode for grounding shall be treated as separate, if required).

40. Preventive Maintenance of Polarisation cells: Preventive Maintenance of Polarization cells supply of KOH electrolyte, complete in all respect to make the cell in working condition and as per specifications and instructions of EIC.

41. Supply and installation of pre-packed Magnesium anodes with cable: Supply and installation of pre-packed Magnesium anodes with cable having weight 17 pounds including excavation, backfilling, cable laying up to test station and cable termination in test station, cable identification ferrules, with consumables labour etc. as per approved drawing, specification and direction of EIC.

42. Supply, replacement & installation of prepacked High Silicon Chromium/Iron Solid Anodes: Supply, replacement & installation of prepacked High Silicon Chromium/ Iron Solid Anodes(22kg) of reputed make including excavation, backfilling, anode to tail cable connection, cable identification, coke breeze backfills complete with labour, tools & tackles as per drawings, specifications & instructions of EIC (item is applicable for Normal AGE not for Deep Well AGB).

43. Supply and Installation of pre packed Zinc grounding cell: Supply and Installation of pre-packed Zinc grounding cell 22Kg (H-Type) including all tools, tackles, consumables, labour chemical back fill, excavation, backfilling, cable to insert joint, laying of tail cable, cable termination at TS complete and in all respect as per drawing, specification and as per direction of EIC.

44. Supply and Installation of pre packed Zinc Grounding Anode: Supply and Installation of pre-packed Zinc Grounding Anode (Weight: 17 lbs) including all tools, tackles, consumables, labour, chemical back fill, excavation, backfilling, cable to insert joint, laying of tail cable, cable termination at TS complete and in all respect as per drawing, specification and as per direction of EIC.

45. Supply, Installation, Testing and Commissioning of Deep Well Anode Ground Bed (MMO Titanium anodes): including all tools, tackles, consumables, labour, chemical back fill, excavation, backfilling, cable to insert joint, laying of tail cable, cable termination at TS complete and in all respect as per drawing, specification and as per direction of EIC.

46. Preventive maintenance of Anode Ground Bed -The scope of work includes necessary excavation for carrying out ground bed curing with 500 kg of common salt and water of 18 KL. The work includes necessary backfilling and restoration to the original condition as per the direction of EIC. The contractor shall measure the grounded resistance after the treatment of round bed. The resistance of rounded after the maintenance shall be less than 01 ohm.

47. Supply, installation, commissioning of earth pits: Supply, Installation & Commissioning of Earth Pits as per scope of work & enclosed drawing and specifications including supply and installation of GI Pipe earth electrode, salt, charcoal, sand and brick masonry work, excavation and backfilling in all type of soils and MS cover at the top. (Earthing Cable/ strip extra).

48. Half-yearly Monitoring of Earth-pits: Resistance measuring of earth-pit, pouring of water to bring down the resistance if required, cleaning of connecting nuts and bolts, etc as per directions of EIC.

49. Recharging of existing earth pits: Job includes supply of new GI Pipes, material and consumables, transportation of material and manpower, painting of top cover plates and numbering, recharging of earth pit by pouring sufficient salt, charcoal and water in it for bringing down the circuit resistance including making, necessary excavation, backfilling etc complete in all respect and as per directions of EIC.

50. Chamber Repair of Earth Pit: Job includes reconstruction of Earth pit chamber with raising the height of civil foundation, repair of cement plastering, painting of top cover plates and numbering the earth pit, charging the earth pit with common salt 50 Kg and water 100L for bringing down the circuit resistance including making necessary excavation, mixing & pouring of salt & water, replacement & cleaning of connecting nuts and bolts, etc complete in all respect and as per directions of EIC.

51. Supply of Earth pit chamber MS Cover 600 X 600 X 5 mm (Approx).

52. Supply and installation of cable markers: - Supply and installation of cable markers for underground cables and equipment as per specifications.

53. CIPL Survey: Carrying out on-off Close Interval Potential Logging (CIPL) Survey with Lateral Gradient at one-meter interval using data loggers and standard Cu/CuS04 Reference Electrode and as per specifications.

(a) The main objectives of CIPL survey:

(1) To know the effectiveness of CP system

(2) To identify Anodic and Cathodic regions of the Pipeline, as existing

(3) To study whether the entire pipeline is catholically protected

(4) To predict the interference areas due to Transmission lines, Tractions & foreign pipelines etc. for further detailed interference survey & mitigation if any.

(5) To predict areas of pipeline where there may be possibility of some coating defect.

(b) Before commencing the CIPL Survey, contractor shall identify & locate the TRU, Grounding Cells provided at IJ / IF, Sacrificial Anodes, bonding locations of the pipeline section considered for the CIPL survey.

(c) All bonding with foreign pipeline if any, Valve earthing (in protected section) and sacrificial anodes shall be disconnected (in case connected through de-coupler, disconnection is not required). Grounding Anodes/Earthing provided for the grounding through polarization Cells shall not be disconnected. Grounding of Isolating joints on un-protected side shall not be disconnected. After completion of survey contractor shall restore all disconnected CP bonding and Grounding anodes to original condition.

(d) Pipelines Sections which are catholically protected through Sacrificial Anodes, at first CIPL survey in Anode connected condition shall be conducted. After this, GPS based battery operated interrupter system shall be installed at the Anode stations & on-off survey shall be performed to ensure the effectiveness of CP system. Further DVCG & CAT Survey shall be performed for whole length of such sections.

(e) The Contractor has to remove the bonding between two isolating joints and shall keep the TR units in manual mode output control (AVCC).

(f) The Contractor shall note down the CP Unit parameter, and put the CP Unit in AVCC mode. CIPL survey shall be performed with the same TRU input settings. However, after when survey is completed and mitigation actions implemented, TR settings (both in AVCC & Auto mode) should be selected such that the OFF PSP at the CP Unit Location should not be more negative than (-) 1200 mV and at far end location, it should not be less negative than (-) 850 mV. In case of multiple CP units in same section, PSP at mid-location should not be less negative than (-) 850 mV. A set of ON & OFF PSP record of the pipeline shall be noted as compliance of the above. These data records should be part of the final report. Following parameters of CP Unit shall be noted down on daily basis for the pipeline section under survey and shall be maintained till completion of the CIPL survey for that section:

(1) TR input voltage & current

(2) TR output voltage & current

(3) Pipe to Soil Potential (PSP) at TR unit

(4) Setting for Target Pipe to Soil Potential

(g) The required no. of GPS based current interrupter for the survey has to be arranged by the contractor.

(h) The ratio of the ON & OFF interruption shall be set at 4:1 (i.e. 4 Second ON & 1 second OFF), the OFF time shall not be less than 1 seconds for CIPL Survey. If more than one CP Unit is feeding the current to a section of the pipeline (IJ to IJ) identified for CIPL survey, then all CP Units shall be synchronized for current interruption.

(i) A synchronization check shall be conducted for on each day to check that the timers stay in sync without error that may subvert the purpose of the survey. This test may be repeated as per instruction of EIC/SIC during the survey in a day if it is observed that sync is deviating or at any time a new timer needs to be in place for faulty one. During the survey, if it is observed that there is some issue with synchronization based on the survey readings, it shall be again fixed before proceeding for the further survey.

(j) Pipeline locators must be used for pipeline route identification and the Surveyor shall walk exactly over the pipe line during the survey. Pipeline alignment shall be fixed by pipeline locator at regular intervals not more than 10 meters apart, for accuracy over the line of survey. Both peak and null modes of pipeline identification shall be used for accurate pipeline alignment fixation.

(k) Potentials shall be measured on ground surface exactly over the pipeline to minimize error due to inclusion of lateral soil potential drops in the measured values of pipe-to- soil potentials. However, for all Coal Tar coated Pipelines and wherever PSP is showing beyond the protection criteria or there is abrupt change, lateral CIPL survey shall be also performed to identify the anodic and cathodic areas. Lateral CIPL survey at every 50 meter or wherever there is abrupt changes in PSP, shall be also carried out where multiple pipelines are running in same ROU.

(l) The data logger should have the capability to record the GPS coordinates along with survey. It's accuracy to be cross checked with Ground Control Points (GCP) provided by BGL. If GCP data is not available with BGL, then same needs to be verified with the known benchmarks in the vicinity such as data from survey of India etc.

(m) CIPL survey shall be carried out by logging (ON/OFF) potential measurement in data loggers at an interval of not more than 01 meter by leap frog /long leap technique over the pre-determined route of pipeline. Also, other readings such as foreign line PSP, casing to soil potential, AC voltages shall be recorded at respective locations.

(n) Distance traversed and physical features such as pipeline route markers, roads, rivers, canal / nala crossings, HT crossings, Valves etc. shall be recorded to assist with locating specific areas after processing the data and should be the part of the report.

(o) Contractor shall download the data into the PC / laptop of EIC/SIC/Representative on daily basis. If downloading on BGL's PC not possible, data can be sent on daily basis to the EIC/SIC through e-mail.

(p) Areas where the surface is very dry i.e., expected soil resistivity is more than 200 Ohm-M or Rocky areas/Paved Roads; such locations need to be wetted with water just before carrying out the survey to record the true potential. At such locations & under paved roads or other such high soil resistivity areas, the minimum input impedance of the logger should be more than 20 M-Ohms.

54. DCVG/ ACVG Survey:

Carrying out Direct Current Voltage Gradient (DCVG) OR Alternate Current Voltage Gradient (ACVG) survey using standard DCVG/ ACVG equipment to pin point the coating defect/ holidays on pipeline as per the specification.

Scope of work consists of conducting ON/OFF CIPL survey over pipe line for detecting coating defects, anomalies in existing cathodic protection system such as insufficient CP currents, coating defects / damaged etc. and based on the findings of the CPL survey identifying locations for conducting DCVG/ACVG survey/ CAT with A frame to ascertain the exact location and size of all types of coating defects and secondarily to find out the existence of any existing interference of the pipe line. For Isolation field where line is protected by sacrificial anode CIPL as well as CAT survey has to be carried out. Excavation of bell holes in defective coating locations, conducting thickness measurement, repair of coating with cold applied tapes and restoration of ROU CPL & DCVG/ACVG survey has to be carried out for pipe line at different locations.

Scope of Work includes –

- To locate the pipeline by using pipe locater
- To find out the depth of the pipeline from natural grade level.
- To plot a single line sketch of the P/L route with chainage and all obstacle crossings, ROU installation and Depth of the P/L etc
- To ascertain exact location and magnitude of coating defect throughout the periphery of the pipeline.
- Bench marking of the defect location for relocation for coating repairing.
- To establish the existence of interference situation if any.
- To verify the defect by excavating the pipeline.
- To carryout coating repair at the defect locations.
- To prepare the detailed report of the entire survey work in tabulation as well as graphical form.
- To summarize the total report along with interpretation and recommendations.
- To record co –ordinates of every TLP along the P/L route and also at all defect locations/ coating repair locations.

The latest version of the following codes and standards will be considered as a minimum requirement: - NACE Publications.

(a) The main objectives of DCVG/ACVG survey are:

1. To pinpoint the coating defect in pipeline sections from probable locations identified from CIPL & CAT Survey.
2. To categorize the Coating defects for their repairs
3. To give accurate coating defect locations for future coating repairs
4. Classify defects as Anodic or Cathodic

(b) Contractors shall carryout analysis of CIPL & CAT survey data for identifying the probable defect locations for carrying out DCVG survey at these locations in consultation with the EIC/SIC. However, for non-Piggable pipeline section, DCVG survey has to be performed for entire length of the pipeline section at every 1 meter.

(c) It is preferable to use the digital recordable DCVG equipment over conventional type of DCVG instruments to avoid manual interventions.

(d) Contractor shall further carry out DCVG survey on the indicative areas of the fault locations to pinpoint the exact location i.e. epicentre of coating faults and other meaningful data like interference, drainage etc. For carrying out DCVG survey high sensitivity milli-voltmeters and current interrupters shall be used to get the accurate results.

(e) To facilitate the measurement of DCVG Signal strength at Test stations, DCVG potential (Von) during switch on CP system and DCVG potential (Voff) during switched off CP system at each measurement point shall be measured. The CP current should be continuously switched on and off and the ratio between the switch on and switch off periods of CP current should be 1:2.

(f) Nearest TR/CPPSM unit shall be interrupted for DCVG survey work. The output of TR/CPPSM unit along with interrupter shall be adjusted in such a way to achieve good signal strength at longer distances as the most important parameter in ensuring an accurate survey is the amplitude of DCVG pulsed signal. In case of survey area falls at centre of two CP units, one CP unit shall be switched off for conducting the survey.

(g) The amplitude of DCVG signal strength shall be not less than 1200 mV. For any set point, DCVG signal strength can be measured at each test station by touching the bottom of one reference cell to the pipeline terminal in the Test Station and putting the other reference cell on the soil above pipeline.

(h) For pipelines at higher depths or as wherever required based on site conditions and instruction of EIC/SIC, ACVG survey shall be used to pin point the Coating defects. In such cases, survey procedure as per equipment manufacturer shall be strictly followed. It is to be ensured that spikes of A-Frame used in ACVG survey are inserted fully in the soil where the ground conditions are particularly dry or having high resistance.

(i) Contractor shall ascertain locations with GPS coordinates and some referenced physical features like Markers, TLP, Road etc. and magnitude of coating defect throughout the periphery of the pipeline and shall summarize interpretation and recommendation for repair of the coating.

(j) Accurate location identification drawings should be prepared for each and every coating anomalies showing the reference with permanent markers available around that area, terrain features, details of nearest TLP and Chainages.

(k) All coating Anomalies shall be peg marked on surface using temporary markers with specific nos. and their start /end Chainage with GPS coordinates shall be recorded. These wooden Temporary markers shall be of size 2''x2''x24'' with yellow colour.

(l)After completion of the survey and analysis of the report, size and location of the defects are to be categorized as Minor/Moderate/Severe and anodic / cathodic in accordance with best industry practices & standard or as suggested by manufacturer of the equipment.

(m) Excavation, removal of coating, cleaning of pipeline surface, recoating of the pipe using BGL's material and restoration of ROU. Contractor shall carry out verification of any metallic anomaly / defect by NDT methods (UT, MPT) as and when required.

(n) As a minimum, following no. of Coating anomalies to be reported (including minor, moderate & severe category) based on %IR calculation/ACVG findings and digs must be performed at such locations for each pipeline section:

Pipeline Section Length (L)	Minimum no. of reported probable coating anomalies	Minimum no. of Digs to be verified for Coating anomalies by BHAGYANAGAR GAS LIMITED
L ≤10 Km	3	1
10Km < L ≤ 30 Km	5	2
30Km < L ≤ 60 Km	8	4
L > 60Km	10	6

(o)In case of no. of reported Coating anomalies are less than as mentioned above, then dig verification shall be carried out with no. of digs as mentioned above or the no. of reported coating anomalies (whichever is lower).

(p) EIC/SIC of the respective region shall witness the dig verification of coating anomalies with respect to the anomalies reported in the survey and accordingly the report will be signed jointly by the contractor and EIC / SIC. The coating defect shall be photographed with proper numbering of the defects before and after carrying out coating repairs & after removing the Coating in defect area, before & after cleaning the surface. After Coating repair, thickness measurement must be done after surface preparation and shall be made the part of the report.

55. Stray current Interference survey: - Stray current Interference survey at railway crossing or running parallel to BHAGYANAGAR GAS LIMITED (BGL)Gas Pipelines, including 24 hours data logging, data collection from railways, study the effectiveness of existing diode bonding and recommend mitigation measures /modification required at existing doide JB, at all the railway crossings or running parallel as defined in scope of work with specification, design and detail engineering.

56. **Stray current Interference survey at foreign P/L crossing: -** Stray current Interference survey at foreign P/L crossing or running parallel with BHAGYANAGAR GAS LIMITED (BGL)Gas Pipeline, including 24 hours data logging, data collection from foreign pipeline operator, and recommend mitigation measures at foreign pipeline crossing or running to BHAGYANAGAR GAS LIMITED (BGL)pipeline as defined in the scope of work, with design, specification and detail engineering.

57. **Stray current Interference survey at HT crossings:-** Stray current Interference survey at HT crossings or running parallel to BHAGYANAGAR GAS LIMITED (BGL)Gas Pipelines, including 24 hours data logging, collection of data from SEB, calculation of human touch and step voltages, measurement and calculation of AC corrosion current and recommendation for mitigation/effectiveness of existing grounding with modification if required, at HT Line crossings /parallel sections as defined in the scope of work with design, specification and detail engineering.
58. **Excavation & Backfilling of pipeline: -** Excavation & Backfilling of pipeline in all type of soils and ordinary rocks for a width of D+500 mm on each side of pipe and exposing the pipeline from top upto 500mm below the bottom of Pipeline including the stacking of excavated earth, lead upto 50m,stacked earth to be levelled and neatly dressed 'as per the scope of work and directions of EIC.
59. **Coating repair:** Coating repair which includes Removing the old/ damaged coating/ rust grease, moisture and all foreign material at defect material with scrapper, manual surface preparation using hand wire brush, emery paper, scrappers or a combination of all processes, repairing of the coating with supply of Raychem sleeves/cold applied tape/PERP/patch repair kit ,holiday testing after repair, as per the scope of work and to the entire satisfaction of EIC. Multiple patch repairing at one location within one meter span shall be treated as single quantity only.(Compensation if required to land owners shall be in the scope of contractor). Same is applicable in case of coating damage by third party agencies. Bidder has to repair the coating damaged as per applicable standards.
60. **Repair & Rectification of TR Unit** : To carry out breakdown maintenance of cathodic protection equipment TR units . EIC will issue instructions for breakdown maintenance to be carried out. Immediately upon receiving such orders, the contractor shall make necessary arrangements and submit schedules thereof in line with the time frame given by the EIC. The scope of work includes tracing out the fault in the system, carrying out necessary repair and rectification, supply of component level spares for repairing the cards and making the unit operational in all respect. The contractor should attend the break down call with in 24 Hrs. Breakdown maintenance will be carried out by the contractor under the guidelines and instructions of the EIC and as per manual.

61. Quarterly Monitoring and Collection of data related to CP System from Manual Test Stations along the pipeline route including compilation and preparation of the reports in the office by a technically qualified person. Quarterly monitoring includes On-Off Potential Survey using current Interrupters once in a year. Total length of pipeline is approximately 70 Kms for Hyderabad, 50 Kms for Vijayawada & Kakinada and rates to be quoted on quarterly basis. Monitoring of MTSs (approx. 60 Nos in Hyderabad CGD, 45 Nos in Vijayawada CGD & 42 nos in Kakinada CGD) are for eight quarters.

62. Monthly Monitoring and Collection of data from TR Units including compilation and preparation of the reports in the office by a technically qualified person. Monitoring of TR units (1 no. in Kakinada, 2 No in Vijayawada & 3 nos. in Hyderabad CGD) are for 24 (twenty-four) months.

63. Half-yearly Monitoring and Collection of data related to CP System from Anode Ground bed including compilation and preparation of the reports in the office by a technically qualified person. Total number of anode beds in Kakinada CGD is 1, Vijayawada CGD is 2 and Hyderabad CGD is 3 and rates to be quoted on Half yearly basis. Monitoring of Anode Beds are for Four Half-years.

64. Annual Monitoring and Collection of data related to CP System from Reference electrodes including compilation and preparation of the reports in the office by a technically qualified person. The rates to be quoted on annual basis. Monitoring of reference electrodes (1 Nos in Kakinada CGD, 2 Nos. in Vijayawada and 3 Nos. in Hyderabad) are for two years.

(a) Mandatory spares of Raychem make TR Unit : Control Card CEC-103A
(b) Mandatory spares of Raychem make TR Unit : Control Card CEC-104C1
(c) Mandatory spares of Raychem make TR Unit : Control Card CEC-105D1
(d) Mandatory spares of Raychem make TR Unit : Control Card CEC-106
(e) Lightning Arrestors for Raychem make TRUnit.
(f) Transducers for Raychem make TR Units (PSP, O/P Voltage, O/P Current, I/P Voltage, I/P Current)
(g) Mandatory spares of KristonSystemTRUnit:Control Card RRL-MB 01.
(h) Mandatory spares of KristonSystem TRUnit: Control Card KS-103A.
(i) MMandatory spares of KristonSystem TRUnit: Control Card KS-104C1.
(j) Mandatory spares of KristonSystem TRUnit: Control Card KS-105D1.
(k) Mandatory spares of KristonSystem TRUnit: Control Card KS-106.
(l) Mandatory spares of KristonSystem TRUnit: Control Card KS-118C.
(m) Lightning Arrestors for KristonSystemTRUnit.
(n) Transeducers for KRISTON MAKE TRUnits (PSP,O/P Voltage, O/P Current ,I/P Voltage, I/P Current)
(o) Panel Meters for KRISTON MAKE TRUnits.
(p) Mandatory spares of Raychem System TRUnit: Control Card CEC0107.
(q) Supply and Installation of mother board Suitable with TR Unit - 1KVA.
(r) Supply and Installation of Potentiometer Output/Reference voltage or current limit setter
(s) Supply and Installation of Aux / Power Transformer for TR Unit (upto 0.625 kVA)
(t) Mandatory spares of KristonSystem TRUnit: Control Card KS-118C.
(u) Supply and Installation of Ammeter suitable with TR Unit - AC 0-30 Amp.
(v) Supply and Installation of Voltmeter suitable with TR Unit - AC 0-300 Volts.
(w) Supply and Installation of Ammeter suitable with TR Unit - DC 0-60 Amp
(x) Supply and Installation of Voltmeter suitable with TR Unit - DC 0-60 V.
(y) Supply and Installation of reference PSP Volt Meter Suitable with TR Unit - DC 0- 30 V.
(z) Supply and Installation of GSM based ON/Off Current Intruptor with GPS interface
(aa) Supply and Installation of Contactors suitable with TR UnitAC 0-230 V.
(bb) Supply and Installation of Main Transformer for TR Unit (upto 5 kVA).
(cc) Supply and Installation of Auto Transformer for TR Unit (upto 5 kVA).

65. Design of Anode Ground Bed including Soil Resistivity Survey for specified locations.

66. CAT Survey: CAT survey of Pipelines at every 10M Interval with Field data analysis at every 500-meter interval by plotting Pipeline Map current v/s Distance on graph sheets / Field computer for immediate on-site review including recording of elevation profile of entire pipeline at 10M as well as depth survey recording at every 10M. Submission of draft report along with data to BHAGYANAGAR GAS LIMITED (BGL) for each pipeline section, Dig Verification & Completion of Validation surveys, Completion of all survey work, submission of final reports and printed reports for all sections.

(a) The main objectives of CAT survey are:

(1) To identity the pipeline coating condition along the Pipeline based on the Current distribution.

(2) To measure the depth of cover over the Pipeline

(b) CAT Survey shall be carried out by Pipeline current mapping survey at all the pipeline sections.

(c) The survey along the pipeline should be carried out after duly identifying the pipeline alignment using the Pipeline Locator's peak and null modes of operation. The pipeline ROU should be identified using temporary markers, at defined distance intervals. This shall facilitate retracing back high current attenuation locations for DCVG survey.

(d) Distance of survey traverse - survey chainage shall be accurately measured with tape for accurate demarcation. The same shall be re-matched with Pipeline marker Chainage/TLP Chainage, at regular intervals to avoid accumulation of error of measurement.

(e) The measurement by CAT survey data shall be done at an interval of every 10 meters for Un-Piggable Pipelines along with pipeline depth measurement.

(f) Measurement of CAT readings shall start at least after a 100 meter distance from the current injection from Transmitter.

(g) The Contractor has to arrange for field computer/laptop for downloading data from the CAT instrument. Field data analysis should be done at every 500 meter interval to identify places of high current attenuation, by plotting Pipeline Map current v/s Distance on graph sheets / Field computer for immediate on site review to undertake the DCVG/ CAT 'A' frame survey at close intervals.

(h) CAT survey at streams/rivers/canals where flowing water makes it difficult to conduct the survey, is not required. However, such survey shall be conducted from the bank sides of the streams/rivers/canals.

(i) For digital surveying equipment, the digital data output including the graphs can be presented simultaneously for all the surveys.

(j) Elevation profile of entire pipeline (un-piggable sections- at every 10 meter) and depth of cover of pipeline shall be also recorded.

67. Supply, Installation & Commissioning of Earth Pits as per scope of work & enclosed drawing and specifications including supply and installation of copper plate, GI Pipe, salt, charcoal, sand and brick masonry work, excavation and backfilling in all type of soils and MS cover at the top. (Earthing Cable/ strip extra).

68. Supply & Laying/ Erection of 25 mm X 3 mm G.I strip at 0.50 metre below ground as strip including connection/ terminating with G.I. nut, bolt, spring, washer etc. as required. (Jointing shall be done by overlapping and with 2 sets of G.I. nut bolt & spring washer spaced at 50mm) including all associated civil work/ restoration and labour for Grid Fabrication of Existing Earth Pits as per IS 3043.

69. Supply & installation of Corrosion Coupon compatible to steel pipeline of 100*100 with 4 sq and 6 sq cable along with manetic switch for mrasyremen t of AC inflence on netrakized surorodingof pipeline (Polaize).

70. Supply and installation of 1KVA, single-phase/three-phase AC-operated, automatic/manual Transformer Rectifier (TR) units for Cathodic Protection (CP) system from reputed makes such as Kristron or Raychem RPG. complete in all respects, including AC input 240V ±10% VAC, single phase, 1000 VA, frequency 50 Hz, DC output 25 Volts and 25 Amps, along with all required accessories, cabling, earthing, mounting arrangements, testing, and commissioning.

3. Detailed Specifications, Requirement & Procedures

I. EARTHING SYSTEM / EARTHING PIT :-

a. The earthing system of TR Unit and P/L or at Gas terminal comprises of Earth pits, Earthing grid etc. Monitoring, Maintenance/Repair is to be carried out as per IS 3043 (pipe or plate).

II. Installation of Polarization cell (Solid State type), Supply, installation, testing and commissioning of Static type Polarization cell of as per SOR along with enclosure suitable for housing the cell as per specification including supply of cable, cable laying up to the test station, terminal board, terminals, installation on (plinth/pole/wall mounted) support, excavation and restoration, foundation, cable termination and laying of cable, cable termination in TS complete and in all respect as per drawing, specification and as per direction of EIC.

a. Solid state type polarization cell shall be designed to simultaneously provide isolation for DC current and low resistance path for AC current. The device shall require minimum maintenance. The device shall have weather proof enclosure and shall be suitable for mounting inside a test station. DC blocking voltage shall not be less than 1.2 volts. The DC leakage current at 1.2 volt shall not be more than 0.5Ma.

III. Excavation and backfilling of pipeline.

a. Without regard to soil conditions and topography the trench shall be excavated & backfilled and finished to the dimensions for all kind of soils and mild rocks for a width of D+500 mm on each side of pipe and exposing the pipeline from top up to 500mm below the bottom of Pipeline including the stacking of excavated earth, lead up to 50m, stacked earth to be levelled and neatly dressed as per directions of EIC.

b. The contractor is warned that while excavation job is carried out, the pipeline, which is carrying highly explosive natural gas, should not be damaged and chiselling, hammering, etc. shall not be resorted to on the pipeline surface in any case. The contractor shall exercise care to see that the fresh soil recovered from trenching operation intended to be used for backfilling over the laid pipe in the trench is not mixed with loose debris or foreign matter.

c. The contractor shall be responsible for making all necessary arrangement to remove or pump out water from the trench or from wet area, if required during excavation and operations of coat and wrap are in progress, without any extra cost/liability to the owner.

IV. **Maintenance of Horizontal anode ground bed.** The scope of work includes necessary excavation for carrying out ground bed, curing with bentonite, coke breeze etc with common salt and water for bringing down the ground bed resistance to the required value. The work includes necessary backfilling and restoration to the original condition as per the direction of EIC. The contractor shall measure the grounded resistance after the treatment of ground bed. The resistance of ground bed after the maintenance shall be less than 01 ohm.

V. **Supply, Installation, Testing and Commissioning of Static type Spark gap arrestors/Surge Diverters across IJs of reputed makes (As defined in the SOR).** The requirement of spark gap arresters are, Over voltages on pipeline causing shock hazards shall be diverted to earth, The discharge current should not damage the surge diverter, Normal condition should be restored soon after the surge has been diverted. Surge diverter when connected in parallel across the insulating joints shall protect the insulating joint against surges coming across it due to lighting strikes; electrical faults etc., on the above ground portion of the pipeline. The surge diverter shall be of spark gap type. The device shall have weather proof enclosure suitable for outdoor mounting. The surge diverters shall be of explosion proof type.

VI. **Repair and Rectification of TR Units**

(a) Once in a Year yearly health checkup including capacity and performance test/ Calibration check of the critical equipment's, control cards, display meters etc. The scope of work includes arranging the OEM representative/Engineer for major breakdowns/ Once in Year annual health check and performance test of the panel/ Critical parts from the OEM. Arranging vehicle for the OEM engineer will be in the scope of the contractor. Consumables like fuses, resistors, shunts, diodes etc. to make panel normalization shall be in the scope of contractor. (b) Attending breakdown calls for repair & rectification of TR Unit of all make & models and making the units operational in all respect under Repair and Rectification of TR Units & CPPSM. The work includes carrying out necessary repair of control cards, supply of component level spares, fuses, complete with necessary man power tools, tackles etc. The scope of work includes after receiving the breakdown call either by phone or by email or by Job card & tracing out the fault in the system, carrying out necessary repair and rectification, with supply of component level spares for repairing the cards or replacement of faulty cards with new cards and making the unit operational in all respect. The contractor should attend the break down call with in 48 Hrs after receiving the information for Inspection and fault diagnose. Breakdown maintenance will be carried out by the contractor under the guidelines and instructions of the EIC and as per drawing and manual of OEM. The scope of Arranging visit of OEM representative/ Service Engineer of TR Unit under Repair and Rectification of TR Units .

VII. Monitoring and breakdown maintenance

Monitoring and breakdown maintenance of the Cathodic Protection System consists of carrying out monitoring/ breakdown maintenance/repairing of various installations/equipments which are briefly described below to give an overview of the system -

a) T/R Unit CP Station:

Presently BHAGYANAGAR GAS LIMITED (BGL) has TR units at various locations under different maintenance bases as per the details mentioned in the scope of works. This consists of Auto/Manual T/R unit having step down transformer, electronic control cards, hour-meter etc. and anode ground beds (drill pipe anodes / high silicon anodes), CP junction box, Anode Junction Box, reference electrode, chain-link fencing, earthing system, Spark gap arrestor, associated cabling and allied structures etc.

b) Test Stations

Manual Test Stations (MTS) type A B C D E F G H or combination thereof has been installed along the pipeline ROW at an interval of approx. 1 Km's. This type of T.S. has the facility to measure PSP and current. In addition to these, intermediate test stations have also been installed depending upon the location of special points like Railway, H.T., Foreign P/L crossing, SVs etc. Each test station has a terminal plate having terminals fitted in a lockable metal enclosure. Brass links, resistors, shunts etc. have been used as per the wiring diagram of each test stations.

c) Terminal / SV / tap off / over ground installations:-

This consists of Insulating joints, test stations, Spark gap arrestor, Earthing System, TR unit, etc.

d) Anode Ground Bed : Anode Ground Beds (Horizontal or Deep well) are made of scrap drill pipe or high silicon Cast Iron material or any other Anodic material e.g. MMO etc. which are connected to +ve terminal of DC supply either from T.R. Unit. Pipeline is connected to –ve terminal of T.R. Unit / CP Station.

e) Permanent Reference cells : These are high reliability copper - Copper sulphate reference cells / AS3 Cu-cuso4, permanently buried adjacent to pipe line in order to measure pipe to soil potential (PSP).

f) Equipment / System Installed along the Pipeline: This includes mainly Manual Test Station, Sacrificial Anodes, Grounding Cells, Insulating Joints Polarization cell, Surge diverter, Corrosion Sensing Probe etc.

g) Sacrificial Anodes: Sacrificial anode have been installed for protection of pipelines of smaller length as well as coated casing pipes wherever required.. Mg Ribbon, Mg or Zinc prepacked anodes have been installed on few pipelines protected with impressed current CP Systems on need basis.

h) Grounding Cell/Spark Gap Arrestor: These are connected across insulating joints to protect the pipeline against high voltage surges.

i) Insulating Joints: Insulating Joints are installed either to isolate two sections of Pipelines from each other or where aboveground pipeline is going / coming to plants etc. These are mono block type insulating joints or IJ consisting of Insulating Gaskets, sleeves and insulating washers

A. MONITORING

The Bidder shall submit the recommendations for mitigation measures after Fortnightly Monitoring of CP units / Quarterly monitoring of PSP/ Anode Bed Monitoring / Interference Survey / CIPL/DCVG Survey/modifications required to maintain Integrity of CP System etc from a NACE Level 2 (min) qualified with Graduate in Elect Engg / MTech in Corrosion Science with min 10 years practical experience in ICCP based Cathodic Protection System. The recommendations shall be given by any reputed specialist having NACE Level 2 qualification along with the Monitoring or Maintenance Reports. The cost of hiring CP expert/specialist (traveling, lodging & boarding if required) shall be borne by the Contractor. Bidder shall quote including all the above-mentioned requirements.

The CONTRACTOR in his recommendations for mitigation measures shall submit the detailed drawing, specifications, location for installation, quantity required etc of the mitigation measures and equipment's to maintain Integrity of our CP system.

Monitoring team must carry Handheld Portable GPS System during PSP monitoring activities. EIC can ask submission of the Co-ordinates details or its downloading as and when required basis without any extra charge once in a year for any section of the pipeline.

PERIODICITY FOR MONITORING

Sr. No.	Brief Description of job	Periodicity
1	Monitoring of TR/ CP Units	Monthly
2	ON PSP Monitoring (Along wit Graphs)	Quarterly
3	Monitoring of Anode ground bed	Yearly
4	Monitoring of Earthing system of T unit,	Half yearly
5	ON-OFF PSP monitoring	Once in a Year
6	Monitoring of Reference Electrodes	Yearly

(i) **Monthly monitoring of CP Units (TR)**

During the monthly monitoring of CP units are within the scope of the contractor under this item:-

a) Visual inspection of CP unit, cleaning with vacuum cleaner, checking of earthing cables, connections, nut-bolts etc. Removal of vegetation in and around CP unit.

b) Checking of TR unit operation both in AUTO / MANUAL mode.

c) Checking all the indicative meters for accuracy by comparing with standard valid calibrated multimeter.

d) Submission of calibration certificate from approved Lab for Multimeter used to BHAGYANAGAR GAS LIMITED (BGL)is mandatory once in a year

e) Checking of all protective devices (fuses/circuit breakers/lightening arrestor etc.) for their satisfactory operations and replacements if found defective.

f) Recording of all the required monitoring or maintenance parameters as per ISO formats (including breakdown report) as well as in the site registers or log sheets.

g) Cleaning and tightening of all bolted connections.

h) Cleaning of all ventilating screens in Air-cooled unit for smooth airflow.

i) In case the TR UNIT system is not functioning properly due to any fault, the rectification of the same is to carried out as per maintenance items defined in the SOR separately.

(ii) Quarterly Monitoring of ON PSP including River crossings/Rail /Road Crossings/Encroachment status of known areas or Yearly once On-Off PSP at test points,

During the Quarterly ON PSP monitoring of test points (3 nos. of ON PSP monitoring in a Year) and once in a year On-off PSP Monitoring (01 no) on route CP Units following works are within the scope of the contractor under this item:-

a) Cutting/Cleaning of bushes/grasses around the Test station / IJ & making clear path or approach to the test point in every quarterly monitoring.

b) Cleaning of test station interiors from any unwanted insects/bird's nest, soil etc.

c) Taking measurement of different pipes-to-soil potential as per P/L list enclosed including BGL's independent P/L's network or common ROU P/L network on requirement or as per ISO Format.

d) The contractor shall take **ON/OFF PSP** measurement Once in the Year as defined separately in the SOR items, which is to be recorded with graphs using current interrupter & GPS synchronizer and simcorder with compatible half-cell . The parameters to be recorded during monitoring includes Anode potential, Anode current, IJ protected side & unprotected side , casing potentials etc. as mentioned in the ISO formats, & valid calibrated multimeter. Operational parameters of the respective TR / CPPSM unit is also to be recorded while taking PSP .The contractor will make all necessary arrangement for tools / tackles , instrument like current interrupter etc. to carry out the work.

e) Proper Disbanding of pipelines installation of current interrupter synchronization with GPS receiver is within the scope of the bidder to record On-Off potentials as per ISO Formats.

Contractor should provide and install Current Interrupters with GPS Receiver for time Synchronization at CP Stations on one section of pipeline under monitoring once in a year to log ON- OFF PSP.

Connect current interrupters in the output of the CP unit and Set the current interrupter cycle to 4 Sec. "ON" and 1 sec. "OFF" cycle and synchronize all the interrupters.. Check whether CP units are working and note their input/ output voltages, currents and reference cell readings.
Checking of cable & integrity of spark gap arrestors across IJ/IF, surge diverters at HT crossings.
Checking of cable lugs, ferrules, terminal plate, nut & bolts and maintaining them in good condition.
Cleaning of test stations with brush and duster cloth and lubrication of test station door hinges and locks with grease or oil.
The contractor shall furnish detailed report containing all the field readings, graphs.

f) Physical, checking of IJ and taking PSP readings of both side of IJ, grounding cell etc.
g) Physical & functional checking of surge diverter connections (also if provided with Mg ribbon) and its condition. Replacing faulty or providing new surge diverters (as per SOR item defined separately) wherever AC interference is being observed
h) Collection of the details of foreign P/L crossing if any within the vicinity.
i) Submission of reports in hard copy (3 sets) as well as through email also within one week after completing the monitoring on regular basis as per ISO formats given by BGL. The Contractor will also submit graphical presentation of PSP monitoring as per guidelines of EIC.
j) PSP monitoring points can be added or deleted as per suitability of CP requirement of BHAGYANAGAR GAS LIMITED (BGL)at any time.
k) Reporting of any soil erosion or washout where pipeline is exposed along with the pipeline if detected by the PSP monitoring team.
l) Checking of on route TR unit or Solar CP unit operation along with PSP monitoring of one pipeline section in AUTO / MANUAL mode.
m) Submission of quarterly monitoring reports along with graphs in hard copy (3 sets) as well as through email also within one week after completing the monitoring on regular basis on BGL'S prescribed ISO formats.

(iii)Yearly Monitoring of Anode Ground Bed

Check visually for the condition of ALJB enclosure, locks and its components.

- Measure the anode ground bed resistance to earth by Wenners three pin method.
- Measure the voltage drop across shunt and thus calculate the current flowing Through individual anodes in case of High silicon steel anode ground bed.

The current through each individual anode should approximately be equal. If the current is not equal, adjust the variable resistance so as to get equal currents. Value of variable resistance should be preferred to a minimum so as to lower the total circuit resistance.

- Take measurements and checks as reflected in ISO Format and record the observations.
- The resistance of anode ground bed to earth as measured should be less than 1.0 Ohms. If the resistance is more than 1.0 Ohm, action is to be taken to reduce it as per SOR items defined separately.

REFERENCE

Wenner's Three Pin Method

During the yearly monitoring of Anode ground bed of CP stations following works are within the scope of the contractor under this item :-

a) Taking readings of Anode ground bed using digital earth tester (calibrated) as per ISO formats by following BGL's approved procedure.

b) As per ISO procedures, It is to make sure that there has been no disturbances of earth above the header Cable and line of anodes in a conventional type bed. If any part of the ground bed is subjected to washout with exposure of cable this should be immediately brought to the notice of the EIC for its remedial action.

c) If any construction activity is noted in the ground bed vicinity which may disturb it, the location of ground bed should be stacked out so that in advertent damage may be avoided, if new construction involves installation of underground structure, test whether or not they will be within the potential gradient field surrounding the ground bed and possible stray current. This is to be done jointly along with BHAGYANAGAR GAS LIMITED (BGL)engineer.

d) Submission of reports in hard copy (3 sets) as well as through email also within one week after completing the monitoring as per ISO formats given by BHAGYANAGAR GAS LIMITED (BGL)LTD.

e) Replacement of the shunt (in AJB), and variable resistance (provided by BHAGYANAGAR GAS LIMITED (BGL)) in case of faulty or damaged on chargeable basis separately.

f) Readings must be recorded to maintain current balancing in all the Anodes equally before and after the Shunt adjustments.

g) Renovation of Anode ground bed is to be carried out if ground bed resistance found to be high through separate SOR item rate.

(iv) Half Yearly Monitoring of Earthing System:-

Check visually for the condition of earthing pit enclosure. It should be clean and intact.

- Disconnect the Earth Pit from the equipment's. Measure the Earthing Resistance of the disconnected pit by Wenners three pin method. After measurement reconnect the same to the equipment.
- Check for tightness of all earthing connections.
- Record the observations in the log book available inside CP station installation and in ISO Format.

REFERENCE

Wenner's Three Pin Method. Activities to be performed:

a) Cleaning of all connections and greasing them with replacement of brass nut, bolts if found damaged or missing. Jointing of earth cable if found open circuited, disconnected / damaged.

b) Pouring of common salt, water & soil reactivation compound as per requirement to bring down the earth resistance within limit.

c) Proper cleaning & housekeeping inside & surrounding the earth pits.

d) All consumables, materials required for the above said jobs will be in contractor's scope..

e) Submission of reports in hard copy (3 sets) as well as through email also within one week after completing the monitoring as per ISO formats given by BGL.

f) Marking with Paint for the date of monitoring and next due date and Earth Pit no etc.

B.MAINTENANCE

(1)Maintenance of CP Unit

Maintenance jobs shall be carried out on scheduled quarterly basis as well as on breakdown calls basis as and when required basis under the presence of qualified supervisor/Engineer only with good engineering practices as per specifications attached or existing design or ratings, drawing details standard, codes and work instruction attached in the tender documents or as per the instruction/guidelines issued by EIC/site I/C at the time of issue of job card.

List of specific jobs with spare parts / components as per existing specifications or ratings are being covered under Breakdown maintenance & details of which are as under:

Based on monitoring reports the contractor shall have to submit a consolidated list of TR/Solar CP station breakdowns, damages, faults etc. for review and issuance of instructions/orders for attending the breakdown maintenance related jobs as stated above, if any, which is to be carried out within the stipulated time schedule after receiving the work instructions as per above list..

The contractor shall supply & replace the genuine spares as per OEM's recommendations & if any out sourcing is required (when OEM is not able to provide specific spares) then it is to be done with the prior consent of the EIC, which covers, repairs / providing servicing by CP Engineer itself OR FROM OEM SERVICE ENGINEER.

Bidder has to make the arrangement for transportation and accommodation of OEM Service Engineer or its authorized servicing agency to attend CP unit breakdown faults. No separate payment would be admissible under this item for transportation or accommodation arrangements.

Submit Reports as per enclosed Format.

(2) Replacement of Permanent Reference Cell:

The scope of work under this item includes:

(a) Locating the permanent ref. cell with the line locator.
(b) Excavation job on normal or hard surface at TR/Solar Stn or at pipeline location.
(c) Chemical backfill material e.g. Gypsum, Bentonite, Sodium sulphate, coke breeze etc.
(d) Pour sufficient water and backfill.
(e) Epoxy cable Joints if broken or loose.
(f) Submit Report after completion of the Job.

(3) Specifications for material in execution of maintenance works

Details of Each Major Equipment / Component is Specified with Drawings IN OEM MANUAL available with EIC. However, minimum requirements for the major equipment / component to be supplied by the Contractor are given below: All spares or components shall be new and supplied by approved reputed manufactures only as recommended by OEM. The equipment, accessories and material supplied shall comply in design, construction and performance with the latest relevant Indian and International standards together with the requirement of concern authorities having jurisdiction over all or part of their manufacture, installation and operation.

All MS Component / Equipment should be protected against corrosion by Hot Dipped Galvanizing, coated with one coated of Epoxy Zinc Rich Primer, second coat of Epoxy Painted and Third Coat of Poly Urethane Paint.

The minimum testing and inspection requirements for all components/ equipment shall conform to the requirement as defined in the relevant codes and standard.

(i) Arrangement of all consumables items viz. insulation tape, MS-Brass nuts & bolts, washers, cable lugs, Bakelite-plates & terminals, warning tapes / mats, lubricants, grease, waste cotton, cold soldering materials like eutectics 157-Sealing / capsulation materials like M-seal and the necessary tools and tackles, instruments, equipment's (tri port, chain pulley ec.) to carry out tendered job is in the scope of contractor without any extra cost. Contractor shall have to furnish all details regarding availability of tools and tackles, instruments, equipment's before commencement of work..

(ii)All arrangements / payments (if any) necessary for carrying out maintenance of SOR mentioned jobs, ROU opening, excavation job, crop compensation and negotiations / discussions with landowner, farmer or any other public / private agency , liaison with statutory or Electricity authorities for non receipt of the energy bills, correction in reading/ Energy Bills etc. & power restoration of TR / Solar CP unit in case of any fault, shall be the contractor's responsibility without any extra cost to BGL.

(iii) To carry out the monitoring or maintenance activities as per SOR items, Job orders would be issued for respective jobs to the contractor, which should be executed strictly within the stipulated timeframe.

(iv) The CP material abandoned at site due to replacement / new installation or due to whatsoever reason will be retrieved by the contractor and delivered at BGL' s designated store.

(v) Contractor should ensure minimum availability of CP unit spare components / control cards (the details of which can be obtained from the reference operation manuals of TRunit / CPPSM) with proper planning / assessment so that breakdowns can be attended within stipulated time frame.

(vi) As the operation and maintenance of cathodic protection system is based on electrical engineering with professional experience in the field of CP system, hence contractor shall deploy only the educationally and professionally qualified personals during execution of contract.

(vii) During execution of contract, if contractor feels that the given time schedule is in- appropriate based on volume of work, and then contractor may approach to EIC for time relaxation. Time period relaxation may be given by the EIC/SIC only after reviewing the estimated time defined for the item and deviations taking place in the volume of work of respective item due to constrains beyond control of the bidder.

(viii) The contractor will be responsible for carrying out various General maintenance activities along with monitoring, as included in the schedule of rates, on as & when required basis .

a) In view of pipelines being under pressure/charged with gas, cad-welding method for making pipe to cable connection is not permissible. Cold soldering method (Eutectic 157 product of L & T make) / Pin Brazing shall be used for all such connections. Having completed the soldering, the joint will be epoxy encapsulated and holiday tested.
b) The contractor shall carry out Holiday testing (11 KV/25 KV) of all such portions of pipelines as may be exposed for carrying out any maintenance activities whatsoever.
c) Material composition certificate form reputed test lab is to be submitted for Mg or Zinc or silicon anodes or MMO Anodes.

d) The painting of CP test station, ALJ Box, CTS Box, shall be as per following procedure:-

1. Removing the old paint or color with proper tools and tackles.
2. Surface preparation before applying the primer.
3. Apply the suitable primer on surface.
4. Apply color coat (at least two) on surface.
5. Marking Ch No on TS.

MATERIAL SPECIFICATIONS

(i) Anode Specifications:

CODES AND STANDARDS

The Anode shall be in accordance with the latest revisions of the following Indian standards, wherever applicable. Where appropriate Indian standards are not available, the relevant IEC standards shall apply.

a) Indian Standards institution (ISI)
b) International Electro technical commission (IEC)
c) American Standards Institution (ANSI)
d) British Standards Institution (BS)

TESTING CERTIFICATES:

The testing shall be conducted in accordance with codes and standards enclosed in this document, as per routine tests done by manufacturer. Test Certificate shall furnish.

a) HIGH SILICON ANODE :- Typical chemical analysis of anode is -

Typical chemical analysis of anode is -

Silicon - (13% - 16%)
Manganese - (0.5% - 0.58%)
Carbon - (1.0% - 1.4%)
Iron - (4.0% - 5.0%)
Weight - 22 kg (Minimum)

Anode tail cable connection should be such ensuring low resistance electrical connection, sealed by epoxy resin and as per following -------

Type : Double insulated standard tinned copper cable.
Size : 10 sq mm. 7 strands, single core.
Insulation inner : PE insulated PVC sheathing.
Armouring : Unarmoured
Voltage : 600 V/1000 V
Length of cable : As per requirement.
Spacing : 5 meters horizontal grounded bed configuration

Anode No.	Individual length of cable required
1	32 M
2	27 M
3	22 M
4	17 M
5	12 M
6	12 M
7	17 M
8	22 M
9	27 M
10	32 M

Total - 10 Anode 220 M

b) ZINC GROUNDING CELL :

The Zinc Grounding Cell Anode shall be a standard product of a manufacturer regularly engaged in production. The Cell shall be supplied in accordance with the following specifications and data sheets.

DATA SHEET:

Galvanic Material	: Zinc
Net Weight of Active Zinc Metal	: 22 Kg
Number of Cell Plates	: 2 Nos.
Insulating Spacer	: Backlite
Insulating Spacer Thickness	: 25mm
Rating	: Greater than 10KA surge
Composition of Zinc Anode	
Aluminium	: 0.005%
Cadmium	0.003%
Copper	: 0.002%max.
Iron	: 0.0014%max.
Lead	: 0.003%max.
Zinc	: Remainder

Active Anode Cross Section Dimensions	: 42MM x 43MM x 50MM x43mm (indicative only)
Length of Active Anode	: 1500MM (Indicative only)
Backfill Mixture for Zinc Anodes	: Gypsum 75% +Bentonite 20%+Sodium Sulphate 5%
Anode Insert core	: 10mm TOR Rod – Electro galvanized
Anode Cable Connection	: Silver Soldered connection to TOR
Anode tail Cable Conductor Size	: Copper 1C X 25 sq mm
Cable Insulation and Sheathing	: Unarmoured PVC/PVC insulated
Anode Cable Joint Insulation	: Epoxy Sealed.
Pre-packed Anode Dimensions	: 200mm Dia x 2000mm Length
Pre-packed Anode Gross Weight	: 60 Kgs (Min)
Open circuit potential w.r.t. cu- cu sulphate	: -1.1 Volts

(ii) COKE BREEZE:-

DATA SHEET:

ICAL COMPOSITION

Moisture, Volatile (On Dry Basis), Ash and Sulphur	: 1% (% By Mass)
Fixed Carbon	: 99% Minimum
BULK DENSITY	: 800 – 1200 Kgs / M3
REAL DENSITY	: 2.03 gm / cc
POROSITY	: 40%
RESISTIVITY	: 0.1 Ohm Cm at 150 PSI
Particle Size	: (-) 1.0 mm Max Dust Free

(iii) ANODE LEADS JUNCTION BOX:-

(a) Anode lead junction box is having facility for individual anode connection and suitable for pillar mounting. Appropriate cable glands provided in bottom side of box. A hinged lockable lid is provided as front door for access to the box. Box includes min 10 No. single anode circuits and main positive feed cables of maximum 35 Sq. mm cross section lugged copper conductor.

(b) Bus bar -- NiCd plated Copper bus bar of 25mm x 3mm mounted on two number epoxy supports, with brass studs/nuts/washers and anti-vibration washer to accommodate lugged cable connection of up to 2 x 35 sq. mm. main anode cable and tap off interconnection for 18 nos. individual anode circuits.

All terminals should be of SS-304 material and size M-8 (08mm) nut, bolts, spring washer. The termination boards should be Fabric reinforced Bakelite of minimum 08 mm thickness.

(c) Anode Circuit --- Each anode circuit is provided with following:

1. Removable link (Copper)
2. Measurement shunt: 10Amp, 100mV rating.
3. Variable Resistor: Slides wire type 5 Ohm 5 amps rating.
4. Individual anode terminals will comprise of studs/nuts/washers and anti-vibration washers to terminate 10 Sq. mm lugged cable

(d) Enclosure: The fabrication details as per following -

Material - MS Sheet 2.5 mm thick, weight - 30 Kg (approximate),

Painting : Surface Preparation SA 2 ½
Hot Dipped Galvanised – 80um
One Coat of Zinc Primer
Two Coat of Epoxy Paint IS631 Shade

(iv) PSP MEASUREMENT BOX:-

In this box reference cell cable, feeding and drain cable are properly fitted in Bakelite plate with standard size of copper nut & bolt. The fabrication details and foundation will be same as per anode lead junction box and drawing enclosed.

(v) Power supply /Energy meter box and Isolation switch box:-

Both boxes are same size as per existing meter and switches & isolation boxes at TR or Solar stations/ terminals. The fabrication details as per following -Material- MS Sheet 2.5 mm thick, waight-5 -7 Kg (approximate), the cabinet has hinged front doors with neoprene gasket and is Pad lockable. Any modification, if required, must be accommodated as directed by the EIC.

Surface painting : Sand Blasting SA 2 -1/2 Hot Dip Galvanizing to 80um
One Coat of Zinc Chromate Primer,one coat of Phosphate & Two Coats of Epoxy Paint - Light Grey 631
Total Paint Thickness – 120um DFT

(vi)CP Test Station :-
As per design of lock and size various type CP Test stations are provided along the pipeline. The size and fabrication details and foundation are as per attached drawings.

Terminal board : 06 MM Backelite / Hylam sheet with20% spare terminals.
Terminals : SS – 304 Nut & Bolts.
Surface painting : Sand Blasting SA 2 -1/2
Hot Dip Galvanizing to 80um
One Coat of Zinc Chromate Primer,one coat of Phosphate & \
Two Coats of Epoxy Paint - Light Grey 631
Total Paint Thickness – 120um
DFTTerminal board Marking / Identification: Screened with Permanent Ink Test Station
Identification No.
Connection Scheme - TYPE
Chainage and direction of Flow
Distance from Pipeline in meters.

(vii) **<u>Deep anode ground bed specifications & data sheet</u>:**

SCOPE:

This specification covers the minimum technical requirements for the design, manufacture, performance, inspection, testing and supply of Mixed Metal Oxide Coated Titanium Tubular Anode String for Deep Anode Groundbeds for ICCP System.

The MMO Anode String should be a standard product of a manufacturer regularlyengaged in production of MMO Anodes. The Anodes shall be supplied in accordancewith the following specifications and data sheets.

CODES AND STANDARDS

The design, manufacturing, testing of MMO lida Anode String for Deep Anode Groundedshall be in accordance with the latest revisions of the following Indian standards, wherever applicable. Where appropriate Indian standards are not available, the relevant IEC standards shall apply.

a) Indian Standards institution (ISI)
b) International Electro technical commission (IEC)
c) American Standards Institution (ANSI)
d) British Standards Institution (BS)

DATA SHEET DEEP WELL ANODE BED (54M/96M):

Anode Base Material	: Titanium subtrate (ASTM B 861 Grade I)Coated with mixed metal oxide (MMO) ofnoble metals of group VIII.
Anode Type	:LIDA (Linear Distributed Anodes)- MixedMetal Oxide (MMO) coated Titanium Anodes
	Anode Diameter : 25.4mm + 0.40 / -0.79 mm
	Anode Length : 1000mm +/- 5 mm long
	Anode Weight : 0.280kg/m +/- 0.028 kg/m
	Anode Current Output : 8 Amperes
	Number of Anodes in Single String : 6 Nos
	Total Anode String Current Output : 48 Amperes.
Anode Design Life at Maximum Output	: 35 years
Maximum Operating Current Density	: 100 Amp/M² with carbonaceous backfill
Coating resistivity	:6 x 10^{-5}Ohm - cm
Anode to cable connection	: LIDA anode to cable patented crimp connection at centre and end sealing.
Anode quantity on string	: As per current requirement
Contact resistance/ Electrical continuity	: 1 milli Ohm (max.)
Coating Consumption rate	: 1 mg per ampere -year

Mixed metal Oxide (MMO) coating More than 9 gm /M² Weight

Coating deposition Method	: Thermal decomposition
Inactive Depth of Deep Anode bed	: 24 (FOR 54M DEEPWELL) / 66 M (FOR 96M DEEPWELL)
Active Depth of Deep Anode bed	:30 Meters FOR BOTH 54M/96M DEEPWELL
Total Depth of Deep Anode bed	: 54 Meters / 96 MDeep Anode bed
Casing Pipe Material	: MS
Deep Anode bed Casing Pipe Diameter	: 150 mm
	PVC perforated vent pipe

VENT PIPES:

Deep Anode Ground Bed installations must have the Flexible vent pipe is perforated throughout the active column and solid through the inactive column, standard perforations range from .006-inch-wide slots to 1.4 in diameter holes and are commonly placed every 6 in of pipe length. To prevent plugging with inactive column, backfill, perforations should end even with top anode. Upper end of the vent pipe should be terminated so produced gases are allowed to dissipate naturally to the atmosphere. Terminations should be above any flood plain elevation.

ANODE CENTRING DEVICES:

Anode centralizers may be installed to ensure that carbon backfill surrounds each anode. Centralizers should be designed to prevent damage to anode wires during installation and allow anode movement in the well without snagging on down hole formations or other anode assemblies**.**

CARBON BACKFILL

High quality calcined petroleum coke is to be used for all deep anode installations. Granular carbon sinks readily in fresh water and is normally poured directly from the bag into the well. Fluid coke is comprised of fine carbon particles that compact tightly around anodes.

LOADING PROCEDURES

As previously mentioned, deep anodes are ordinarily drilled with direct mud rotaryequipment. After reaching desired depth, downhole mud slurry must be thinned to nearly the viscosity of fresh water to allow proper carbon settlement around anodes. Thinning is performed by pumping potable water from the bottom up through mud circulation system until it returns to surface in well bore. Accurate well thinning is critical to systeminstallation. After thinning, drill pipe is removed from well to allow system loading. Vent pipe is usually lowered first and tied into position. Anodes are lowered by their attached wire to the desired elevation and tied off at the surface. After anodes are placed at desired elevations, carbon backfill is poured or pumped downhole. Anode resistance logging before, during,

and after carbon backfill provides proof of proper carbon settlement. Settlement of top-loaded granular carbons normally occurs within 1 hr. Settlement of pumped fluid carbons normally takes 6 to 12 hr. Total settlement should occur before Backfill of inactive column.

EMMO ANODE:

The Anode base metal shall be titanium substrate confirming the ASTM Grade – I / II material specifications. The Titanium substrate shall be coated with refractory & precious mixed metal oxides augmented by the Plasma Spray Processed Catalytic Coating Method. The coating density, mixture ratio, type of precious & refractory metal oxides and the dielectric material used for insulation shall be suitable for operations in different electrolytes and environment.

The Plasma Spray Coating process gives an Enhanced Mixed Metal Oxide Coating that should give three distinct advantages.

a. Abrasion Resistance:

The EMMO Coating on the Anode should be abrasion resistant to sharp rock or sharp metal edges.

b. Coating Mechanical Stability:

The EMMO Coating on the Anode should be mechanically stable and resistant to rupture due to electrolysis-generated gas in the coating porosity.

c. Coating Thickness:

The EMMO Catalytic Coating mean thickness on the Anode should be ~900 microns.

ANODE STRING CABLE AND JOINT:

The EMMO tubular Anode string cable should be highly conductive copper of cross-sectional area of 10 mm2 or 4 AWG with double insulation. The EMMO tubular Anodes cable primary insulation of ECTFE Copolymer of 1mm +10% thickness to isolate the copper conductor in presence of Nascent chlorine gas that is generated at the anode in the electrolysis process in chloride / halogen ion environment. The ECTFE primary insulation should be protected by a 1.6mm Thick HMWPE jacket to provide mechanical strength.

The Anode to Cable joint should be TIG Welded Circumferential Swage, which shall give a very low resistance as specified in data sheet.

The Anode String shall be String Anodes as shown in the attached drawing with Individual cable which should make the Anode Grounded fail-safe. The anode to cable connection shall have high tensile pull strength within 10% of the cable handbook pull strength.

ANODE STRING CENTRALIZER AND VENT PIPE:

Each EMMO tubular Anode string should have a centralizer. The Dual feed cable should have a spacer to separate the Cable from the Anode. The Anode String shall be installed with a flexible vent pipe with micro slots / holes for venting of gas generated at the anode surface during electrolysis. The Vent pipe diameter shall be 25mm and bottom end of the vent pipe should be sealed.

ANODE GROUNDBED BACKFILL:

Calcined Petroleum Coke Breeze with chemical composition of minimum 98% Carbon and (-)1mm mesh size. The consumption rate of coke breeze should be 1.1Kg / Amp – Yrand the Anode Grounded Design life should not be less than 35 years at an operating loadcurrent of 50 Amperes.

DOCUMENTS AND DRAWINGS:

The Anode Manufacturer shall have a proved track record in manufacturing of EMMO Anodes for 10 years and Performance Certificates should be produced for Approval from Owner. The Anode Manufacturer should provide fabrication drawings and data Sheet for approval from Owner before placement of Purchase order.

The Anode Manufacturer should provide fabrication drawings and data Sheet for approval from Owner before proceeding with manufacturing. After approval of Fabrication drawing and proto type test is cleared the anode strings should be finally manufactured.

CP CABLE TRENCH BED & BACKFILLING: -

(i) 1 Mtr. deep laying
(ii) 0.3 Mtr. layer of sand
(iii) Approved class brick layer of 3" thick
(iv) Red color polythin of 0.25 mm thick
(v) Back filling with soil
(vi) Watering (As & when required)
(vii) Making normal surface
(viii) As per the approved drawing

Cable laying, details & cable connections:

The following types of cables are to be used for different jobs:

I. Anode Header Cable – 1Core X 35 SQMM XLPE, Copper conductor (as per specification)
II. Cathode cable, bonding & grounding – 1 Core X 25 SQMM XLPE, Copper conductor (as perspecification)
III. Permanent reference cell cable - (1 Core X 10 SQMM XLPE, copper conductor (as perspecification)
IV. Test station cable (Potential measurements) – 1Core X 6 SQMM XLPE, Copper conductor (asper specification).

V. Current measurement – 1 Core X 10 SQMM XLPE

PROCEDURES

i) Procedure for CPIL survey & DCVG/ CAT with A Frame Method

The contractor shall submit a detailed procedure to carry out the CPL survey, & DCVG/ Current Attenuation (CAT) with A-Frame Method along with formats for recording the data etc. The

procedure qualification will be done before commencement of work. During procedure qualification, the contractor has to do a sample survey in the presence of the Engineer In Charge or its representative and has to verify the results by excavating the coating defects and only after satisfactory report approved by the EIC/ Site In charge, further survey will be allowed.

The contractor shall first locate the pipeline by using pipe locator and collect all the data's along the ROU. The route of the pipeline with chain age shall be plotted in single line sketch with details of Rou installation like markers, boundary pillars, test stations etcand above ground installation like valve platforms, cp station etc.

CPIL Survey:

1.**CPL ON – OFF survey** for pipe line having ICCP system of cathodic protection.

2 **CPL ON survey** for pipe line having Sacrificial anode system ofCathodic protection.

Connect current interrupters in the output of the CP unit and set the current interrupter cycle to 4 Sec. "ON" and 1 sec. "OFF" cycle and synchronize all the interrupters. Check whether CP units are working and note their input/ output voltages, currents and referencecell readings.

Locate the pipeline using pipeline locator prior to conducting the 'ON' / 'OFF' CPL survey and flag it at every 30/40 meters to ensure that measurements are recorded directlyover the pipeline for accurate readings.

The 'ON' / 'OFF' CPL survey onshore procedure is as described below:

One terminal of the data logger is to be connected to a test lead point and other terminal isconnected to the probe sticks.

The operator to walk on the pipeline marked with flags with the data probe sticks in his hands, and the data logger slung around his neck. The operator will use data probe stick like a walking stick, triggering the button on top of the stick as he walks. Hence, any given time, at least one data probe stick is in contact with the ground, which when triggered, picks up the pipe-to-soil potential (PSP) signal and transmits it to the data logger where it is stored. Both 'ON' & 'OFF' PSP shall be measured at all locations. This PSP value is a measure of the extent of cathodic protection. The interval of approximately 0.75m – 1 mtrs is to be maintained between consecutive measurements.

To carry out the On /Off CPL survey across rivers and canals, the Cu-CuSo4 half cells are replaced with Ag-AgCl / Zinc half cell. Contractor should arrange his own arrangement for movement to collect data's across the river / canal.

At the end of the day's work, the PSP data is to be transferred to the personal computer where it is then processed.

Finally, graphs providing a profile of PSP (in volts) versus distance in Km or meters areto be generated. These graphs are to be analysed to report the extent to which the buried pipeline is catholically protected. For categorization and qualification of defect, DCVG survey shall be carried out as per procedure.

To minimize distance measurement error, the actual pipeline chainage is to be manually entered into the data logger at regular intervals along the ROW.

Precautions:

Connections at TLP and data logger to be checked regularly.Keep constant watch on logger monitor.

Enter 'Road Crossing' etc. in logger to avoid wrong interpretation

DCVG survey / CAT with A-Frame Method shall be carried out at the indicative area of fault location based on the report of the CPL survey to pinpoint the exact location i.e. epicentre of coating faults and other meaningful data's like interference etc.
The survey shall be carried out with external C.P source by disconnecting the existing CP system. The contractor has to remove the bonding between two insulating joints with others pipeline in the common ROU. The supply and installation of external CP source and temporary anode bed in case it is required etc. shall be in the scope of the contractor.
All the CPL survey reports and Graph showing PSP profile against distance, CAT surveyreports for lines are CP protected by sacrificial anode shall be submitted along with analysis report so as to decide on the locations for which DCVG survey is to be carriedout.
Thickness measurement is to be done by ultrasonic thickness gauge on the defective locations as identified in the DCVG survey and locations identified by site in charges / EIC after removing of coating along the radius of the pipeline.

Coating repair: Coating repair has to be done with cold applied tapes of Raychem or Denso make. by standard coating procedure with coating expert. Holiday testing with holiday detector is to be done to the satisfaction of EIC prior to the restoration of the bell hole. Party has to submit the coating procedure and thickness measurement procedure forthe approval of the EIC.
The defect spread in 1 mtr length of pipeline section shall be considered as one location
Payment for excavation and repair of coating beyond
01 mtr length at particular location will be paid on pro rata basis as per SOR rate.

i) Procedure for excavation & physical verification

Contractor must be ready to excavate for physical verification in all vulnerable location for a particular line as per instruction of site in charges on the basis of survey report.

The contractor shall mark the pipeline location for the pit on the selected location as per details provided by E.I.C./ Site In-Charge. The location of pit shall be measured from the permanent structures along with GPS coordinates so as to recheck the same pit for future inspection.

Excavate the pit keeping pipe in center for approx. size of 2.0 M width x 2.0 m length x required depth at each selected location, so that the work is carried out smoothly all around the pipe surface. In some places it may be required to excavate upto depth of 3-3.5mtr approx. Excavation any depth along pipe line is in contractor scope and no extra amount will be paid. All safety precaution has to be taken for excavation.

In each location of physical verification contractor has to arrange to take the thickness measurement of the pipe line in all direction surrounding the pipe at different location after cleaning the coating. Contractor has to arrange for ladder for get down for inspectionby BHAGYANAGAR GAS LIMITED (BGL) engineers at bell hole with all safety measure to avoid any accident.
Fresh soil recovered from trenching will not be mixed with the loose debris or any other foreign material. Proper care shall be taken while excavating the soil such that theexisting pipeline does not get damage. The removed earth shall be supported properly such that it does not get collapsed or fall back.
During excavation work due care shall be taken for avoiding any damage to underground utilities and if any damage is done it shall be repaired immediately.

ii) Procedure for Holiday Testing

All coating shall be inspected visually as well as using Holiday Detectors by contractor/Site Engineer as per NACE standard RP-0274 latest edition.

Portable, low ampere, adjustable voltage, pulse type holiday detector using an audible signalling device to be used. The holiday detector shall be furnished with a coil spring electrode or a suitable brush type electrode. The operating voltage of the detector shall be as determined in NACE RP – 0274 latest edition.

Before using holiday detector, it shall be checked and calibrated with the accessory for calibration standard attached with the instrument.

The entire surface of the coating repair shall be inspected by means of a brush / Ring typeholiday detector at the specified voltage of 20/25 KV maximum.

iii) Procedure for Coating Removal (Coal tar & PE Coating)

Coal tar coating shall be removed with the help of non- sparking tools, knife, mallet,Brass hammer etc.

Proper care shall be taken for removal PE coating so that no damage of the gas pipeline oradjacent coating surface get effected.

The Coating removal shall be carried out for the required length of gas pipeline. Ensure that the surface is thoroughly cleaned, free from dirt, oil and grease etc. for coating repair.Proper cleaning tools to be used with proper safety measures for working in charged gas pipe line.

iv) Procedure for recoating/coating repair (coal tar /3 LPE line)

The Proper primer suitable to particular make cold tape to be used. Primer shall be extended approx. 50 mm to each side of the existing coating. Inner wrap & outer wrap (Raychem / denso make) 0f 100mm width thickness for 3LP shall be wrapped spirally around the pipe surface there shall 50% overlap. The tape shall stick properly to the surface of the pipeline such that there is no air cavity entrapped between the tape and the pipe. Suitable primer for coal tape also to be used. The new coating should provide sufficient bonding between the tape and the pipe surface and also with the existing coating.

If small cut damage are observed it should be repaired with patches of PERP 60.All the coating repairs also shall be subject to holiday detection test.

v) Procedure for backfilling & restoration

The excavated pit shall be backfilled immediately after completion of Coating repair work. However, if any delay is found, the pit has to be properly barricaded. After the coating repair is completed, inspected and approved, the pipeline pit shall be backfilledimmediately. The dumped soil shall be levelled properly so that in future there should not be any complain from the owner of the land.

vi) Procedure for pipe to cable connection

GENERAL REQUIREMENT

1.0 Reference

1.1 All material received at site shall be inspected, handled and stored upon receipt.

1.2 All installation/construction/testing works shall be carried out in compliance with Project Safety Requirement

1.3 Inspection and testing shall be conducted by the client.

1.4 Verification of inspection, checklist and testing shall be recorded on installation/test formats and will be signed by the client where appropriate.

1.5 All test equipment shall have a valid calibration certificate available at site.

2.0 Installation & Testing Equipment

2.1 Pin Brazing Machine Kit

2.2 Tool Box

2.3 Dobefill 6o Epoxy & Harder 758 Resin & Mseal / Beckseal.

2.4 Grinder, West Cloth

2.5 Holiday Detector & Multi Meter & Portable Reference Electrode

INSTALLATION PROCEDURE

Pipe to cable connection involves following steps:

1.0 Select the location for making cable to pipe connection away from the seam or circumferential weld of the pipe. Ensure that location is as specified and in case of change in location obtain necessary approval.

2.0 Remove pipe coating of size (2" X 2") to expose joint area on the pipe surface.

3.0 Clean the exposed area to get a shining surface with rought file.

4.0 Remove approximately 25 mm of insulation on the cable at one end, polish the copper conductor strands and crimp 15 to 20 mm long copper sleeve on wire strands

5.0 Place pin brazing gun on exposed area of pipe & done the pin brazing on Pipe.

6.0 Check the Mechanical integrity of the weld by the use of flight hammer (0.5 kg.) striking the weld firmly but gently as close to the steel pipe surface as possible in a direction parallel to the pipe surface.

7.0 Check the continuity of the cable.

8.0 Remove 3-layer polyethylene (3 LPE) coating around the joint such that a surface area of 60 mm dia is exposed.

9.0 Position a plastic funnel around the exposed area such that about 5mm wide coating remains inside the plastic funnel. Place M seal around the plastic funnel to prevent leakage of encapsulation materials.

10.0 Seal the exposed are by pouring Epoxy and hardner mixture (10:1) by volume in the funnel so as to achieve electrical insulation and bonding.

11.0 After Pin Brazing check pipe coating using Holiday detector.

12.0 After completing total work check the natural Pipe to soil potential using Multimeter & Reference electrode.

13.0 The inspection will be recorded on inspection / installation formats

PRECAUTION

1. Before start the work check materials inspection test certificate & shipment release note
2. Prior to removal to site the cable will be inspected for mechanical damage.
3. Check using pins are supplied from original supplier only.
4. Cables are to be of sufficient length so as to reach the termination point without any joint providing sufficient lop for future maintenance purposes.
5. The distance between two cable-to-cable connections shall be a minimum of 300 mm.
6. Any damage to coating or pipe metal should be brought to the notice of engineer/supervisor/inspector so that requisite corrective actions may be taken.
7. All cables are to be appropriately tagged.
8. One set of drawing/documents should be kept by site supervisor at work place

RECORD

All the parameters recorded during the installation at site will be recorded in inspectionformat.

ATTACHEMENT

1. INSPECTION REPORT
2. INSPECTION & TEST PLAN

INSPECTION REPORT: PIN BRAZING REPORT				
Chainage No.	LOCATION/REFERENCE:			
Report No		**Date:**		
Sr.No.	**Cable Size sq.mm**	**Continuity Check**	**Holiday Test**	**Remarks**
STRENGTH OF PIN BRAZING : OK/ NOT OK EPOXY & HARDNER FILLING : OK/ NOT OK				

	For	**For**
Sign:		
Name:		
Date:		

INSPECTION & TEST PLAN FOR PIN BRAZING

Sl. No	**Material details and Activity Description**	**Procedure to Cable to Pipe connection by Pin Brazing**	**Frequency of inspection**		**Record tobe submitted By**
				Client	

1	Check location	Procedure	W	R	Procedure
2	Check spacing between Two welds		P	W	
3	Cable for cable size and type		P	W	
4	Check connection To pipe		P	W	
5	Check Encapsulation		P	W	
6	Check continuity of cable to pipe		P	W	
7	Check holiday at 15 KV (For encapsulation)		P	W	
8	Check restoration		P	W	
9	Holiday testing equipment Calibratio Certificate Test		P	W	

Inspection Codes:
W – Witness. Prior notification required
P - Perform
R – Review

00		For Review and Approval		
Rev.	Date	Description	Prepared by	Approved by

Viii Procedure-cable laying

GENERAL REQUIREMENT

1.0 Reference

1.1 All material received at site shall be inspected, handled and stored upon receipt.

1.2 All installation / construction / testing works shall be carried out in compliance with Project

Safety Requirement

1.3 Inspection and testing shall be conducted by the client /client representative. Verification of inspection, checklist and testing shall be recorded on installation / test formats and will be signed by the client/ client representative.

1.4 All test equipment shall have a valid calibration certificate available at site.

2.0 Installation & Testing Equipment

2.1 Crimping Tool

2.2 Cable Jack

2.3 Sand, bricks, cable lugs, cable warning mat etc.

2.4 Tool Box for Cable Termination to test station

3.0 INSTALLATION PROCEDURE

3.1 The cables are laid in Soil at a required depth with bricks & sand cover. Laying of cables involves following steps:

3.1.1 The Cables will be identified, checked against the data sheet and inspected formechanical damage.

3.1.2 Identify the cable layout route and measure the actual length of cables.

3.1.3 Cut the cable as required at site and check the continuity of cable.

3.1.4 Lay the cables in ROW at minimum depth of 1.5m outside plant & inside plant 0.75M depth and cover it with sand and brick. Cable laid under road crossings will be through RCC Hume / GI pipes/ pvc pipe as per customer requirement.

3.1.5 In paved area on Identified location a narrow trench will be cutting the existing concrete.

3.1.6 Lay the cable in proper sized G.I.Conduit & installed in a concrete trench.

3.1.7 After installation of the conduit & cable trench shell be properly paved to restore the RCCto its original condition.

3.1.8 Wherever possibility for damaged of cables the cable shell be installed in proper G.I./ PVC Conduit.

3.1.9 Terminate cables should be terminated using lugs through support pipes.

3.1.10 Cable Identification mark is to be done properly.

3.1.11 The cable route should be identified with permanent cable markers.

3.1.12 The inspection will be recorded on inspection / installation formats

4.0 PRECAUTION

1. Before start the work check materials inspection test certificate.
2. Prior to removal to site the cable will be inspected for mechanical damage.
3. Cable termination shall be by means of correctly sized compression (crimped) lugs.
4. Crimping shall be by means of properly designed tools only.
5. Cables are to be of sufficient length so as to reach the termination point without any joint.
6. All cables are to be appropriately tagged.
7. One set of drawing / documents should be kept by site supervisor at work place

5.0 RECORD

All the parameters recorded during the installation at site will be recorded in inspectionformat.

6.0 ATTACHEMENT

1. INSPECTION REPORT
2. INSPECTION & TEST PLAN

INSPECTION REPORT: CABLE LAYING REPORT					
INSPECTION REPORT: CABLE LAYING REPORT					
Chainage No.			LOCATION/REFERENCE:		
ReportNo.			**Date:**		
Sr.No.	**Cable Size in sq.mm**	**From**	**To**	**Continuity Check**	**Remarks**
SAND BRICKS COVER WARNING MAT & BACK FILLING: OK/ NOT OK CABLE TERMINATION : OK/ NOT OK DEPTH OF LAYING : OK/ NOT OK					
	For			**For**	
Sign:					
Name:					
Date:					

Inspection Test Plan: Cable Laying for Underground Pipeline

Sr. No.	Activity Description	Reference Document	Frequency of Inspection		to be submitted by
				Client	
1	Approval of Work Instruction	procedure	W	R	procedure
2	Excavation & depthcheck if underground		P	W	
3	Sand padding & brick laying		P	W	
4	Warning mat		P	W	
5	Tagging and restoration of earth work				

Inspection Codes:
W – Witness. Prior notification required
P - Preform
R – Review

00		For Review and Approval		
Rev.	Date	Description	Prepared by	Approved by

ix Procedure for Anode Junction box Installation

1.0 PURPOSE

To describe the procedure for installation of anode junction box provides adequate quality assurance/control of workmanship and inspection at site.

2.0 SCOPE

The procedure covers installation of anode junction box should be as per site conditionleft /right side towards direction of flow.

3.0 MATERIALS AND REFERENCES

3.1 Equipments: Calibrated portable multimeter, Portable Reference Cu/$CuSO_4$ electrode.

3.2 Materials: Shuttering, concrete, Cable lugs, ferrules, etc.

4.0 PROCEDURE

4.1 Make a pit of dimension 1 m x 1 m x 0.5 m. The pit should be made at proper distance from pipeline on the wider side of the ROW.

4.2 Foundation should be cast either in site or at a convenient storage yard. Keeping the M.S. pipe vertically aligned. Take care so that the top of the foundation andthe top of the enclosure the overall dimensions of foundations shall be 900 mm x 900 mm x 600 mm.

4.3 Take care about the mainline pipe and its insulation to ensure that no damage is caused to them during excavation on the pipeline for cable to pipe connections. Areference should be made to approve anode Junction box Schedule for the type of connection scheme designed for the respective anode Junction box. Make requirednumber of cables to pipe connections of appropriate cable size and length.

4.4 Insert cable carefully on the rim of the M.S. pipe protruding out of the foundation block. This is to avoid damage to cable insulation while pulling the cables into the enclosure.

4.5 Pull the cables up to the top of foundation and then harness them through the support pipe into the enclosure.

4.6 The M.S. support pipe along with enclosure should be erected on top of foundation block by matching the base plate holes and fastening the bolts grouted in the foundation secured by the matching nuts.

4.7 Take care so that the top of the foundation and the top of the enclosure remain in the horizontal plane.

4.8 The orientation of the enclosure (box) should be such that its door faces the pipeline.

4.9 Mount the necessary hardware within the enclosure and terminate the cable onto the respective terminals.

4.10 Measure pipe to soil potential with portable multimeter and Cu/CuSO4 reference electrode at all cables terminals inside the box.

5.0 PRECAUTIONS

5.1 Cables used shall be of sufficient length so as to reach termination point withoutany joint and providing sufficient slack for future maintenance purposes.

5.2 Tag all cables appropriately.

5.3 Check all the connections for proper tightening

5.4 Provide cable core ferrules at both ends before final termination.

5.5 Keep one set of drawing / documents by site supervisor at work place.
5.6 Neatly dress the cable inside the trench and terminated inside junction box.
5.7 Installed test stations are in the cultivated land / open field at the boundary of twoplots and not in the middle of these plots.

6.0 TEST REPORT

Record and document all inspection result obtained in the Inspection report formatInspection and Test Plan

Inspection Report

Inspection Test Plan: Anode Junction Box Installation

Sr. No	Activity Descriptio	Reference document	Frequency of Inspection		record to be submitted. by
				Client	
1	Check Pitdimensions andlocation as per drawing	procedure	W	R	procedure
2	Concrete foundation Size and grade including curing Time		P	W	
3	AJB top Mounting on foundation		P	W	
4	Check Foundation level		P	W	
5	Checking heightabove ground Level		P	W	

Inspection Codes:

W – Witness. Prior notification required
P - preform
R – Review

00		For Review andApproval		
Rev.	Date	Description	Prepared by	Approved by

INSPECTION REPORT: TEST LEAD POINT/ JUNCTION BOX INSTALLATION REPORT

Chainage No.	LOCATION/REFERENCE:	
ReportNo.		**Date:**

TYPE OF TLP/JUNCTION BOX	**CHAINAGE**	**DISTANCE FROM PIPE LINE**	**PIPE TO SOIL POTENTIAL**	**OTHERS**

REMARKS:
LETTER WRITING ON TLP /JUNCTION BOX (CH No DISTANCE FROM PIPE LIN
DILINE FLOW): OK/ NOT OK
CONNECTION DIAGRAM OF TLP/JUNCTION BOX (INSIDE): BALANCE COMPLETED

	For	For
Sign:		
Name:		
Date:		

x. Procedure for Cathode Junction box Installation

1.0 PURPOSE
To describe the procedure for installation of Cathode junction box provides adequatequality assurance/control of workmanship and inspection at site.

2.0 SCOPE
The procedure covers installation of Cathod junction box should be as per site conditionleft/right side towards direction of flow.

3.0 MATERIALS AND REFERENCES
3.1 Equipments: Calibrated portable multimeter, Portable Reference $Cu/CuSO_4$ electrode.
3.2 Materials: Shuttering, concrete as per enclosed Dwg. no. (Attached with approved design document) Cable lugs, ferrules, etc.

4.0 PROCEDURE
4.1 Make a pit of dimension 0.7 m x 0.7 m x 0.8 m. The pit should be made at properdistance from pipeline on the wider side of the ROW.
4.2 Foundation should be cast either in site or at a convenient storage yard. Keeping the M.S. pipe vertically aligned. Take care so that the top of the foundation andthe top of the enclosure the overall dimensions of foundations shall be 600 mm x 600 mm x 800 mm.
4.3 Take care about the mainline pipe and its insulation to ensure that no damage is caused to them during excavation on the pipeline for cable to pipe connections. Areference should be made to approve Cathode Junction box Schedule for the type of connection scheme designed for the respective Cathode Junction box. Make required number of cable to pipe connections of appropriate cable size and length.
4.4 Insert cable carefully on the rim of the M.S. pipe protruding out of the foundation block. This is to avoid damage to cable insulation while pulling the cables into the enclosure.
4.5 Pull the cables up to the top of foundation and then harness them through the support pipe into the enclosure.
4.6 The M.S. support pipe along with enclosure should be erected on top of foundation block by matching the base plate holes and fastening the bolts grouted in the foundation secured by the matching nuts.
4.7 Take care so that the top of the foundation and the top of the enclosure remain inthe horizontal plane.
4.8 The orientation of the enclosure (box) should be such that its door faces thepipeline.
4.9 Mount the necessary hardware within the enclosure and terminate the cable onto the respective terminals.
4.10 Measure pipe to soil potential with portable multimeter and Cu/CuSO4 referenceelectrode at all cables terminals inside the box.

5.0 PRECAUTIONS
5.1 Cables used shall be of sufficient length so as to reach termination point withoutany joint and providing sufficient slack for future maintenance purposes.
5.2 Tag all cables appropriately.
5.3 Check all the connections for proper tightening

5.4 Provide cable core ferrules at junction box ends before final termination.
5.5 Keep one set of drawing / documents by site supervisor at work place.
5.6 Neatly dress the cable inside the trench and terminated inside TLP.
5.7 Installed test stations are in the cultivated land / open field at the boundary of twoplots and not in the middle of these plots.

6.0 TEST REPORT
Record and document all inspection result obtained in the Inspection report formatInspection and Test Plan
Inspection Report

Inspection Test Plan: Cathode Junction Box Installation

Sr. No	Activity Description	Reference document	Frequency of Inspection		Record to be submitted by
				Client	
1	Check Pit dimensions and location as per drawing	procedure	W	R	procedure
2	Concrete foundation, size and grade including curing time		P	W	
3	TLP top mounting On foundation		P	W	
4	Check foundation level		P	W	
5	Checking height aboveground level		P	W	

Inspection Codes:
W – Witness. Prior notification required
P - preform
R – Review

00		For Review and Approval		
Rev.	Date	Description	Prepared by	Approved by

INSPECTION REPORT: TEST LEAD POINT/ JUNCTION BOX INSTALLATION REPORT

Chainage No.	LOCATION/REFERENCE:	
Report No.		**Date:**

TYPE OF TLP/JUNCTION BOX	**CHAINAGE**	**DISTANCE FROM PIPE LINE**	**PIPE TO SOIL POTENTIAL**	**OTHERS**

REMARKS:
LETTER WRITING ON TLP /JUNCTION BOX (CH No DISTANCE FROM PIPE LINE DIR. LINE FLOW) : OK/ NOT OK
CONNECTION DIAGRAM OF TLP/JUNCTION BOX (INSIDE) : BALANCE COMPLETED

	For	For
Name:		
Date:		

xi. Procedure for transformer rectifier unit installation

1..0 PURPOSE

To define the procedure for Installation of transformer rectifier unit and provide adequatequality assurance / control of workmanship and inspection at site.

2.0 SCOPE

This procedure covers installation of transformer rectifier unit for cathodic protectionsystem.

3.0 MATERIALS & EQUIPMENTS

Equipment : Measure tape, Electrician tool kit.

Materials : Cable, Cable lugs, Ferrule, Gland.

4.0 REFERENCE

Data sheet & Manual

5.0 PROCEDURE

1. Carefully unpack the unit after taking it is from the wooden case. Inspect the outside of the unit and check for transit damages.
2. Install the unit on the foundation (outdoor) or on channels (indoors). Care should be takento ensure that the horizontal level of the foundation is correct. Incorrect foundation level will affect the alignment of the panel doors, which may cause difficulty in closing the doors. CP unit shall be installed inside the control room.
3. Take the cable entry in to the unit through suitably sized gland, which are fixed on the bottom gland plate of the unit. Open the front and back doors of the unit and visually inspect the inside of the unit carefully. Check all the components inside to ensure that there is no damage in transit. Tighten all connections.
4. Check the insulation between the AC input terminal and panel body by means of a megger.
5. The unit should be earthed by copper cable to be connected between the station earth system and the earthing bolt.
6. Pull up various cables such as AC input, anode header, cathode header, reference cell and negative cables, transducer cables and connect them to appropriate terminals in the unit asper wiring and cable termination diagram. The cable entry to the unit shall be through cable glands.
7. All the cables shall be tagged appropriately and ferruled before lugging with appropriate size lug.

6.0 PRECAUTION

All cables are to be appropriately tagged.

7.0 TEST REPORT

Record and document all inspection results obtained in the inspection report format.

8.0 ANNEXURE

Inspection Test Plan

Inspection Report

Inspection Test Plan: TR Unit installation

INSPECTION & TEST PLAN FOR TR UNIT INSTALLATION				
SR.NO.	**ACTIVITY**	**By**	**By Client**	**REMARKS**
1	PROCEDURE APPROVAL	S	A	
2	VERIFICATION OF LOCATION, EARTHING & REFERENCE CELL	P	R/RM	
3	TR UNIT INSTALLATION	P	R/RM	
4	CABLE TERMINATION & TAGS	P	R/RM	
5	INSPECTION REPORT	P	R/RM	
LEGENDS:				
"P"	PERFORM			
"RM"	RANDOM CHECK			
"W"	WITTNESS ALL			
"S"	SUBMITTED BY			
"A"	APPROVAL			

00			
Rev.	**Date**	**Prepared by**	**Approved by**

INSPECTION REPORT:

TR UNIT RATING	KVA
INPUT VOLTAGE (AC/DC)	**VOLTS**
INPUT CURRENT (AC/DC)	Amps
OUTPUT VOLTAGE (DC)	**VOLTS**
OUTPUT CURRENT (DC)	Amps
EARTHING	OK / NOT OK
SCADA MONITORING FACILITY	OK / NOT OK
DISTANCE FROM PIPELINE(M)	OK / NOT OK
CABLE TERMINATION IN TEST STATION	OK / NOT OK
REMARK:	

Inspection Codes:

W – Witness. Prior notification required
P - Perform
R – Review

00		For Review and Approval		
Rev.	**Date**	**Description**	**Prepared by**	**Approved by**

xii. Procedure for iccp anode bed installation (deepwell)

1.0 PURPOSE

To describe a procedure for installation of ICCP Anode ground bed and providesadequate quality assurance/control of workmanship and inspection at site.

2.0 SCOPE

This procedure covers installation of Deep anode ground bed as per standard drawing &design document.

3.0 REFERENCES

Installation drawing for Deep anode ground Bed Design and Calculation document forCP system.

4.0MATERIALS REQUIRED

Sr. No	Material/Tool	Make	Application/Purpose
01	Crimping Tool	Standard	For crimping cable with lug
02	Excavation tools & Augers	Standard	For Excavation
03	Measuring Tape	Standard	Measurement
04	Petroleum coke breeze	Goa Carbons	Backfill material
05	Canister	Standard	Sheet steed for Backfilling
06	MMO Tubular anodes	Lida®/SME/other approved	Anodes for Anode bed
07	Anode Tail cable	10 sq.mm XLPE	Connection for CP
08	Cu Sleeves/ Cable Lug/ clamps/Ferrules, PVC pipe Warning mat etc.	Standard	Connection, Marking & Laying
09	Holiday Detector	Caltech	For cable insulation check
10	Electrical Tool Box	Standard	
11	Soil Resistivity meter	WACCO	Measurement of resistance
12	Casing Pipe for Deep anode bed	6" dia., 3.5mm thick	Casing Pipe for Deep anodebed
13	PVC Shrouding Pipe	8" dia., 5mm thick	For Deep anode ground bed
14	PVC Vent Pipe	1" dia., 3mm thick	For Deep Well

5.0 PROCEDURE

PROCEDURE FOR DEEP WELL ANODE BED

1. Mark the boundary of the land acquired for installation of anode bed. This shall be in linewith approved CP equipment layout drawing

2. Locate the Drilling Rig at approved deep well ground bed location.

3. Start the drilling of borehole with suitable diameter drilling bit and drill a borehole of suitable depth as per approved document.

4. Lower the casing pipe (3mm thick min.) one length at a time and coupling various lengthswith couplers one after the other.

5. After lowering MS casing pipe, a PVC shrouding pipe equal to the inactive length of thedeep well ground bed shall be lowered along the casing pipe from the top.

6. Mark length equal to the required depth on the tail cables of anodes to avoid excessive lowering.

7. Shrouding pipe to be hold at top of casing suitably not to go higher depth.

8. Tie all MMO anodes with vent pipe and cables together and also install the centralizersfor each anode and End weight to last anode as per design approval.

9. Install the MMO anodes with nylon rope by preparing strings together and lower in borehole

15	GI Pipe, Pit foundation, coveretc.		For Deep anode bed pit
16	Power Distribution Box	As per Drawing	For Incoming supply
17	Cathode Junction Box	As per Drawing	For cable termination & Measurement
18	Anode Junction Box	As per Drawing	For cable termination & measurement
19	Pin Brazing	Safe track	As per procedure defined In tender

along with end weight & vent pipe.

10. Pour coke breeze inside the bore well up to the active length by using suitable methodand rest backfill with grout material. Insert PVC conduit up to required depth.

11. Backfilling to be done till active length from top of the pit, and then allow it to settle, fillthe top of pit as per approved drawing with grout.

12. Clamp / Tie the anode tail cable and lay up to anode junction box

13. All the tail cables and Header cable shall be laid and terminated in anode junction box.

14. Prepare Anode Ground bed top cover as per approved drawing.

15. All anode tail cable and anode header cable to be laid as per cable laying procedure.
16. Restoration work to be carried out at cable laying and anode bed location.

6.0 PRECAUTIONS

1. Lower anode carefully to avoid damage to tail cable.
2. After lowering the anode numbering to be done.
3. Tail cables and PVC conduits shall be of sufficient length so as to reach Anode JunctionBox without any joint.
4. Wherever the underground cable rises above ground, suitable take care to prevent damageto the cable must be provided.
5. All cables are to be appropriately tagged before lowering cables in to trench/bore well.
6. Cable termination at AJB is to be done carefully so as not to damage insulation of thecable.

7.0 HEALTH, SAFETY & ENVIRONMENT

Hazard Identification and risk assessment will be carried out and Operational Controlmeasures shall be adopted for Anode Installation Activities.

1. Necessary PPE to be utilized
2. Only trained personnel to be deployed for this activity.

8.0 QUALITY ASSURANCE & QUALITY CONTROL

Quality Assurance shall be maintained by ensuring the systematic implementation of thisProcedure and ensure that necessary quality records are generated as per ITP.

9.0 APPENDIX / FORMATS

1. Inspection & Test Plan
2. Inspection Report

INSPECTION & TEST PLAN FOR CONSTRUCTION OF DEEP ANODE GROUND BED

Owner :	
CP Contractor :	
Project :	
P/L Description :	**Juridiction :**
Report No. :	
DOC No. : Procedure/ Drawing	**Date:**

Sl No	Activity Description	Controlling Specification / Acceptance Criteria	Verifying Document	cp	client	Remarks
1	Location check & checking of Distance, Depth and Length/dia of Anode Bed	Design document & Drawing	Inspection report	P	W	
2	Individual anode tail cable connection & conduit sealing	Drawing	Inspection report	P	RI	
3	Check alignment, & installation of Anode f deep well	Drawing	Inspection report	P	RI	
4	lowering of MS pipe for deep well	Drawing	Inspection n report	P	RI	
5	Filling of Coke Breeze for deep anode bed	Procedure	Inspection n report	P	RI	
6	Check the Cable Laying up to AJB and Backfilling of Soil	Drawing	Inspection report	P	RI	
7	Cable termination	Drawing	Inspection report	P	AP	

LEGEND: RI - RANDOM INSPECTIO W - WITNESS ALL AP – APPROVAL/ACCEPTANCE
P - PERFORM I - INPECTION H - HOLD R- REVIEW

For		For	
Name:		Name:	
Date:		Date:	

xiii. Procedure for interference survey

Interference Survey has to be conducted as per procedure mentioned below at Railway crossings or at HT Locations or at foreign pipeline crossing points or parallel running pipelines or in common ROU. Job Card will be issued to complete the interference survey covering all points in a particular pipeline section only. Bidder needs to submit therecommendation with mitigation measures from a CP specialist ie NACE Level 2 (min) qualified with Graduate in Elect Engg / MTech in Corrosion Science with min 10 years practical experience in ICCP based Cathodic Protection System.

(i) Interference survey procedure at railway crossing or running parallel to BHAGYANAGAR GAS LIMITED (BGL) Pipelines:
scope includes 24 hours data logging of on/on current magnitude using high speed high impedance data loggers at various locations (preferably simultaneously) under different conditions, analysis of dynamic stray current, data collection from railways, study the effectiveness of mitigation measures already taken if any and recommend mitigation measures /modification required at existing measures, at the railway crossings or running parallel to BHAGYANAGAR GAS LIMITED (BGL) Pipeline. The party shall conduct detailed analytical study mitigation measures to arrest the deleterious effect of stray current interference from railways, at the railway crossings or along the parallel pipelines route.

(ii) Interference survey at foreign pipeline:
Pipeline: - The scope includes 24 hours so that survey operator follows the route of thepipeline exactly of Pipeline Section and locations.
Pipeline route markers, roads, rivers, nalla s, respective region. but not limited to: following completion of each day's survey. pipelines shall be carried out to know thepresence of any type of interference along the pipeline as per SOR of the tender –
on-off PSP changes, changes in the line current / stray current to recommend suitablecrossing or running parallel with data logging using high speed high impedance data loggers at owners as foreign pipeline against various conditions, data collection from foreign pipeline operator, GPS interrupted ON-OFF PSP data collection at various locations of stray current pick up/discharge along the pipeline crossing/length and recommend mitigation measures at foreign pipeline crossing or running parallel to BHAGYANAGAR GAS LIMITED (BGL) pipeline.

(iii) Interference survey at HT crossing or running parallel to BHAGYANAGAR GAS LIMITED (BGL) Pipeline: - The scope includes AC/DC Interference Survey, 24 hours data logging, collection of datafrom MGVCL, interference analysis and Mitigation at Overhead High-Tension Electric Line Crossing or running parallel to BHAGYANAGAR GAS LIMITED (BGL) pipelines within a corridor of 5OOm on each side of pipeline including collection of field data of pip dine / electrical system and drawings.
The AC corrosion current density on the pipeline should be measured using AC coupon and reference electrode. Coupon and reference cell shall be provided by the contractor forthe purpose of AC corrosion measurement for this survey.

(iv) Recommendation for mitigation of interference: - The CONTRACTOR shall submit the recommendations for mitigation measures of all type of interference encountered all along the pipeline with detailed study of by NACE Level 2 (min) qualified with Graduate in Elect Engg /

MTech in Corrosion Science with min 10 years practical experience in ICCP based Cathodic Protection System.

a) Existing ICCP system,
b) Utility crossings,
c) Parallel running and proximity of utilities like railways and HT lines topipeline,
d) Telluric effect,
e) mitigation measures already taken,

Results of all the above studies and surveys conducted under this contract including brain storming sessions are for bringing the PSP in the range of polarized potential! of (-)0.85 to (-)1.2 or close to it without affecting the pipeline and coating integrity in line with NACE and international standards. The recommendations shall be given by any reputed CP expert! Specialist NACE Level 2 (min) qualified with Graduate in Elect Engg / MTech in Corrosion Science with min 10 years practical experience in ICCP based Cathodic Protection System. The cost of hiring of expert/specialist (traveling. lodging & boarding if required) shall be borne bythe Contractor.

The CONTRACTOR in his recommendations for mitigation measures shall submit the detailed drawing. Specification, location for installation, quantity required etc of themitigation measures and equipment's for all type of interference encountered along the pipelines.

EQUIPMENT:

The following equipment should be available with survey team as a minimum requirement: -

A computerized field data collector (preferably with the printer) with input impedance more than 10M Ohms and adequate level of AC rejection. (M.C.Miller/ Cath-tech hexcorder make only)

Cu/CuS04 reference electrode (M.C.Miller /Equivalent make)

Current interrupters (GPS based). Accuracy should be compatible with instrumentation used for potential measurements.JR-I & JR-2 (M.C.Miller/Canara /Kriston/Raychem make).

Computer hardware and software for processing and printing the data and profile plots. Silver / silver chloride reference electrode. (For river crossing only)

Holiday detector- Range 15 to 25 KY.

Pipeline Thickness/Coating thickness measurement gaugePipeline Locator

Note: - All equipment should be calibrated, rugged, weather proof suitable for the field conditions.

COMPLETION TIME FOR JOB EXECUTION

Brief Description of job	**Maximum Completion Time permissible /qty/ Location**
Attending breakdown maintenance complaint by Bidder's maintenance team itself covered under comprehensive AMC of TR unit or Including Hiring Professional service from OEM or its authorized agency to attend CP unit breakdown Complaints covered under Comprehensive AMC. Repairing of TR unit spares/control cards or display meters or lightening arrestor or transformer etc covered under Comprehensive AMC	Inspection / Fault diagnose within 48 hours and provision of spare TR unit in case Repairing time may take more than weeks' time. Max – 1 month is permissible / CP Unit, subject to provision of spare TR unit to maintain pipeline CP system healthy.
Attending Preventive Maintenance complaints ie Display meter fault / Auto Manual faults etc	Within 15 days/ Location
Supply & replacement of TR Oil covered under Comprehensive AMC	Two Weeks/CP unit
Painting of TR unit	Two weeks/CP unit
Permanent ref cell installation	Two weeks/Location
Installation of new Test station	Two weeks/ Location/ 10 kms section of any pipeline
Siemens key lock replacement including missing Door	One week/ Location
Cathode junction box	15 days/Location
Copper conductor of different sizes	Two weeks/Location
Cold soldering	One week/Location
Pin brazing	One week/ Location
Cable laying normal surface	15days/Location
Cable laying on Hard surface	15 days/Location
CP cable joint	One week/Location
Mg Anode /Zn /Si Anodes	One week /Location/10km's of any pipeline section
Coke breeze laying	15 days/location
Anode Junction Box	Two weeks/location
Power meter box	15 days/location
Anode ground bed maint.	15 days/location
Repair of coating	Two weeks/location
TR unit shifting /Replacement/Commissioning	Three weeks/location
Hi Si Anode bed installation	One month/location
Deep well Anode bed installation	Three weeks/location
Solid state polarization cell	Three weeks/location
CIPL Survey	1 week /1 km of any pipeline section

DCVG / CAT- A frame Survey	1 week /1 km of any pipeline section
Physical Verification	2 weeks / Location
Interference Survey	4 weeks / including railway crossings, foreign pipeline crossings or parallel running pipeline or HT Locations for any 1 pipeline section of min 10 km/s section.
Approach Route Map	4 -5 weeks / Pipeline section of 10 km's
Brick Wall Chamber	1 week / Location
Metallic Printed Circuit Board	1 week / location
Carrying out ROU Washout check / Soil Erosion / or encroachment status checking.	Two Weeks /Location as and when required basis.

Remarks: Decision of EIC will be Final and binding on the Bidder depending uponquantum of work / emergency.

Report Analysis & Deliverables

1. CIPL Survey

(a) For the purpose of the CIPS survey analysis in view of CP protection, the limits of OFF PSP with respect CuCuSo4 (Half-cell) shall be between (–) 850 mV to (-) 1200 mV & for SRB areas if provided by BGL, it shall be between (–) 950 mV to (-) 1200 mV.

(b) Abrupt variations in the ON & OFF PSP shall be considered for the analysis. Terrain considerations should be also incorporated in the analysis.

(c) The data shall be analyzed & documented in the report considering the following:

(1) Identifying the effectiveness of CP system over the entire length of pipeline.
(2) Identifying the under and over protected zones.
(3) Identifying the zones for any type of interference for stray current pick up and discharge or at a risk of Interference corrosion along the pipeline including location.
(4) Identifying the possible shorted casings or unintentional contact with other metallic structures.
(5) Identifying the any Anodic & Cathodic area for the Pipeline section covered under lateral CIPL survey.
(6) Analysis for the fluctuations in ON & OFF PSP

(d) The CIPL survey to be produced in the tabulated form as well as graphical representation. Graph should be plotted in A-4 size landscape page set up covering maximum of 1 Km of Pipe length. It should also contain the lines for Min. and maximum OFF PSP limits, Pipeline segmentation showing Good/ Poor CP protection, Terrain physical features along with their legends, locations of TR/CPPSM units. The lines of the ON & OFF PSP in the graph should be of different colours.

(e) Report shall also include survey data depicted in the alignment sheet style format. Same is to be also presented in soft copy. If some software tool is required to view thesame, same shall be also supplied free of cost along with the reports to view the same.

(f) Hard copy Reports should be submitted. Along with this, one no. of editable soft copy(excel) and one no. non-editable soft copy should be submitted to concerned Official.

2. CAT Survey

(a) CAT survey analysis shall be done to identify and segment the Pipeline section based on coating condition to enable for pin pointing the coating fault location by DCVG/ACVG survey.

(b) Wherever there are abrupt changes in current observed in a segment than the normal current trend in other segments, such zones need to be considered for further study by DCVG/ACVG survey.

(c) The coating condition can be assessed by evaluating current mapping and signal loss indB/Km.

(d) CAT survey report shall also incorporate the System conditions like indicating the CP stations that were switched off, Date of survey, CAT transmitter power source details like set current and mode of operation and location of CAT transmitter.

(e) The final report documentation of CAT survey as a minimum shall involve each transmitter setup with its unique serial no. along with the Pipeline current measured foreasy identification. The serial no. shall be uniquely identified for each IJ-IJ section. It shall also include the System conditions like CP stations that were switched off, Dateof survey, PCM transmitter power source details like set current and mode of operationand location of PCM transmitter and in Remark column features

like TLP/KM marker/Road/Canal/River/Power line crossings etc.

(f) Results of survey shall indicate Survey Chainage, Pipeline Chainage, GPS Coordinates current, Depth and Remarks column which shall indicate the pipeline features like TLP/KM marker/Road/Canal/River/Power line crossings etc.

(g) The CAT survey to be produced in the tabulated form as well as graphical representation. Graph should be plotted in A-4 size containing Pipeline segmentation showing Good/ Poor Coating, Terrain physical features along with their legends.

(h)Report should be prepared from Isolation valve to Isolation valve (before and after IJ's)on a Pipeline section.

(i) Relative categorization of Coating condition based on loss of current shall be done as Excellent, Good & Poor. This can differ from one pipeline to other and also the loss of current can be sudden which may be due to shorting of carrier pipe with any other metallic structure. Such type of finding shall be also reported in the report.

(j) Report shall include survey data depicted in the alignment sheet style format. Same to be also presented in soft copy along with the software tools to view the same if same is required.

(k)Hard copy Reports should be submitted. Along with this, one no. of editable soft copy (excel) and one no. non-editable soft copy should be submitted to concerned official.

3. DCVG/ACVG Survey

(a) DCVG/ACVG Survey analysis shall be done to pin point the coating fault with itsorientation & size and should be peg marked.
(b)In case of digital DCVG/ACVG equipment's, its downloadable data format shall bealso acceptable.

(c) Location identification drawings should be prepared for each and every coating fault with GPS coordinates referenced with physical features like permanent markers etc. available around that area for subsequent coating repair activity.
(d)**DCVG % IR Calculation:** The Calculated Pipe to remote earth Potential (P/RE) are calculated using the following formula.

$$\boldsymbol{PRE}=\boldsymbol{S1}+\{\boldsymbol{dx}(\boldsymbol{S1}-\boldsymbol{S2})/(\boldsymbol{d1}-\boldsymbol{d2})\}$$

Where:
PRE = Pipe to remote earth DCVG signal magnitude (mV)
S1 = DCVG signal amplitude to remote earth at Test Station-1 (downstream TS, in mV)S2 = DCVG signal amplitude to remote earth at Test Station-2 (upstream TS, in mV) d1= Distance of Test Station-1 (m)
d2 = Distance Test Station-2 (m)
dx = Distance of defect location from Test Station 1 (m)

(e) % IR Calculation:
Once a Coating defect is located, its % IR is estimated by measuring the potential difference from the epicentre of the coating defect to remote earth (OL/RE). This potential difference is then

expressed as a percentage of the total calculated potential shift on the pipeline at the Coating defect location (P/RE), as shown in the Equation below.

$$\%\ IR\ (Coating\ defect\ Serity) = Over\ th\ e\ Line\ to\ Remote\ Earth\ mV\ (OL_{RE})$$

$$\text{.....X } 100$$

$$Calculated\ Pipe\ to\ Remote\ Earth\ at\ Indication\ mV(PRE)$$

(f) Coating defects are to be analysed and categorized as Minor/Moderate/Severe as givenbelow:

% IR	Recommendations
0 – 15%	Characterized as 'Minor' or small coating faults. Such coating faults can usually be left unrepaired provided the pipeline cathodic protection is good and there are not too many small coating faults in close proximity. However, if such area is falling in probable AC interference zones, same needs to be rectified along with Severe & Moderate typeof Coating defects as such defect sizes are prone to AC Corrosion.
15 – 35%	Characterized as 'Moderate' or medium coating faults. These coating faults needs repair usually within normal scheduled maintenance activities. However, as a standard practice same also needs to be repaired along with 'severe' type defects.
35 – 100%	Characterized as 'Severe' or large coating faults. These coating defects need to Be repaired at earliest i.e. within 60 days from the date of completion of DCVG survey.

(g) For ACVG, above criteria of IR categorization including calculations may not beapplicable and severity shall be as per measuring equipment manufacturer.

(h) Any Anodic & Cathodic area for the Pipeline sections are also to be identified.

(i) The DCVG survey to be produced in the tabulated form. In case of digitalDCVG/ACVG equipment, its downloadable data format shall be also acceptable.

(j) Report should be prepared from Isolation valve to Isolation valve (before and after IJ's) on a Pipeline section.

(k) Report shall include survey data depicted in the alignment sheet style format. Same to be also presented in soft copy along with the software tools to view the same if required.

(l) Hard copy Reports should be submitted. Along with this, one no. of editable (excel) soft copy and one no. non-editable soft copy should be submitted to concernedofficial.

Annexure : Scope of work

CATHODIC PROTECTION SYSTEM

INTRODUCTION

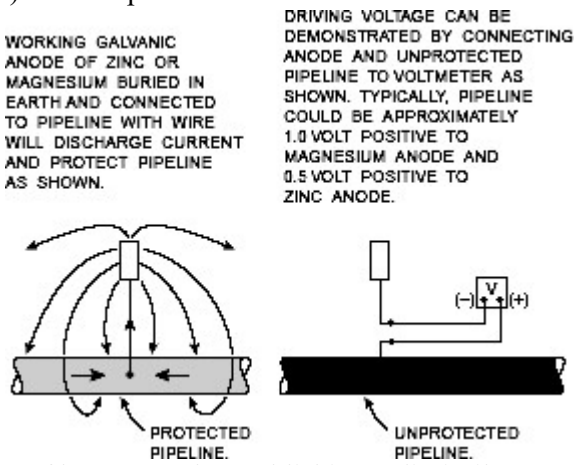
The principal methods for mitigating corrosion on underground pipelines are coatings and CP.A primary function of a coating on a cathodically protected structure is to reduce the surface area of exposed metal on the pipeline, thereby reducing the current necessary to cathodically protect the metal. **CP is defined as "a reduction of the corrosion rate by shifting the potential of the structure toward a less oxidizing potential by applying an external current.**

Cathodic protection (**CP**) is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. The simplest method to apply CP is by connecting the metal to be protected with another more easily corroded metal to act as the anode of the electrochemical cell. Cathodic protection systems are used to protect a wide range of metallic structures in various environments. Common applications are; steel water orfuel pipelines and storage tanks; steel pier piles; ships and boats; offshore oil platforms and onshore oil well casings and metal reinforcement bars in concrete buildings and structures.

Galvanic CP

Cathodic Protection with Galvanic Anodes

The corrosion cell results from contact of dissimilar metals In such a cell, one metal is active (negative) with respect to the other and corrodes. In CP with galvanic anodes, this effect is taken



advantage of by purposely establishing a dissimilar metal cell strong enough to counteractcorrosion cells normally existing on pipelines. This is accomplished by connecting a very active metal to the pipeline. This metal will corrode and, in so doing, will discharge current to the pipeline as shown in Figure 2.

Fig 2 Cathodic protection with galvanic anodes

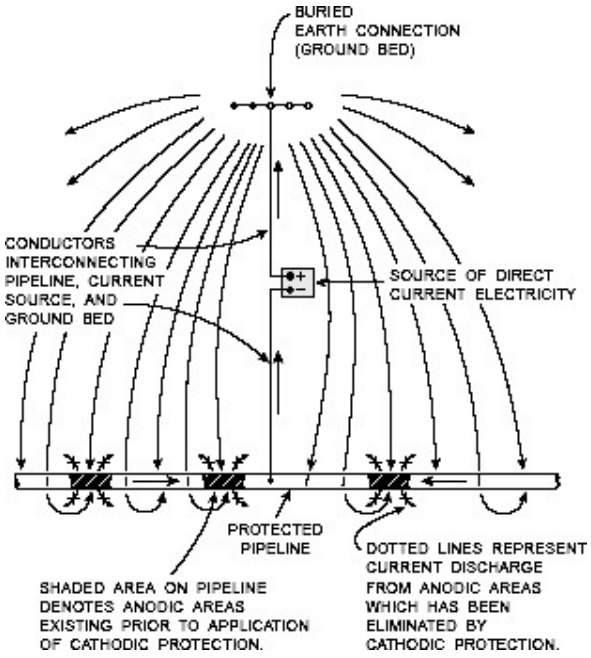
Galvanic or sacrificial anodes are made in various shapes and sizes using alloys of zinc, magnesium and aluminium. ASTM International publishes standards on the composition and manufacturing of galvanic anodes

In order for galvanic cathodic protection to work, the anode must possess a lower (that is, more negative) potential than that of the cathode (the structure to be protected). The table below showsa simplified galvanic series to show which metals can thus be combined.

Metal	**Potential with respect to a Cu:$CsSO_4$ reference electrode in neutral pH environmer (volts)**
Carbon, Graphite, Coke	+0.3
Platinum	0 to -0.1
Mill scale on Steel	-0.2
High Silicon Cast Iron	-0.2
Copper, Brass, Bronze	-0.2
Mild Steel in Concrete	-0.2
Lead	-0.5
Cast Iron (not Graphitized)	-0.5
Mild Steel (Rusted)	-0.2 to -0.5
Mild Steel (Clean)	-0.5 to -0.8
Commercially Pure Aluminum	-0.8
Aluminum Alloy (5% Zinc)	-1.05
Zinc	-1.1
Magnesium Alloy (6% Al, 3% Zn, 0.15%Mn)	-1.6
Commercially Pure Magnesium	-1.75

Galvanic anodes are designed and selected to have a more "active" voltage (more negative electrochemical potential) than the metal of the structure (typically steel). For effective CP,the potential of the steel surface is polarized (pushed) more negative until the surface has a uniform potential. At that stage, the driving force for the corrosion reaction is removed. The galvanic anode continues to corrode, consuming the anode material until eventually it must bereplaced. The polarization is caused by the electron flow from the anode to the cathode. The driving force for the CP current is the difference in electrochemical potential between the anode and the cathode.For larger structures, galvanic anodes cannot deliver economically enough current to provide complete protection. Impressed current cathodic protection (ICCP) systems use anodes connected to a DC power source. Usually this will be a cathodic protection rectifier, which converts an AC power supply to a DC output. In the absence of an AC supply, alternative power sources may be used, such as solar panels, wind power or gas powered thermoelectric generators.

Impressed current CP



To be free of the limited driving voltage associated with galvanic anodes, current from some outside power source may be impressed on the pipeline by using a ground bed and a power source. Figure 1 illustrates this situation. The most common power source is the rectifier. The rectifiers operate in the range between 10 and 50 V and can be obtained with maximum current outputs ranging from less than 10 A to several hundred amperes.

Anodes for ICCP systems are available in a variety of shapes and sizes. Common anodes are tubular and solid rod shapes or continuous ribbons of various materials. These include high silicon cast iron, graphite, mixed metal oxide, platinum and niobium coated wire and others.

A cathodic protection rectifier connected to a pipeline.

A typical ICCP system for a pipeline would include an AC powered rectifier with a maximum rated DC output of between 10 and 50 amperes and 50 volts. The positive DC output terminal would be connected via cables to the array of anodes buried in the ground (the anode groundbed).The anodes could be installed in a vertical hole and backfilled with conductive coke (a material that improves the performance and life of the anodes) or laid in a prepared trench, surrounded by conductive coke and backfilled. The choice of grounded type and size depends on the application, location and soil resistivity. A cable rated for the expected current output would connect the negative terminal of the rectifier to the pipeline. The operating output of the rectifier would then be adjusted to the optimum level after conducting various tests including measurements of electrochemical potential.

CP CRITERIA FOR STEEL AND CAST IRON PIPING

Three primary criteria for CP of underground or submerged steel are as follows:
1. - 850 mV (CSE)a with the CP applied,
2. A polarized potential of -850 mV (CSE)
3. 100 mV of polarization.

4. *Fourth criteria the 300mVpotential shift*
The application and limitations of each are given below.

- **850 mV with Cathodic Protection Applied Criterion**
The full criterion states that adequate protection is achieved with: a negative (cathodic) potential of at least 850mVwith the CP applied. This potential is measured with respect to a saturated copper/copper sulphate reference electrode contacting the electrolyte. Voltage drops other than those across the structure-to-electrolyte boundary must be considered for
valid interpretation of this voltage measurement.

Applications
The - 850 mV criterion with CP applied, is probably the most widely used for determining if a buried or submerged steel or cast-iron structure has attained an acceptable level of CP. In the caseof a buried steel or cast-iron structure, an acceptable level of protection is achieved, based on this criterion, if the potential difference between the structure and a CSE contacting the soil directly above and as close as possible to the structure is equal to or more negative than (larger in absolute value) -850 mV. As described above, voltage drops other than those across the structure-to-electrolyte boundary must be considered for valid interpretation of this voltage measurement. These voltage drops are a result of current flow in the electrolyte (soil) and are generally referred to as ohmic or IR voltage drops. IR voltage drops are more prevalent in the vicinity of an anode bed or in areas where stray currents are present and generally increase with increasing soil resistivity. For bare or very poorly coated structures, IR voltage drops can be reduced by placing the reference electrode as close as possible to the structure. For the majorityof coated structures, most of the IR voltage drop is across the coating, and the measurement is less affected by reference electrode placement. The IR voltage drop can also be minimized or eliminated by interrupting all of the direct current sources of the CP system and measuring the instantaneous off-potential. The off-potential will be free of the IR voltage drop errors if all ofthe current sources, including sources of stray currents, have been properly interrupted and if long-line currents are negligible. Long-line currents occur on a structure as a result of the presence of macro-cells. The difference between the on- and the off-potential indicates the

magnitude of the IR voltage drop error. when the measurement is made with the protective current applied. This criterion was originally adopted based on the observation that the most negative native potential observed for coated underground steel structures was about -800 mV (CSE). The assumption was made that macro-cell corrosion would be mitigated if sufficient CP current were applied to raise (in the negative direction) the potential of the entire structure to a value that is more negative than the native potential of the local anodic sites. A potential of -850 mV was adopted to provide a 50mV margin of protection. The effectiveness of the criterion has been demonstrated over many years of application.

Polarized Potential of -850 mV Criterion

This criterion states that adequate protection is achieved with "a negative polarized potential of at least 850 mV relative to a saturated copper/copper sulphate reference electrode." **The polarized potential is defined as the "potential across the structure/ electrolyte interface that is the sum of the corrosion potential and the cathodic polarization."** The polarized potential is measured

directly after the interruption of all current sources and is often referred to as the **off-** or**instant off-potential**.

The difference in potential between the native potential and the off or polarized potential is the amount of polarization that has occurred as a result of the application of the CP. As previously stated, the difference in potential between the on-potential and the off-potential is the error in the on-potential introduced as a result of voltage drops in the electrolyte (soil) and the metallic returnpath in the measuring circuit.

100 mV of Polarization Criterion

This criterion states that adequate protection is achieved with "a minimum of 100 mV of cathodic polarization between the structure surface and a stable reference electrode contacting the electrolyte. The formation or decay of polarization can be measured to satisfy this criterion." Of the four criteria, this criterion has the most sound fundamental basis. The corrosion rate decreases and the rate of the reduction reaction on the metal surface increases as the undergroundstructure is polarized in the negative direction from the native potential. The difference between the corrosion rate (expressed as a current) and the rate of the reduction reaction is equal to the applied CP current. **The corrosion rate of a structure decreases by a factor of 10 (an order of magnitude) for every 100 mV cathodic shift in the polarized potential.**

Applications

The 100 mV polarization criterion is most commonly used on poorly coated or bare structures where it is difficult or costly to achieve either of the -850mV criteria. In many cases, 100mVof polarization can be achieved where the off-potential is less negative than
-850mV (CSE). The application of the 100mVpolarization criterion has the advantage of minimizing coating degradation and hydrogen embrittlement, both of which can occur as a result of overprotection. In piping networks, the 100 mV polarization criterion can be used for the older, poorly coated pipes; whereas, a -850mV(CSE) polarized potential criterion can be used forthe newer piping in the network Pipeline network under Gujarat Region is divided in to 4 major Regions,

Fourth Criteria -- 300 mV Potential Shift Criterion

The fourth criteria and the most common other criteria that have been used in the past for underground structures is the 300 mV potential shift criterion 300 mV Potential Shift Criterion. The 300-mV potential shift criterion states that adequate protection is achieved with "a negative (cathodic) voltage shift of at least 300 mV as measured between the structure surface and a saturated copper sulphate half-cell contacting the electrolyte. Determination of this voltage shift is to be made with the protective current applied." This criterion is similar to the 100 mV polarization criterion, which is assessed on the basis of the formation of polarization on a structure.

In general, the 300 mV potential shift criterion should not be used where high-pH SCC is confirmed or suspected, or where stray currents or galvanic couples are present.

This criterion of voltage shifts applies to structures not in contact with dissimilar metals."

FORMATS TO BE USED WHILE EXECUTION OF THE CONTRACT

FORMAT – 1

TRANSFORMER RECTIFIER UNIT MONITORING (STEEL) (MONTHLY)

SITE LOCATION:_____CGD

DATE OF INSPECTION:_____

LOCATION OF TR UNIT:_____

1	**TRANSFORMER RECTIFIER DETAILS:** 1.1 Manufacturer:_____No. of Circuits: _____ Rating: __	
2	**VISUAL INSPECTION & MAINTENANCE:** 2.1 Earthing of Enclosure: OK / NOT OK 2.2 Cleaning & Air Blowing : Done / Not Done 2.3 Indicating lamps/LEDs : OK / NOT OK 2.4 Tightening of connections : Done / Not Done	
3	**WORKING PARAMETERS**	**VALUES**
	3.1 A.C./D.C INPUT VOLTAGE(V)	
	3.2 ANODE VOLTAGE (V)	
	3.3 ANODE CURRENT (A)	
	3.4 PIPE TO SOIL POTENTIAL(- Volt)	
	TARGET	
	Ref Cell – 1	
	Ref.Cell – 2	
	Ref.Cell – 3	
	3.5 Controlling Electrode	
	3.6 Mode (Auto / Manual)	

REMARKS:

REVIEW REMARKS:

MONITORED BY:
NAME:
DESIGNATION:

REVIEWED BY:
NAME:
DESIGNATION:

FORMAT – 2

PIPE TO SOIL POTENTIAL(STEEL) (QUARTERLY)

SITE LOCATION: …… CGD

DATE & TIME OF CHECKING:

SN	TEST STATION NO.	STATIO TYPE	CHAINAGE NO.	LOCATION	PSP (VOLT)	OTHER READING		REMARK (UNDER PROTECTION / OVER PROTECTION / WITHIN LIMIT)	CHECKING DONE BY
						READING TYPE	VALUE		
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
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25									
26									
27									
28									

NAME & SIGNATURE OF SITE O&M EXECUTIVE

FORMAT - 3

PIPE TO SOIL POTENTIAL ON-OFF POTENTIAL (STEEL) (Yearly)

SITE LOCATION:_____CGD

DATE & TIME OF CHECKING:

SN	TEST STATION NO.	STATIC N TYPE	CHAINAGE NO.	LOCATION	PSP VOLT TS(-VE) ON	PSP VOLTTS (-VE) OFF	OTHER READING		REMARK (UNDER PROTECTION/ OVER PROTECTION/ WITHIN LIMIT)	CHECKING DONEB
							READING TYPE	VALUE		

NAME & SIGN OF SITE O&M EXECUTIVE

FORMAT - 4

MONITORING OF ANODE GROUND BED & A.L.J.B (STEEL) (HALFYEARLY)

SITE LOCATION:_____CGD
DATE & TIME OF CHECKING: _____
LOCATION OF ANODE BED: _____

1. GROUND BED DETAILS

1.1 Ground bed configuration _____

1.2 Anode Quantity

2. VISUAL INSPECTION

2.1 Cable glands in anode lead junction box: OK / NOT OK

2.2 Permanent identification tags on all anode cable: YES/NO

2.3 Cable connection tight: YES/ NO

2.4 Operation of all locks: OK / NOT OK

2.5 Painting of AJB: OK/ NOT OK

2.6 Shunt & variable resistance: OK / NOT OK

3. CURRENT OUTPUT OF INDIVIDUAL ANODES

Anode No.	Shunt Measurement (mV)	Current (mA)	Earth Resistance (Ohms)	Anode No.	Shunt Measurement (mV)	Current (mA)	Earth Resistance (Ohms)
1				3			
2				4			

4. CURRENT OUTPUT OF COMPLETE GROUND BED

4.1 Anode current at CPVCM/CPPSM/TR Unit :_____Amps

4.2 Measured value of anode ground bed current at ALJB :_____Amps

TOTAL ANODE GROUNDED RESISTANCE

Wenner 3 pin, groundbed to earth resistance measurement:_____Ohms. (Should be less than 01 Ohm)

NAME & SIGN OF SITE O&M EXECUTIVE

FORMAT - 5

EARTH TEST REPORT CNG STATION(QUARTERLY)

SITE LOCATION:_____CGD DATE OF INSPECTION: _____

LOCATION OF EARTH PITS (CNG STATION):_____

PHYSICAL CHECK: (MENTION THE OBSERVATIONS IN REMARKS COLUMN)

SN	CHECK POINT	CONDITION
1	ELECTRODE:	OK/CORRODED/ EXPOSED
2	CONDUCTOR:	OK/ LOOSE/ BROKEN/ EXPOSED
3	IDENTIFICATION MARK:	OK/ MISSING/ FADED
4	**PIT COVER**	OK/ MISSING/ RUSTED

SN	EP NO	EARTH TESTER NO.	RESISTANCE (ohm)		CONDITION	REMARK	CHECKED BY
			ELECTROD	GRID	OK/ NOT OK		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

NAME & SIGN OF SITE O&M EXECUTIVE

FORMAT - 6

EARTH TEST REPORT CNG STATION(HALF YEARLY)

SITE LOCATION:_____CGD DATE OF INSPECTION: _____

LOCATION OF EARTH PITS (CNG STATION):_____

PHYSICAL CHECK: (MENTION THE OBSERVATIONS IN REMARKS COLUMN)

SN	CHECK POINT	CONDITION
1	ELECTRODE:	OK/CORRODED/ EXPOSED
2	CONDUCTOR:	OK/ LOOSE/ BROKEN/ EXPOSED
3	IDENTIFICATION MARK:	OK/ MISSING/ FADED
4	PIT COVER	OK/ MISSING/ RUSTED

SN	EP NO.	EARTH TESTER NO.	RESISTANCE (ohm)		CONDITION	REMARK	CHECKED BY
			ELECTRODE	GRID	OK/ NOTOK		
1							
2							
3							
4							
5							
6							
7							
8							
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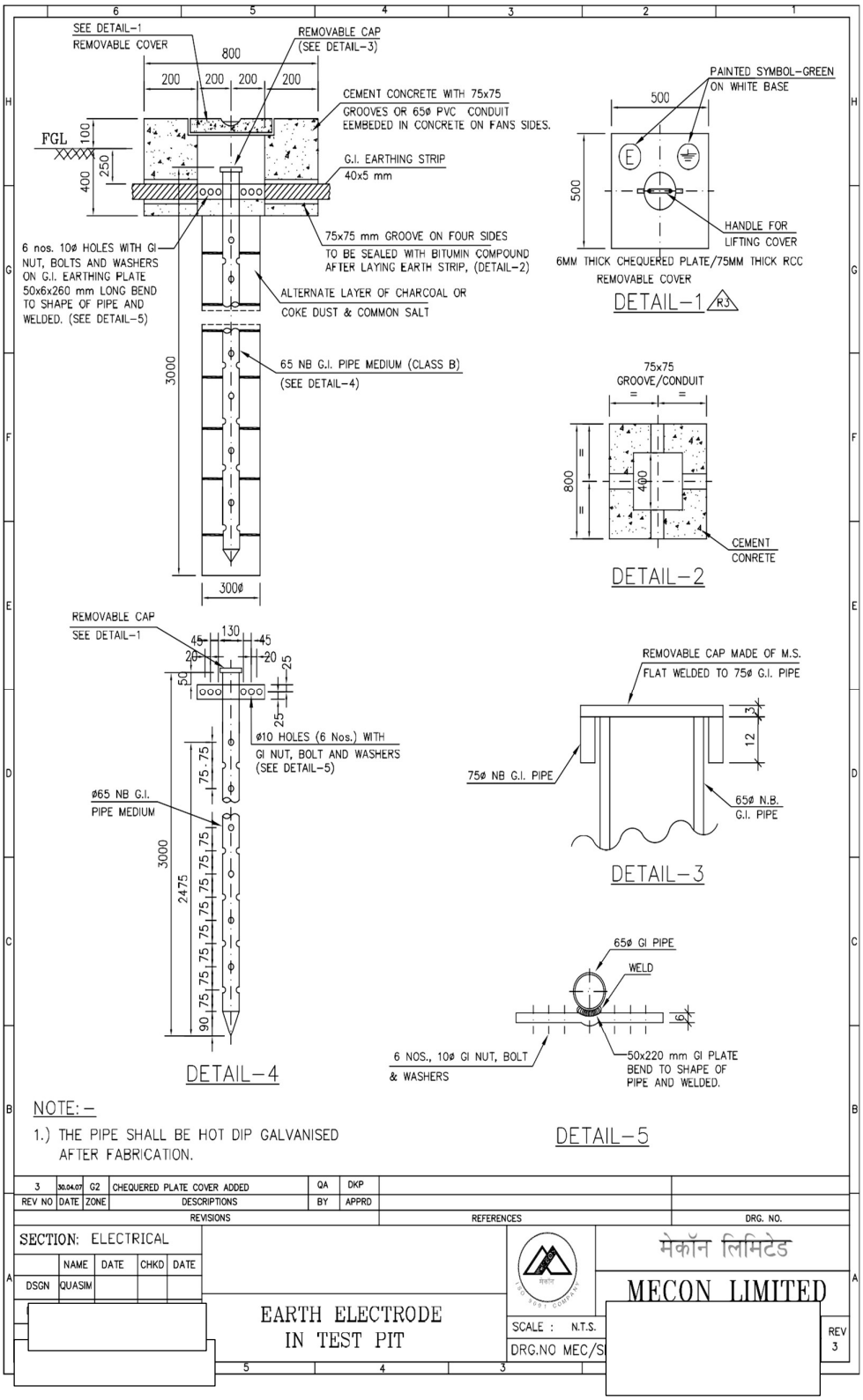
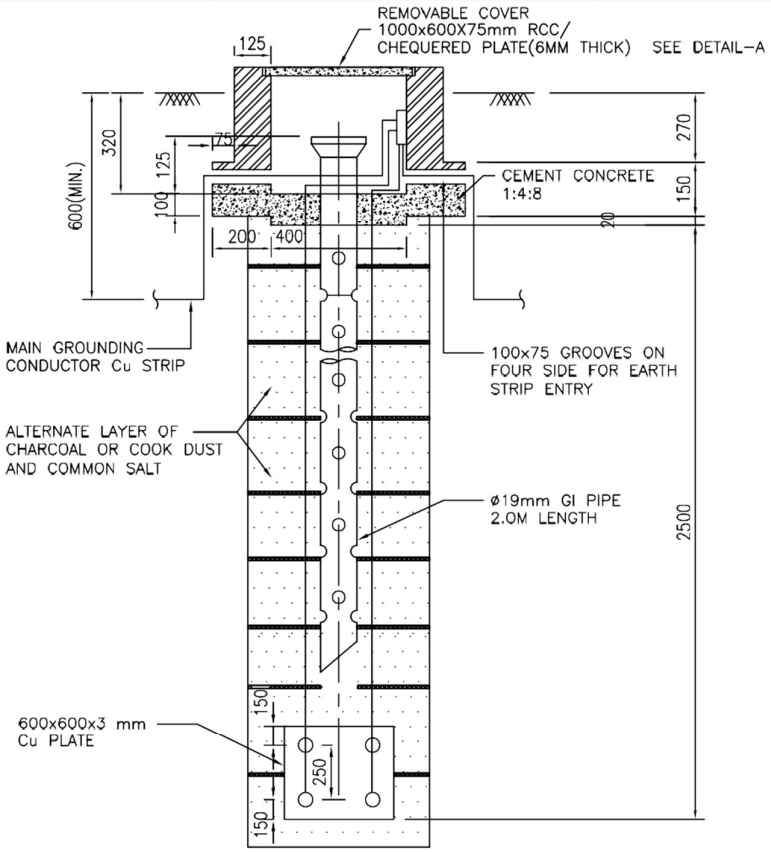
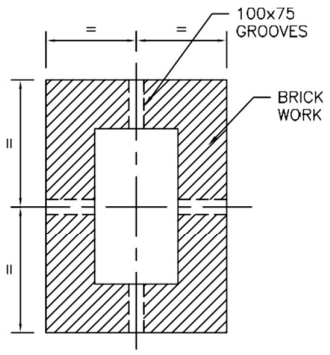
NAME & SIGN OF SITE O&M EXECUTIVE

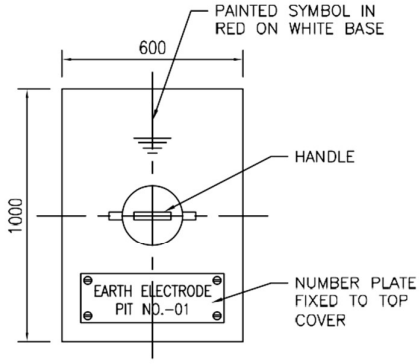




COPPER PLATE ELECTRODE WITH TREATED EARTH PIT



DETAIL-B



DETAIL-A

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
			REVISIONS				

SECTION: ELECTRICAL

COPPER PLATE ELECTRODE IN TEST PIT

Procedures

PIN BRAZING

A. PROCEDURE FOR PIN BRAZING (For Reference Only)

1. Select the location for making cable to pipe connection away from the seam or circumferential weld of the pipe. Ensure that location is as specified and in case of change in location obtain necessary approval from EIC / SIC.
2. Remove pipe coating of size (2" X 2") to expose joint area on the pipe surface.
3. Clean the exposed area to get a shining surface with wrought file.
4. Remove approximately 25 mm of insulation on the cable at one end, polish the copper conductor strands and crimp 15 to 20 mm long copper sleeve on wire strands.
5. Place pin brazing gun on exposed area of pipe & done the pin brazing on Pipe.
6. Check the Mechanical integrity of the weld by the use of flight hammer (0.5 kg.) striking the weld firmly but gently as close to the steel pipe surface as possible in a direction parallel to the pipe surface.
7. Check the continuity of the cable.
8. Remove 3 layer polyethylene (3 LPE) coating around the joint such that a surface area of 60 mm diameter is exposed.
9. Position a plastic funnel around the exposed area such that about 5mm wide coating remains inside the plastic funnel. Place M-Seal around the plastic funnel to prevent leakage of encapsulation materials.
10. Seal the exposed are by pouring Epoxy and hardener mixture (10:1) by volume in the funnel so as to achieve electrical insulation and bonding.
11. After Pin Brazing check pipe coating using Holiday detector.
12. After completing total work check the natural Pipe to soil potential using Multimeter & Reference electrode.
13. The inspection will be recorded on inspection / installation formats.
14. The Required PIN Brazing Kit comprising the following equipment shall be mobilized by the Contractor.

- Pin Brazing Machine Kit
- Tool Box
- Dobefill 6o Epoxy & Harder 758 Resin & M-Seal / Beck Seal.
- Grinder, West Cloth
- Holiday Detector & Multi Meter & Portable Reference Electrode

B. SAFETY REQUIREMENTS & PRECAUTIONS FOR PIN BRAZING.

1. Required Risk assessment be carried out, Risks to be Identified and Mitigation measures be put in place prior to start-up of the job.
2. Required Job Safety Analysis Training to be provided for the Working Personnel.
3. Before start the work check materials inspection test certificate & shipment release note
4. Prior to shifting to site, the cable will be inspected for mechanical damage.
5. Check using pins are supplied from original supplier only.
6. Cables are to be of sufficient length so as to reach the termination point without any joint providing sufficient loop for future maintenance purposes.
7. The distance between two cable-to-cable connections shall be a minimum of 300 mm.

8. Any damage to coating or pipe metal should be brought to the notice of engineer/supervisor/inspector so that requisite corrective actions may be taken.
9. All cables are to be appropriately tagged
10. One set of drawing/documents should be kept by site supervisor at work place

SPEC – A: DETAILED SPECIFICATIONS OF TEST STATION

DESCRIPTION	SPECIFICATIONS
Enclosure Box	Not less than 3 mm MS sheet steel fabricated weather proof type IP:55 rating with canopy and shall be suitable for 1 No.s of MS pipe post mounting with not less than 300 mm (L) × 300 mm (H)
Support Pipe	Not less than 100 mm diameter 4.5 mm thickness MS pipe of class B rating with a length of 1275 mm
Support Pipe bend	Not less than 100 mm diameter 4.5 mm thickness MS pipe of class B rating
Cable entries	Through Support pipes and bends
Door	Hinged lockable door with neoprene rubber gasket
Terminals and Terminal Board	8 mm phenolic hylem sheet with 30 % spare terminals with SS bolts and nuts.
Surface Painting	Sand blasted SA 2.1/2 , one coat of Zinc phosphate, one coat of zinc chromate primer and two coats of epoxy for Box enclosure (both inner and outer sides), Support pipe and bend
Paint	Siemens Light Grey 631
Connecting link	Removable copper link not less than 3 mm thickness for circuit isolation
Terminal Configuration	12 terminals
Test Certificates	Necessary test certificates to be provided at the time of supply.

SPEC – B : DETAILED SPECIFICATIONS OF POLARIZATION CELL TEST STATION

DESCRIPTION	SPECIFICATIONS
Enclosure Box	Not less than 3 mm MS sheet steel fabricated weather proof type IP:55 rating with canopy and shall be suitable for MS pipe post mounting with not less than 400 mm (L) × 400 mm (H)
Support Pipe	Not less than 100 mm diameter ,4.5 mm thickness MS pipe of class B rating with a length of 1275 mm
Support Pipe bend	Not less than 100 mm diameter, 4.5 mm thickness MS pipe of class B rating
Cable entries	Through Support pipes and bends
Door	Hinged lockable door with neoprene rubber gasket
Terminals and Termina Board	Not less than 8 mm thickness phenolic hylam sheet with 30 % spare terminals with SS bolts and nuts. At least five connecting links to be provided for connecting pipe cable to one terminal of polarization cell housed inside the test station and also connecting zinc grounding cell to other terminal of polarization cell
Surface Painting	Sand blasted SA 2.1/2, one coat of Zinc phosphate, one coat of zinc chromate primer and two coats of epoxy for Box enclosure (both inner and outer sides), Support pipe and bend
Paint	Siemens Light Grey 631

SPEC – C : DETAILED SPECIFICATIONS OF CABLES

DESCRIPTION	SPECIFICATION		
GENERAL			
SERVICE VOLTAGE	1100 V	1100 V	1100 V
RELAVENT STANDARD TO WHICH CABLE CONFORMED	IS7098(PT-I); IS 8130/84; IS5831/84	IS 7098(PT-I); IS 8130/84;IS5831/84	IS 7098(PT-I); IS 8130/84;IS 5831/84
TYPE	2XWY	2XWY	2XWY
LENGTH MARKING	SEQUENTIAL LENGTH MARKING ON OUTER SHEATH OF CABLE AT EVERY ONE METER INTERVAL	SEQUENTIAL LENGTH MARKING ON OUTER SHEATH OF CABLE AT EVERY ONE METER INTERVAL	SEQUENTIAL LENGTH MARKING ON OUTER SHEATH OF CABLE AT EVERY ONE METER INTERVAL
MINIMUM BENDING RADIUS OF THE CABLE	NOT LESS THAN12 TIMES OF OUTER SHEATH DIAMETER	NOT LESS THAN12 TIMES OF OUTER SHEATH DIAMETER	NOT LESS THAN12 TIMES OF OUTER SHEATH DIAMETER
APPLICATION	FOR CATHODIC PROTECTION	FOR CATHODIC PROTECTION	FOR CATHODIC PROTECTION
CONDUCTOR			
MATERIAL	ANNEALED TINNED COPPER CONDUCTOR	ANNEALED TINNED COPPER CONDUCTOR	ANNEALED TINNED COPPER CONDUCTOR
SIZE OF CONDUCTOR	**6 SQ MM**	**10 SQ MM**	**25 SQ MM**
NUMBER OF CORES	1	1	1
NUMBER OF WIRES IN EACH CORE	NOT LESS THAN 7	NOT LESS THAN 7	NOT LESS THAN 7
DIAMETER OF CONDUCTOR	NOT LESS THAN 1.05 MM	NOT LESS THAN 1.35 MM	NOT LESS THAN 2.14 MM
SHAPE OF CONDUCTOR	STRANDED CIRCULAR	STRANDED CIRCULAR	STRANDED CIRCULAR
INSULATION			
MATERIAL	XLPE COMPOUND	XLPE COMPOUND	XLPE COMPOUND
THICKNESS (NOMINAL/MINIMUM)	NOT LESS THAN 1.0/0.8 MM	NOT LESS THAN 1.0/0.8 MM	NOT LESS THAN 1.20/0.98 MM
COLOUR OF CORE	NORMAL	NORMAL	NORMAL
ARMOUR			
MATERIAL	GALVANISED STEEL WIRE	GALVANISED STEEL WIRE	GALVANISED STEEL WIRE
SIZE OF WIRE	NOT LESS THAN 1.4+/-0.04 MM	NOT LESS THAN 1.4+/-0.04 MM	NOT LESS THAN 1.4+/-0.04 MM
OUTER SHEATH			
MATERIAL	EXTRUDED TYPE ST-2 PVC COMPOUND	EXTRUDED TYPE ST-2 PVC COMPOUND	EXTRUDED TYPE ST-2 PVC COMPOUND

THICKNESS (NOMINAL/MINIMUM)	NOT LESS THAN 1.24 MM	NOT LESS THAN 1.24 MM	NOT LESS THAN 1.24 MM
COLOUR OF OUTER SHEATH	YELLOW	YELLOW	YELLOW
OVERALL DIAMETER	NOT LESS THAN 10.65+/-2 MM	NOT LESS THAN 11.45+/-2 MM	NOT LESS THAN 14.22+/-2 MM
ELECTRICAL PARAMETERS			
MAXIMUM DC RESISTANCE OF CONDUCTOR	NOT MORE THAN 3.08 OHM/KM	NOT MORE THAN 1.84 OHM/KM	NOT MORETHAN 0.734 OHM/KM
HIGH VOLTAGE TEST	CAN WITHSTAND 3 KV FOR 5 MINUTES	CAN WITHSTAND 3 KV FOR 5 MINUTES	CAN WITHSTAND 3 KV FOR 5 MINUTES
OTHER REQUIREMENT			
TEST CERTIFICATE	OEM TEST CERTIFICATE SHALL BE PROVIDED		

SPEC - D: DETAILED SPECIFICATIONS OF SPARK GAP ARRESTOR

DESCRIPTION	SPECIFICATIONS
Application	For bridging insulating joints, insulating flanges etc in cathodic protected pipe sections
Area of application	For lightning equipotential bonding in hazardous Areas
Type of connection	For indirect connection/earthing of functionally separate parts of installations when being affected by lightning
Type of enclosure	Corrosion-resistant enclosure of zinc die casting with plastic cover
Lightning impulse current (10/350 s)	Not less than 50 KA
Nominal discharge current (8/20 s)	Not less than 100 KA
100% lightning impulse spark over voltage	≤ 2.5 KV
Power frequency spark over voltage at 50 Hz	≤ 1.2 KV
Operating temperature range (T_U)	-20° C to +80° C
Degree of protection	IP 54
Length of enclosure	Not less than 90 mm
Diameter of enclosure	Not less than 60 mm
Type of connecting cable	25 Sqmm flexible copper cable with cable lug M10 hexagon screw, nut and spring washer
Length of connecting cable	Not less than 300 mm
Type of protection	II 3 G EEx nC II T4
Standards	IEC 62305
Accessories	Pair of angled connection brackets for each surge diverter with 12 mm diameter hole to connect flange bolt.
Test Certificates	Necessary test certificates to be provided at the time of supply.

SPEC - E : DETAILED SPECIFICATIONS OF POLARISATION CELL

DESCRIPTION	SPECIFICATIONS
Type of cell	Twin plate type
Plate material	Stainless steel
Cell Enclosure	Acrylic cell enclosure
Cell Housing	In vandalism proof housing and shall have good ventilation to atmosphere.
Rated capacity for ½ second	Not less than 5000 Amperes
Rated Capacity amperes ² second (I^2t)	Not less than 1.25 × 10 7 Ampere-Seconds
Rated steady state AC amperes	Not less than 10 Amperes
Steady state AC amperes for 50 ° F Rise	Not less than 30 Amperes
Number of Plates	5
DC Ampere Hours from high to low solution level	Not less than 1600 Amperes
Potassium Hydroxide (KOH) required	0.43 Kg (15 oz)
Mineral oil required	180 cc (6 oz)
Approximate water required for mixing	1.4 Liters (3 Pt.)
Water to add from Low to high level	0.65 Liters (22 oz)
Complete cell weight	Not more than 2.84 Kg (6¼ Lb)
Cable terminals	Copper
Nominal Dimensions	Not more than 273mm (H) × 209mm (w) × 165mm (D)

SPEC - F: DETAILED SPECIFICATIONS OF MAGNESIUM ANODE

DESCRIPTION	SPECIFICATIONS
Type of anode	Prepacked Magnesium Anode
Galvanic material	Magnesium
Net weight of Active Zinc	Not less than 7.7 Kg
Composition of Anode	Aluminium -0.01%, Manganese – 0.5 – 1.3%. Copper - 0.02%, Iron-0.03%, Nickel– 0.001%, Silicon-0.05%, Other Metallic Elements – 0.3% and remaining Magnesium
Active Anode cross section dimensions	Not less than 120 mm × 430 mm
Length of active Anode	Not less than 430 mm
Anode Insert Core	8 / 10 mm TOR Rod-Electro Galvanised
Anode Cable connection	Silver Soldered Connection to TOR
Anode Tail Cable Size	1C × 25 sqmm copper cable
Anode Tail Cable Insulation	Unarmoured PVC /XLPE
Anode Tail Cable shielding	PVC / XLPE
Anode Tail Cable Length	Not less than 25 meters
Anode cable joint insulation	Epoxy sealed
Dimensions of cotton bag encasement required for packing anode and backfill	Not less than 610 mm (L) × 190 mm (w)
Backfill Mixture	Gypsum – 75%, Bentonite -20% and Sodium Sulphate - 5%
Prepacked anode gross weight	Not less than 20 Kg
Anode open circuit potential	1.5 Volts
Anode Consumption rate	Not more than 7.7 Kg/Amp-year (Max)
Anode utilization factor	0.85

SPEC - G : DETAILED SPECIFICATIONS OF ZINC ANODE

DESCRIPTION	SPECIFICATIONS
Type of anode	Prepacked Zinc Anode
Galvanic material	Zinc
Net weight of Active Zinc	Not less than 10 Kg
Composition of Anode	Aluminium -0.005%, Cadmium-0.003%. Copper -0.002% Iron-0.0014%, Lead– 0.003% and remaining Zinc
Active Anode cross section dimensions	Not less than 45 mm × 45 mm × 1500 mm
Length of active Anode	Not less than 1500 mm
Anode Insert Core	8 / 10 mm TOR Rod-Electro Galvanized
Anode Cable connection	Silver Soldered Connection to TOR
Anode Tail Cable Size	1C × 25 sqmm copper cable
Anode Tail Cable Insulation	Unarmoured PVC /XLPE
Anode Tail Cable shielding	PVC / XLPE
Anode Tail Cable Length	Not less than 25 meters
Anode cable joint insulation	Epoxy sealed
Dimensions of cotton bag encasement required for packing anode and backfill	Not less than 2000 mm (L) × 200 mm (w)
Backfill Mixture	Gypsum – 75%, Bentonite -20% and Sodium Sulphate – 5%
Prepacked anode gross weight	Not less than 70 Kg
Anode open circuit potential	1.1 Volts
Anode Consumption rate	Not more than 11.24 Kg/Amp-year (Max)
Anode utilization factor	0.85

SPEC - G : DETAILED SPECIFICATIONS OF TR UNIT :

SPECIFICATIONS

Annexure-I

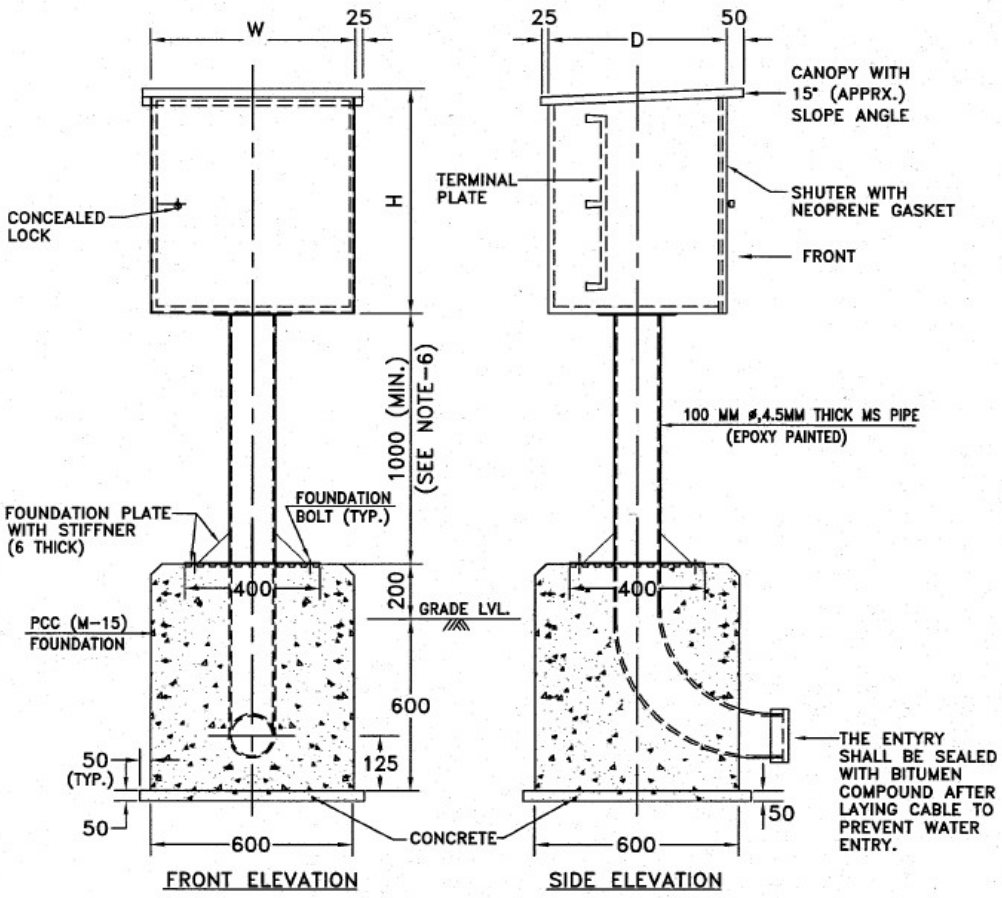
1. 25V, 25A AC OPERATED AUTOMATIC CP RECTIFIER UNIT :

Item	:	Auto/Manual Controlled C.P. Rectifier Unit
Input	:	240V ± 10%, 1Ph, 50 Hz., AC
Output	:	0 to 25V, 0 to 25A DC
Control	:	a) Automatic PSP Control Mode b) Constant Voltage/Constant Current (AVCC) type **Manual control**
Standard Indications	:	1. AC Supply ON 2. Unit working in Auto Mode 3. Unit working in AVCC Mode 4. Underprotection 5. Overprotection 6. Current Limit (Overcurrent) 7. Ref fail
Standard Metering	:	**48mm X 96mm Digital meters for** a) AC Input Voltage b) AC Input Current c) DC Output Voltage d) DC output Current e) Digital meter with 10 Meg Impedance for- P.S.P.
Protection	:	- HRC fuses in AC Input - HRC fuses in DC Output - MCB in AC Input - MCB in DC output - Lightning Arrestors at Input & Output - Surge suppressors at Input & output and across each Diode/SCR - Fast acting Electronic Overcurrent/Overload protection
No. of Ref Inputs	:	**Three.** Manually operated Reference selector switch will be provided to select any desired Reference Electrode out of three, for Monitoring and Control.
Facility for Remote Monitoring through SCADA	:	**NA**
Current Interruption	:	Current interruption facility will be provided by means of a built-in contactor & microprocessor based digital timer with ON/OFF time display. The timer will have facility for adjusting the ON time & OFF time from **1 to 99.9 sec.** by means of keypad. Timer will have START, STOP facility thru local keypad. **The Timer will be GPS Syncronisable type.**
Construction	:	Floor mounted Outdoor type. To be fabricated from 2.5mm M.S. sheet. Confirming to **IP 55** degree of protection. Lockable doors shall be provided in the front and back. Natural Air Cooled (AN)
Finish	:	Surface preparation by degreasing, cleaning & phosphatising by Industry standard Seven Tank pre-treatment process. Final finish of High durability Powder coating of shade RAL 7032 (Siemens Grey). **(DFT of powder coating will be about 100-125 Microns)**

LIST OF APPROVED MAKES FOR CATHODIC PROTECTION

DESCRIPTION	MAKE
Cables	UJALA, NITCO, BROOKS, NICCO, CMI, KEI, RELIANCE SATELLITE CABLES, EVERSHINE TORRENT CABLES UNIVERSAL ASSOSIATED FLEXIBLE & WIRES
Junction Box	EXPROTECTA, BALIGA, FLEXPRO, FCG, FFLP CONTROL GEARS, STERLING, SUDHIR
Anodes	SCIENTIFIC METAL ENGINEERS PRIVATE LIMITED, KARAIKUDI PSL HOLDINGS PRIVATE LIMITED, MUMBAI CATHODIC CONTROLS, BANGALORE BHE, BHOPAL, NIPPON COROSSION JAPAN AFIC, KSA PLATT BROS. AND COMPANY USA YUXI CHINA, WILSON WALTON INTERNATIONAL XIANG METAL CHINA, SHUNRUI CHINA IMPALLOY INTERNATIONAL, CORRPRO INTERNATIONAL HOCKWAY UK, NAKABOTHEC JAPAN, SHAKTI ENTERPRISE, VIJAY CORROSION TECHNOLOGY
Portable Reference Cell	M.C.MILLER, USA; TINKER – RASOR,USA; BORIN MANUFACTURER, USA
Surge Diverters	DEHN – SOHNE, OBO CORRPRO INTERNATIONAL
Polarisation cells	KIRK CORP, DAIRYLAND CORRPRO INTERNATIONAL
Heat Shrink Cap For Anode To Cable Joint	M/S RAYCHEM, USA, M/S MATCOR (USA)
Anode Backfill Material	M/S LORESCO, USA; M/S GOA CARBON (GOA), M/S INDIA CARBON (CALCUTTA), M/S PETROCARBON & CHEMICAL COMPANY (HALDIA)
Pin Brazing	M/S SAFE TRACK; M/S BAC, UK
RF IJ Tester	M.C. MILLER, USA; TINKER – RASOR, USA
Cable Jointing Kit	3M / RAYCHEM / DENSON / COMPAQ

DRG – 1 : TEST STATION WITH FOUNDATION DETAILS

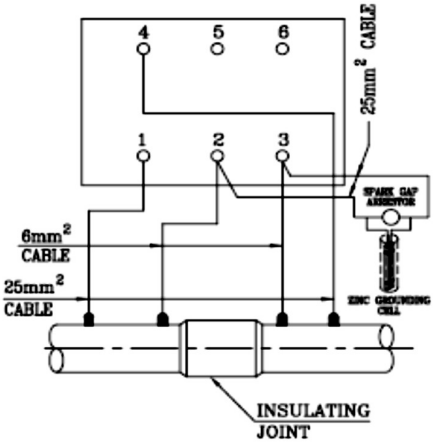


NOTES :-

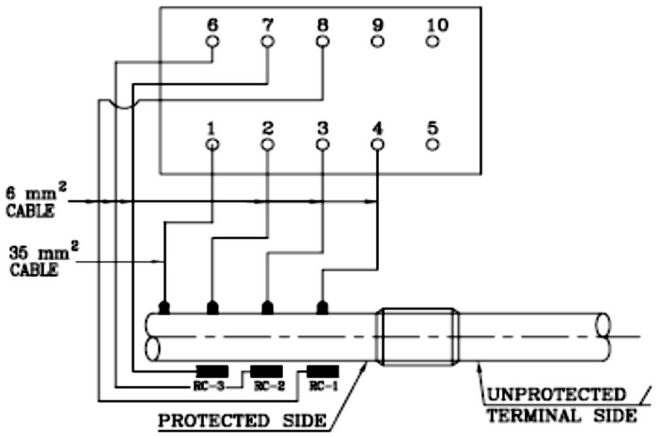
1. THE SHUTTER SHALL BE HINGED TYPE WITH CONCEALED LOCK & SHALL HAVE DOOR GASKET TO MAKE THE TEST STATION WEATHER PROOF (IP:55)
2. THE INNER & OUTER SURFACE OF THE TEST STATION SHALL BE EPOXY PAINTED.
3. THE NAME PLATE SHALL BE OF ANODISED ALUMINIUM WITH BLACK BACKGROUND & WHITE LETTERS & SHALL BE FIXED TO THE INNER SIDE OF SHUTTER.
4. TEST STATION SHALL BE ERECTED WITH THEIR SHUTTERS PARALLEL TO THE LINE OF AXIS & FACING THE PIPE LINE.
5. THE CHAINAGE OF TEST STATION SHALL BE WRITTEN WITH BLACK PAINT ON THE OUTER SIDE OF THE FRONT SHUTTER.
6. HEIGHT OF THE TEST STATION SHOWN ABOVE GROUND LEVEL IS MINIMUM ONLY. THE ACTUAL HEIGHT SHALL BE DECIDED BASED ON LOCAL FLOOD LEVELS TO BE ASCERTAINED.
7. CONTRACTOR SHALL FURNISH ALL THE DIMENSIONS OF THE TEST STATION.
8. ALL THE DIMENSIONS ARE IN MM.

DRG1A : TEST STATION CONNECTIONS SCHEMES

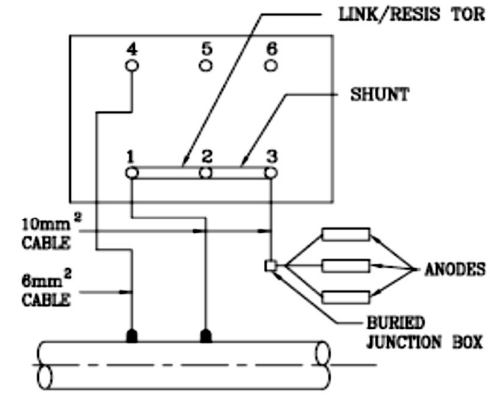
–



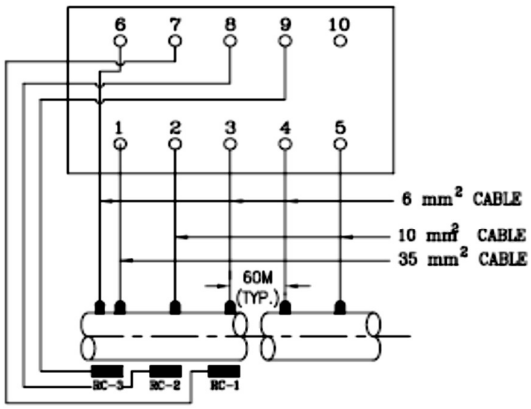
INSULATING JOINT
(CONNECTION SCHEME–F)



TERMINAL STATION
CURRENT DRAINAGE POINT FOR PCP
(CONNECTION SCHEME–G)



TCP GALVANIC ANODE INSTALLATIO
(CONNECTION SCHEME–I)

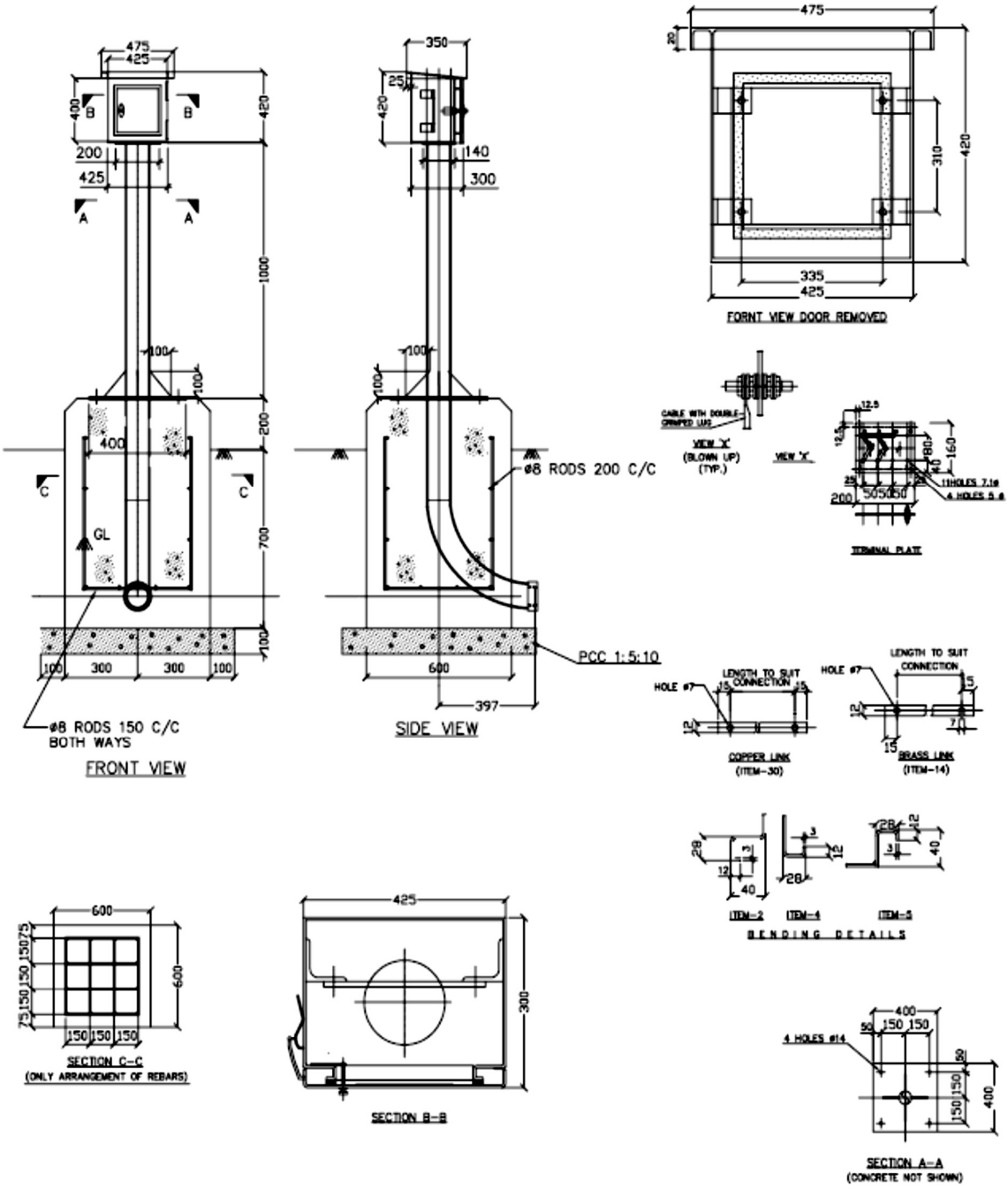


INTERMIDEIATE STATION
INPRESSED CURRENT DRAINAGE POINT
(CONNECTION SCHEME–J)

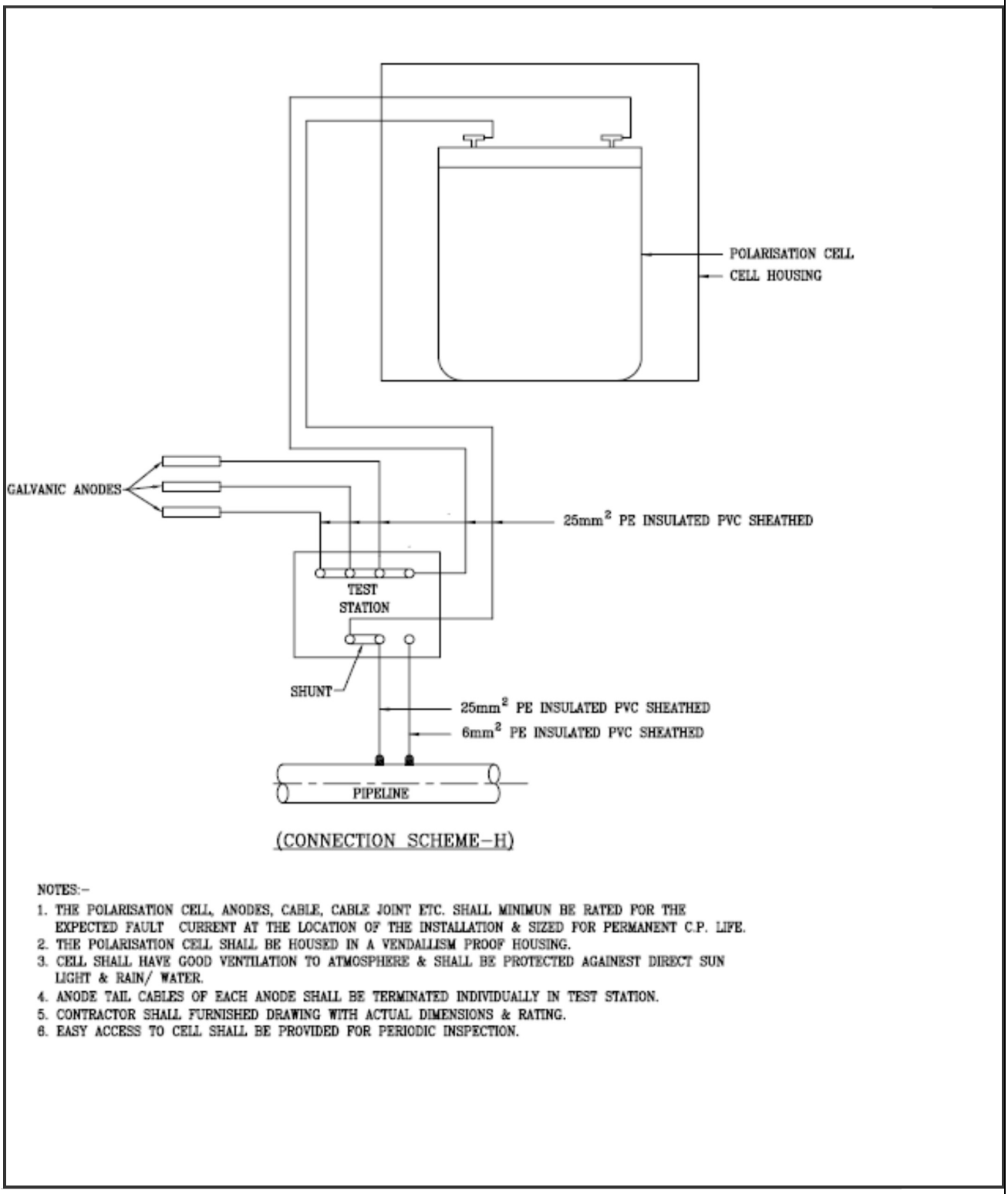
NOTES:–

1. TEST STATION FOR CONNECTION SCHEME – A SHALL HAVE 4 NOS. OF TERMINALS, FOR CONNECTION SCHEME – B,C,D,E,F & I SHALL HAVE 6 TERMINALS & FOR CONNECTIONS SCHEME – G & H SHALL 10 TERMINAL. TEST STATION FOR ANY OTHER SCHEME SHALL PREFERABLY BE SIMILAR TO ANY OF THE ABOVE TYPE.
2. ELECTRIAL CONNECTIONS SHALL BE CLEAN TO BRIGHT SURFACE & TIGHTEND WITH NONOXIDE GREASE APPLIED ON MECHANICALLY MATED SURFACE.
3. NUMBER OF TERMINALS FOR TEST STATION FOR GALVANIC ANODES FOR PERMANENT CP SHALL BE DECIDED BASED ON NUMBER OF ANODES.

DRG – 2 : TEST STATION FOR POLARISATION CELL



DRG – 2A : GROUNDING THROUGH POLARISATION CELL & GALVANIC ANODE

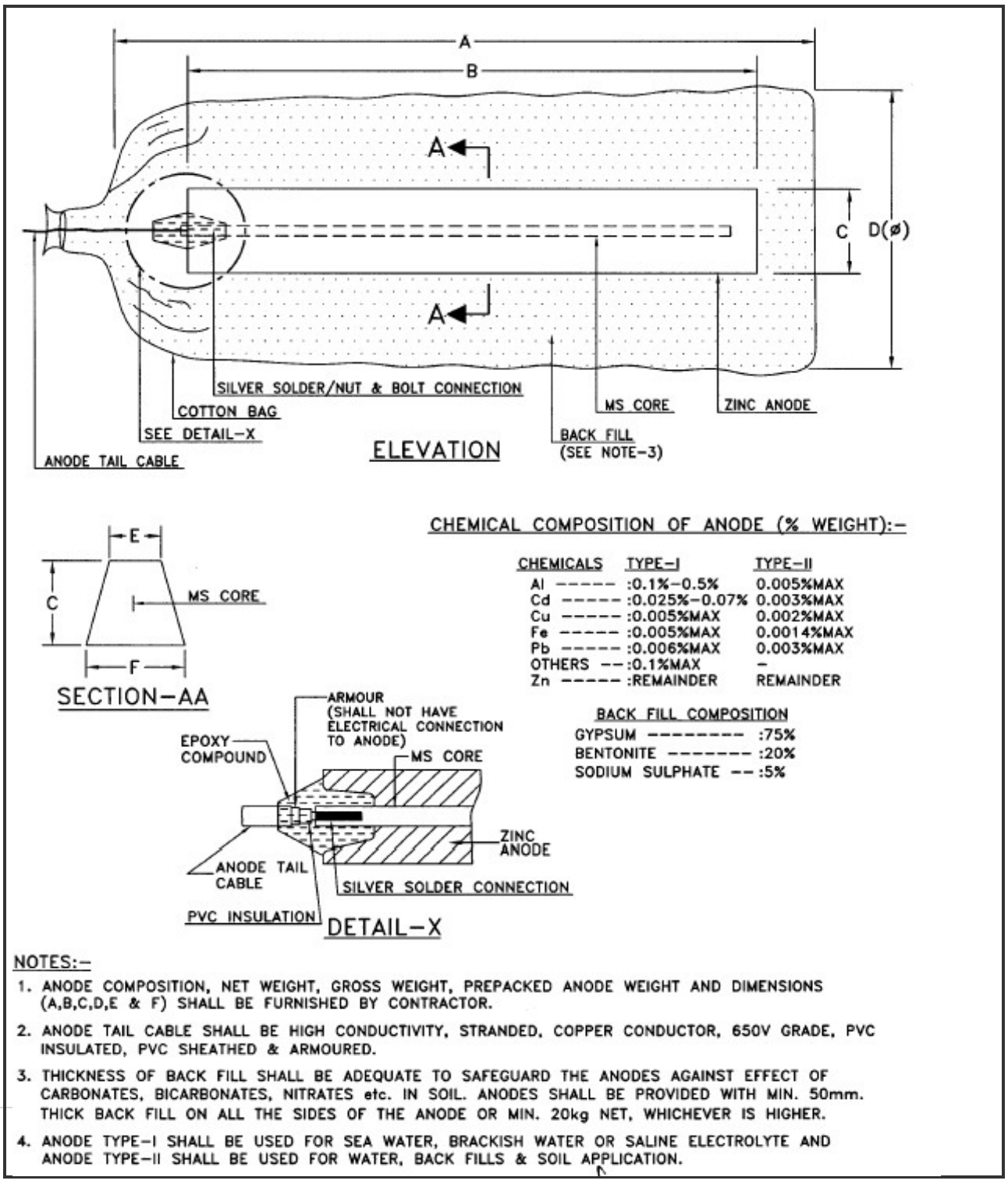


(CONNECTION SCHEME–H)

NOTES:–

1. THE POLARISATION CELL, ANODES, CABLE, CABLE JOINT ETC. SHALL MINIMUN BE RATED FOR THE EXPECTED FAULT CURRENT AT THE LOCATION OF THE INSTALLATION & SIZED FOR PERMANENT C.P. LIFE.
2. THE POLARISATION CELL SHALL BE HOUSED IN A VENDALISM PROOF HOUSING.
3. CELL SHALL HAVE GOOD VENTILATION TO ATMOSPHERE & SHALL BE PROTECTED AGAINEST DIRECT SUN LIGHT & RAIN/ WATER.
4. ANODE TAIL CABLES OF EACH ANODE SHALL BE TERMINATED INDIVIDUALLY IN TEST STATION.
5. CONTRACTOR SHALL FURNISHED DRAWING WITH ACTUAL DIMENSIONS & RATING.
6. EASY ACCESS TO CELL SHALL BE PROVIDED FOR PERIODIC INSPECTION.

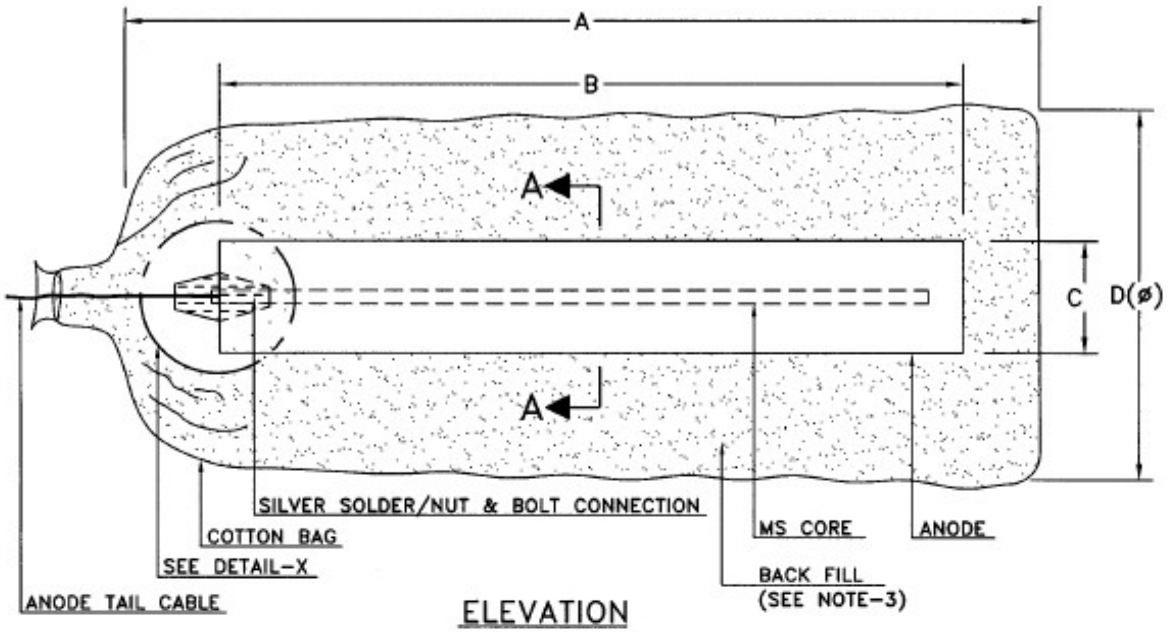
DRG – 3 : PREPACKED ZINC ANODE



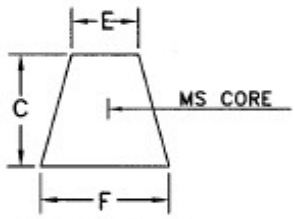
NOTES:-

1. ANODE COMPOSITION, NET WEIGHT, GROSS WEIGHT, PREPACKED ANODE WEIGHT AND DIMENSIONS (A,B,C,D,E & F) SHALL BE FURNISHED BY CONTRACTOR.
2. ANODE TAIL CABLE SHALL BE HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR, 650V GRADE, PVC INSULATED, PVC SHEATHED & ARMOURED.
3. THICKNESS OF BACK FILL SHALL BE ADEQUATE TO SAFEGUARD THE ANODES AGAINST EFFECT OF CARBONATES, BICARBONATES, NITRATES etc. IN SOIL. ANODES SHALL BE PROVIDED WITH MIN. 50mm. THICK BACK FILL ON ALL THE SIDES OF THE ANODE OR MIN. 20kg NET, WHICHEVER IS HIGHER.
4. ANODE TYPE-I SHALL BE USED FOR SEA WATER, BRACKISH WATER OR SALINE ELECTROLYTE AND ANODE TYPE-II SHALL BE USED FOR WATER, BACK FILLS & SOIL APPLICATION.

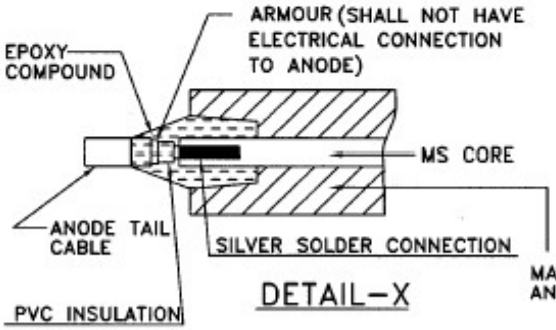
DRG – 4 : PREPACKED MAGNESIUM ANODE



ELEVATION



SECTION–AA



DETAIL–X

CHEMICAL COMPOSITION OF ANODE (%WEIGHT):–

ELEMENT	HIGH POTENTIAL TYPE	LOW POTENTIAL TYPE
Al	0.01(max)	5.3–6.7(max)
Mn	0.5–1.3	0.15–0.7
Cu	0.02(max)	0.02(max)
Fe	0.03(max)	0.003(max)
Ni	0.001(max)	0.002(max)
Zn	–	2.5–3.5
Si	0.05(max)	0.1(max)
Ca	–	–
OTHER METALLIC ELEMENTS		
–EACH	0.05(max)	
–TOTAL	0.3(max)	0.3(max)
Mg	BALANCE	BALANCE

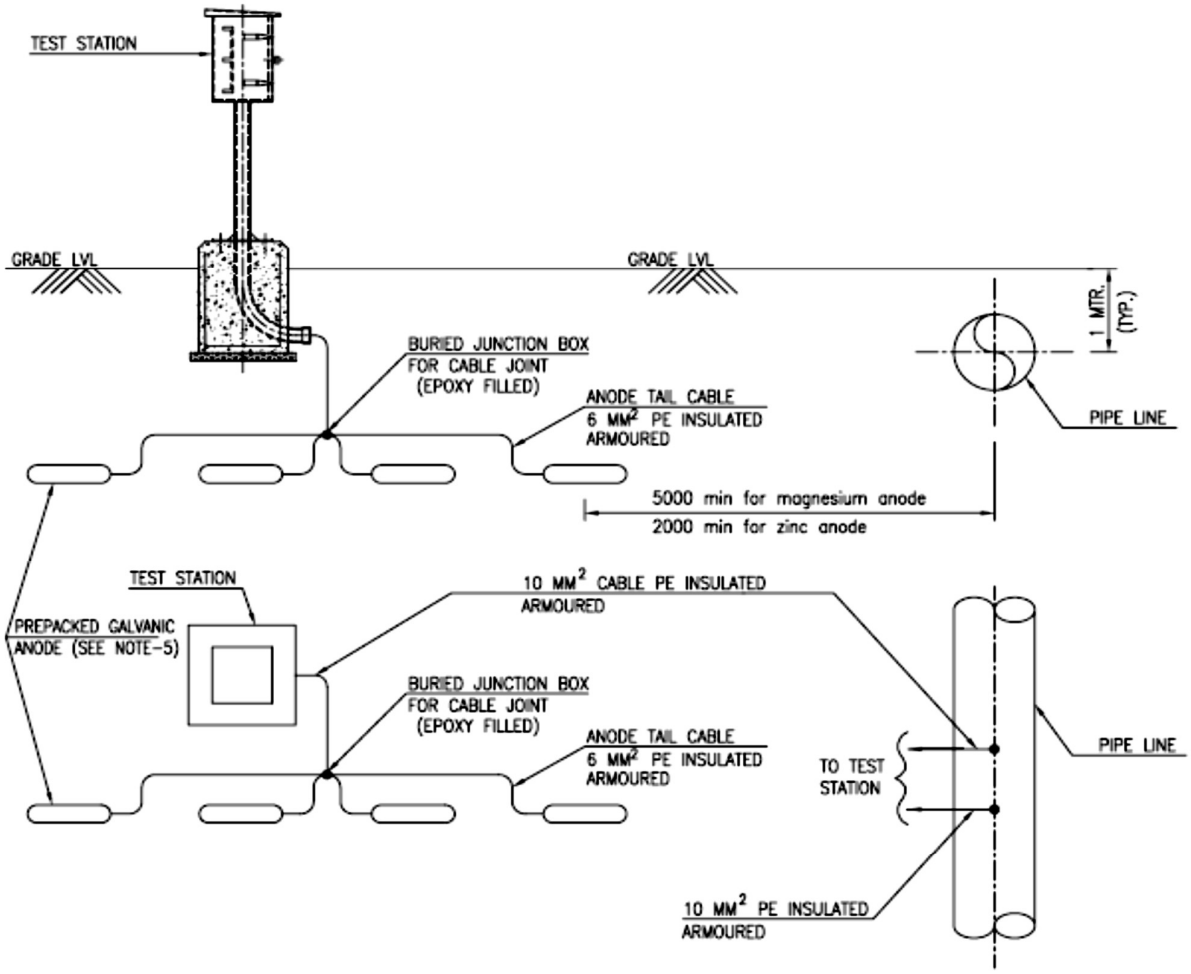
BACK FILL COMPOSITION

GYPSUM ---------- : 75%
BENTONITE---------- : 20%
SODIUM SULPHATE ---- : 5%

NOTES:–

1. ANODE COMPOSITION, NET WEIGHT, GROSS WEIGHT, PREPACKED ANODE WEIGHT AND DIMENSIONS (A,B,C,D,E & F) SHALL BE FURNISHED BY CONTRACTOR.
2. ANODE TAIL CABLE SHALL BE HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR, 650V GRADE, PVC INSULATED, PVC SHEATHED & ARMOURED.
3. THICKNESS OF BACK FILL SHALL BE ADEQUATE TO SAFEGUARD THE ANODES AGAINST EFFECT OF CARBONATES, BICARBONATES, NITRATES etc. IN SOIL. ANODES SHALL BE PROVIDED WITH MIN. 50mm. THICK BACK FILL ON ALL THE SIDES OF THE ANODE OR MIN. 20kg. NET, WHICHEVER IS HIGHER.

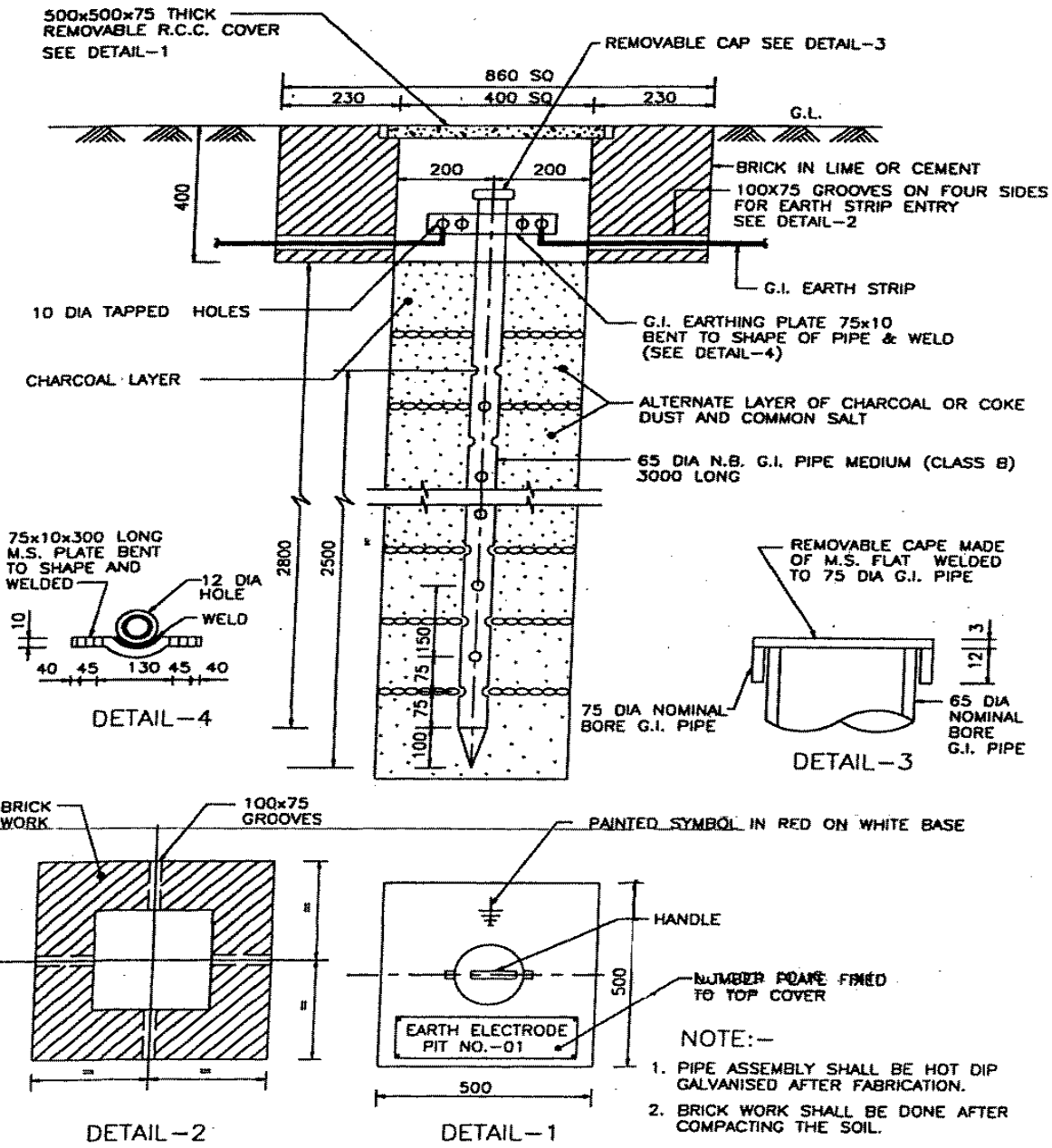
DRG – 5 : GALVANIC ANODE INSTALLATION

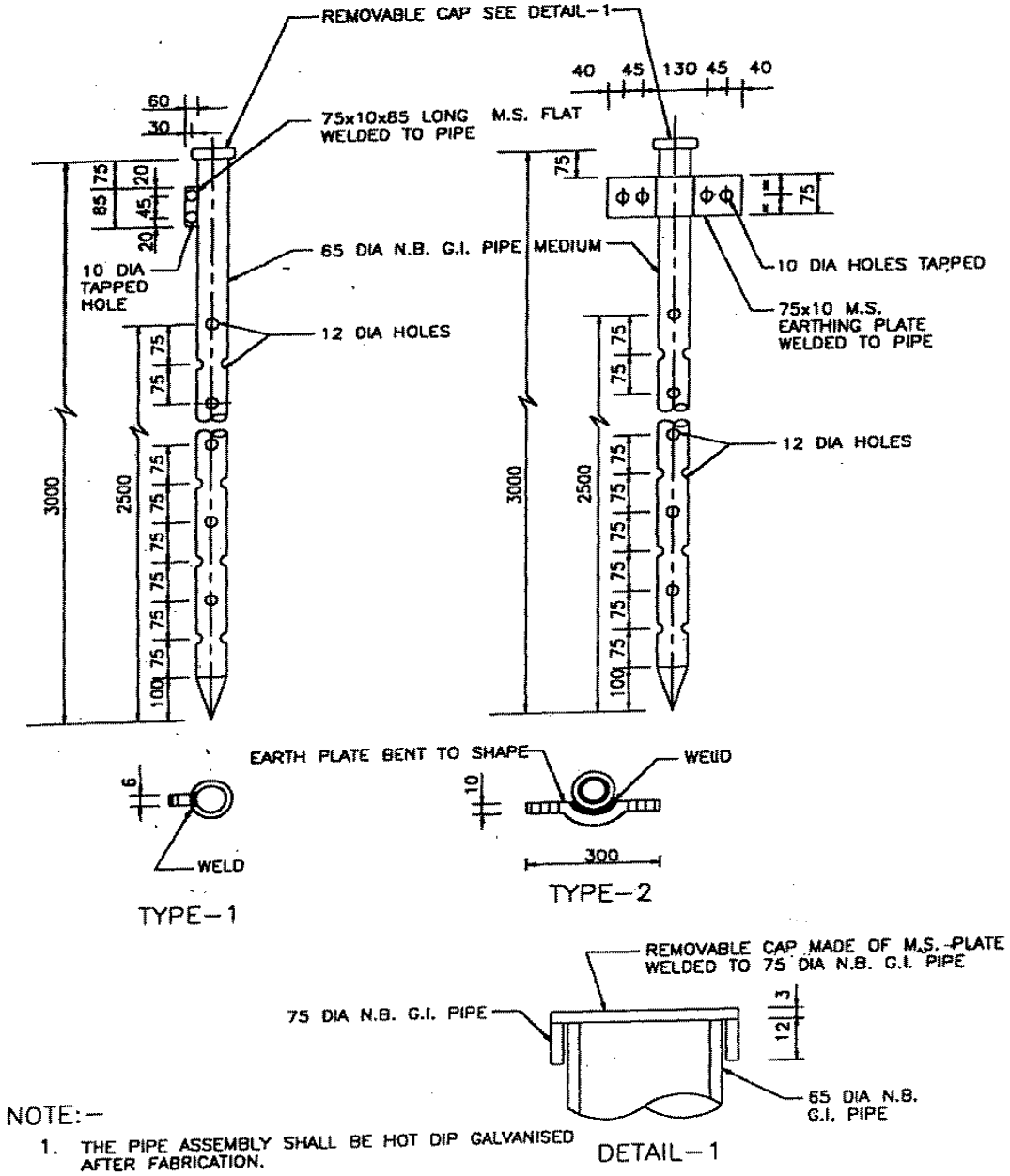


NOTES:–

1. THE PREPACKED GALVANIC ANODE SHALL BE INSTALLED AT MINIMUM DEPTH, EQUAL TO BOTTOM LEVEL OF THE PIPELINE.
2. ALL NATIVE BACKFILL SHALL BE FREE OF ROCKS, GARBAGE, PAPERS, ETC.
3. CABLE SHALL BE LAID WITH ENOUGH SLACKNESS TO AVOID DAMAGE TO CABLES DURING BACKFILLING ECT.
4. THE GALVANIC ANODES FOR PERMANENT CATHODIC PROTECTION SYSTEM SHALL BE INSTALLED IN A SIMILAR MANNER AS SHOWN. BUT ANODE TAIL CABLES OF EACH ANODE SHALL BE BROUGHT UPTO TEST STATION AND TERMINATED. NO BURIED JUNCTION BOX SHALL BE USED.
5. THE ANODES ARE SHOWN HORIZONTALLY LAID. ALTERNATIVELY THE ANODES MAY BE LAID VERTICALLY.
6. ANODE TAIL CABLE & CABLE FROM BURIED JUNCTION BOX TO TEST STATION OR TEMPERATURE C.P. ANODE MAY BE PVC INSULATED TYPE.

DRG – 6 : EARTHING





NOTE:-

1. THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.
2. UNLESS STATED OTHERWISE ON PLAN DRAWINGS, ONLY TYPE-2 SHALL BE USED.

SECTION :- 09

SCHEDULE OF RATES

BHAGYANAGAR GAS LIMITED

SCHEDULE OF RATES

Tender No: BGL/725/2026-27

Tender Name :- Annual Rate Contract for Maintenance of Cathodic Protection (CP) and associated systems at City Gas Distribution project at Hyderabad, Vijayawada and Kakinada GA's for the period of 02 Year

SOR No	DESCRIPTION	UOM	HSN/SAC CODE	Qty.			Total Qty	Unit Rate (Excl of GST)	Subtotal (Excl. of GST)
				HYD	VJW	KKD			
A	B	C	D	E	F	G	H	I	J=I*H
1	**Supply & Installation of Manual Test Station complete with lower bend and with PCC foundation including terminal plate, diagram plate, cable identification ferrules and proper cable termination with lugs, numbering of Test Station etc. as per drawing & specification (with IP55) complete in all respect and per instruction of EIC.**	**EA**		8	6	4	18		0
2	**Supply & Installation of Manual Test Station with out lower bend & without PCC foundation including terminal plate,diagramplate,cableidentificationferrulesandpropercableterminationwithlugs,numberingofTestStation etc. as per drawing & specification (with IP55) complete in all respect and per instruction of EIC.**	**EA**		5	3	6	14		0

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3	**Shifting of Manual Test Station along with foundation and cable to suitable location as per instruction of EIC. (Excluding additional Cable if required).**	**EA**		7	3	4	14		0
4	**Repairing of Manual Test Stations foundation with supply and replacement of foundation bolts and nuts including labour,tools,tackles consumeables like cement, sand aggregates etc complete in all respect as per scope of work, specifications and direction of EIC.**	**EA**		8	5	5	18		0
5	**Repairing of Manual Test Stations including supply and replacement of damaged door, door locks,terminal plate ,diagramplate ,neoprene gasket, brass links cable identification ferrules etc in Manual Test Station with proper cable termination, cable jointing ,lugs with numbering of Test Station complete in all respect including labour, tools, tackles, consumeables like MS /brass bolts, nuts, washers, insulation tape etc.as per scope of work, specifications andthe direction of EIC.**	**EA**		8	8	8	24		0
6	**Supply & replacement of damaged/missing locks in Manual Test Station including labor,consumables,tools& tackles asper drawings, specifications & Instructions of EIC.**	**EA**		8	10	15	33		0
7	**Supply & replacement of damaged/missing doors in Manual Test Station including lock, neoprene gasket,diagram platelabor,consumables,tools&tackles as per drawings,specificationsand instructions of EIC.**	**EA**		10	10	10	30		0
8	**Supply & Installation of damaged / missing terminal plates (all types) with M10 brassstuds, washers, links, lugs & nuts, tools & tackles and consumables including labor asper instruction of EIC.**	**EA**		7	7	7	21		0

9	**Supply and Fixing of diagram plate in the existing test station of all types complete in all respect including labour,tools,tackles,consumeablesetc.as per scope of work specifications and the direction of EIC.**	**EA**		25	25	25	75		0
10	**Supply, installation, testing and commissioning of Anode Lead Junction Box(ALJB) including required backelite plate brass nut bolts, port type resistor & shunt arrangement, civil works with materials as per EIC.**	**EA**		3	2	1	6		0
11	**Repairing of ALJB including supply of newlocks and latch for the outer enclosure,shunt,variable resistance,brass links, ALJB doors including welding mechanical, fittings, hinges, labour, tools tackles, consumables like lugs, MS/ Brassnuts, bolts, washers, insulation tape etc complete in all respect as per approved drawings, specification and as per direction of EIC.**	**EA**		3	2	1	6		0
12	**Supply of 660/1100V grade single core, stranded tinned copper conductor cables,XLPE insulated, PVC sheathed Cable. Armoured cables of following sizes asper scope of work, specifications and direction of EIC. Size:1CX4sqmm**	**M**		35	30	30	95		0
13	**Supply of 660/1100V grade single core, stranded tinned copper conductor cables,XLPE insulated,PVC sheathed Cable. Armoured cables of following sizes asper scope of work, specifications and direction of EIC.Size:1CX6 sqmm**	**M**		40	30	100	170		0
14	**Supply of 660/1100V grade single core ,stranded tinned copper conductor cables,XLPE insulated,PVC sheathed armoured cables of following sizes asper scope of work, specifications and direction of EIC.Size:1CX10sqmm Cable.**	**M**		300	250	100	650		0
15	**Supply of 660/1100V grade single core, stranded tinned copper conductor cables,XLPEinsulated,PVCsheathed armoured cables of following sizes asper scope of work, specifications and direction of EIC.Size:1CX16sqmm Cable.**	**M**		50	20		70		0

16	**Supply of 660/1100V grade single core ,stranded tinned copper conductor cables,XLPE insulated,PVC sheathed armoured cables of following sizes asper scopeofwork, specifications and direction of EIC. Cable.Size:1CX25sqmm**	**M**		100	300	50	450		0
17	**Supply of 660/1100V grade single core ,stranded tinned copper conductor cables,XLPE insulated,PVC sheathed armoured cables of following sizes as per scope of work, specifications and direction of EIC.Size:1CX35sqmm Cable.**	**M**		175	100	50	325		0
18	**Cable laying of given Size(XLPEarmouredcable) inside the test station / overground & underground / insidethe panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable inteststation / panel,cable identification, supply & laying of bricks, sand etc including tools tackles,labour,consumables asper scope of work, specifications and the direction of EIC:Size:1Cx4SQMM**	**M**		35	30	35	100		0
19	**Cable laying of given Size (XLPE armoured cable) inside the test station / overground & under ground / inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in test station / panel, cable identification, supply & laying of bricks,sand etc including tools tackles, labour, consumables asper scope of work, specifications and the direction of EIC:Size:1Cx6SQMM**	**M**		40	30	150	220		0
20	**Cable laying of given Size (XLPE armoured cable) inside the test station / overground & under ground / inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of'cable in test station/panel,cable identification,supply & laying of bricks,sandetcincludingtools tackles,labour,consumables asper scope of work, specifications and the direction of EIC: Size:1Cx10SQMM**	**M**		300	250	100	650		0

21	**Cable laying of given Size (XLPEarmoured cable) inside the test station / over ground & under ground / inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in teststation / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables asper scope of work, specifications and the direction of EIC:Size:1Cx16SQMM**	**M**		50	35	35	120		0
22	**Cable laying of given Size (XLPEarmoured cable) inside the test station / over ground & under ground / inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in teststation / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables asper scope of work, specifications and the direction of EIC:Size:1Cx25SQMM**	**M**		100	300	100	500		0
23	**Cable laying of given Size (XLPEarmoured cable) inside the test station / over ground & under ground / inside the panel including excavation and backfilling, cable laying cable jointing above ground using copper sleeves, termination of cable in teststation / panel, cable identification, supply & laying of bricks, sand etc including tools tackles, labour, consumables asper scope of work, specifications and the direction of EIC:Size:1Cx35SQMM**	**M**		175	100	50	325		0
24	**Cable jointing / repairing of under ground cable as per approved procedure including excavation and back filling,cable jointing by cable jointing kit (raychem / equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, coppersleeves, heatshrink sleeves, feroletc.forgiven CableSizeXLPE armoured Cu cable as per scope of work , specifications and directions of EIC. Size: 1 C x 4 sq mm**	**EA**		2	2	2	6		0

25	**Cable jointing / repairing of underground cable asper approved procedure including excavation and back filling,cable jointing by cable jointing kit (raychem / equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrinksleeves, ferol etc.for given CableSizeXLPE armoured Cu cable as per scope of work , specifications and directions of EIC. Size: 1 C x 6 sq mm**	**EA**		4	2	2	8		0
26	**Cable jointing / repairing of underground cable asper approved procedure including excavation and back filling,cable jointing by cable jointing kit (raychem / equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrinksleeves, ferol etc.for given CableSizeXLPE armoured Cu cable as per scope of work , specifications and directions of EIC. Size: 1 C x 10 sq mm**	**EA**		20	7	3	30		0
27	**Cable jointing / repairing of underground cable asper approved procedure including excavation and back filling,cable jointing by cable jointing kit (raychem / equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrinksleeves, ferol etc.for given CableSizeXLPE armoured Cu cable as per scope of work , specifications and directions of EIC. Size: 1 C x 16 sq mm**	**EA**		1	1	1	3		0

28	**Cable jointing / repairing of underground cable asper approved procedure including excavation and back filling,cable jointing by cable jointing kit (raychem / equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrinksleeves, ferol etc.for given CableSizeXLPE armoured Cu cable as per scope of work , specifications and directions of EIC. Size: 1 C x 25 sq mm**	**EA**		2	2	2	6		0
29	**Cable jointing / repairing of underground cable asper approved procedure including excavation and back filling,cable jointing by cable jointing kit (raychem / equivalent), termination & identification of cables, supply of cable jointing kit & other consumable, labour, tools, tackles, copper sleeves, heat shrinksleeves, ferol etc.for given CableSizeXLPE armoured Cu cable as per scope of work , specifications and directions of EIC. Size: 1 C x 35 sq mm**	**EA**		6	2	1	9		0
30	**Making of Pipe to cable connection as per approved proedure, of all types of cable including excavation and back filling, surface preparation, pipe to cable connection by means of pinbrazing its encapsulation, holiday testing of the exposed section, labour, tools, tackles etc as per scope of work, specifications anddirection of EIC .**	**EA**		10	7	10	27		0
31	**Painting of Manual Test station including removing of old paint, rustetc, surface preparation togetthe smooth level surface, supply and application of 01 coat of ready mix redoxide primer of approved make,02 coats of ready mixed first quality paint of approved brand. (Final dry paint thickness not less than100 micron), Numbering of Test Station as per scope of work, specification and as per direction of EIC.**	**EA**		50	50	50	150		0

32	**Painting of Anode Lead Junction Box(ALJB) including removing of old paint, rustetc, surface preparation togetthe smooth level surface, supply and application of 01 coat of ready mix redoxide primer of approved make,02 coats of ready mixed first quality paint of approved brand. (Final dry paint thickness not less than100 micron), Numbering of Test Station as per scope of work, specification and as per direction of EIC.**	**EA**		3	2	2	7		0
33	**Painting of TRUnits including removing of old paint, rustetc, surface preparation togetthe smooth level surface, supply and application of 01 coat of ready mix redoxide primer of approved make,02 coats of ready mixed first quality paint of approved brand. (Final dry paint thickness not less than100 micron), Numbering of Test Station as per scope of work, specification and as per direction of EIC.**	**EA**		3	2	2	7		0
34	**Supply & replacement of copper-copper sulphate permanent refrenece cells (Make McMiller / Tinker & Rasor/ Caproco) necessary backfill material including excavation /backfilling cable laying,cable identification ferrules, labour, tools ,tackles, consumables likes and, brick, lug, Brass washers, insulationt apeetc ,complete In all respects as per scope of workdrawings, specification and direction of EIC.**	**EA**		6	3	3	12		0
35	**Supply of portableCu-CuSO4 Half cell for measuring of PSP (Pipe to Soil Potential) of Pipeline.**	**EA**		2	2	2	6		0
36	**Supply & Installation of explosion proof spark gap arrestor make across insulating joints at SV / IP / RR / teminal including required cable, lugs, nuts & bolts, labor, tools & tackles and sundry consumables**	**EA**		20	10	5	35		0

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37	**Supply, Installation and Commissioning of Polarization Cell along with the enclosure suitable for housing of PolarizationCellsinallrespectasperspecification&directionsofEngineerIncharge.(Supply of cable ,cable laying upto the test station, Cable Joint to pipe & Zn anode for grounding shall be treated as seperate, if required).**	**EA**		3	3	3	9		0
38	**Preventive Maintenance of Polarisation cells supply of KOH electroly te/Solidstatede coupler (SSD) complete in all respect to make the cell in working condition and as per specifications and instructions of EIC.**	**EA**		5	2	1	8		0
39	**Supply and installation of pre-packed Magnesium anodes with cable having weight 7.6 kg including excavation,back filling, cable laying upto test station and cable temination in test station,cable identification ferrules,with consumables labour etc. as per approved drawing, specification and direction of EIC.**	**EA**		4	2	2	8		0
40	**Supply, replacement & installation of pre packed High Silicon Chromiunm / IronSolid Anodes(22kg) of reputed make including excavation, back filling, anode to tail cable connection, cable identification, coke breeze back fill complete with labor, tools & tackles asper drawings, specifications & instructions of EIC (item is applicable for Norma lAGE not for Deep Well AGB)**	**EA**		2	2	1	5		0
41	**Supply and Installation of prepacked Zinc grounding cell 20 Kg (H-Type) including all tools,tackles, consumables, labour chemical backfill, excavation, backfilling, cable to insert joint, laying of tail cable,cable temination at TS complete and in all respect as per drawing, specification and as per direction of EIC.**	**EA**		2	2	3	7		0

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42	**Supply and Installation of pre packed Zinc Grounding Anode (Weight: 10 kg) including all tools, tackles, consumables,labour,chemical backfill ,excavation, backfilling, cable to insert joint, laying of tail cable,cable termination at TS complete and in all respect as per drawing, specification and as per direction of EIC.**	**EA**		5	5	1	11		0
43	**Supply, installation, Testing and Commissioning of Deep Well Anode Ground Bed (MMO Titanium anodes).**	**EA**		1	1	1	3		0
44	**Preventive maintenance of Anode Ground Bed -The scope of work includes necessary excavation for carrying out ground bed curing with 500 kg of common salt and water of 18 KL. The work includes necessary backfilling and restoration to the original condition asper the direction of EIC.The contractor shall measure the grounded resistance after the treatment of ground bed. The resistance of grounded after the maintenance shall be less than 01 ohm.**	**EA**		8	4	2	14		0
45	**Supply, installation, comissioning of earth pits asper scope of work & enclosed drawing and specififcations including supply and installation of of GI Pipe earth electrode, salt, charcoal, sand and brick masonary work,excavation and back filling in all type of soils and MS cover at the top.**	**EA**		10	10	20	40		0
46	**Half-yearly Monitoring of Earth pits: Resistance measuring of earth-pit, pouring of water to bring down the resistance if required, painting, numbering and cleaning of connecting nuts and bolts, etc as per directions of EIC**	**EA**		30	30	20	80		0
47	**Recharging of existing earth pits. Job includes supply of new GI Pipes, material and consumables, transportation of material and manpower, painting of top cover plates and numbering, recharg in gofearth pit by pouring sufficient salt, char coal and water in it for bringing down the circuit resistance including making, necessary excavation,back filling etc complete in all respect and as per directions of EIC.**	**EA**		6	5	5	16		0

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48	**Chamber Repair of Earth Pit. Job includes reconstruction of Earth pit chamber with raising the height of civil foundation, repair of cement plastering, painting of top cover plate sand numbering the earth pit,charging the earthpit with common salt 50 Kg and water 100L for bringing down the circuit resistance including making necessary excavation, mixing & pouring of salt & water,replacement & cleaning of connecting nuts and bolts,etc complete in all respect and as per directions of EIC**	**EA**		5	5	3	13		0
49	**Earth pit chamber MS Cover 600 X 600 X 5mm (Approx)**	**EA**		5	5	3	13		0
50	**Supply and installation of cable markers forund er ground cables and equipment asper the specifications.**	**EA**		8	8	8	24		0
51	**Carryingouton-off Close Interval Potential Logging (CIPL) Survey with Lateral Gradient at one meter interval using data logger sandstandard Cu/CuSO4 Reference Electrode and asper the specifications.**	**KM**		95	20	15	130		0
52	**Carrying out Direct Current Voltage Gradient (DCVG) / ACVG survey using standard DCVG / ACVG equipment top in point the coating defect / holidays on pipeline as per the specifications.**	**KM**		35	15	15	65		0
53	**Stray current Interference survey at railway crossing or runnig parallel to BGL Pipelines,including 24 hours data logging, data collection from railways, study the effectiveness of existing diode bonding and recommend mitigation measures / modification required at existing doide JB, at all the railway crossing sorrunning parallel as defined in scope of work with specification,design and detail engineering.**	**NUM**		4	5	5	14		0

54	**Stary current Interference survey at foreign P/L crossing or runnig parallel to BGL Pipelines,including 24 hours data logging, data collection from railways, study the effectiveness of existing diode bonding and recommend mitigation measures / modification required at existing doide JB, at all the railway crossing sorrunning parallel as defined in scope of work with specification,design and detail engineering.**	**NUM**		4	4	1	9		0
55	**Stray current Interference survey at HT crossings or runnig parallel to BGL Pipelines,including 24 hours data logging,collectionofdatafromMSEB,calculationofhumantouchandstepvoltages,measurentandcalculationofAC corrossion current and recommendation for mitigation/effectiveness of existing grounding with modification if required, at HT Line crossings /parallel sections as defined in the scope of work with design,specification and detail enggineering.**	**NUM**		5	5	10	20		0
56	**Excavation & Back filling of pipeline in all type of soils and ordinary rocks for a width of D+500 mm one ach side of pipe and exposing the pipeline from top upto 500mm below the bottom of Pipeline including the stacking of excavated earth, lead upto 50m, stacked eartht ob elevelled and neatly dressed'asper the scope of work and directions of EIC.**	**NUM**		4	4	4	12		0
57	**Coating repair, Removing the old/ damaged coating (including third party damage) /rust greese,moisture and all foreign material at defect material with scrapper,manual surface preparation using hand wire brush ,emery paper, scrappers or acombination of all processes,repairng of the coating with supply of raychem sleeves / cold applied tape/PERP/patch repair kit ,holiday testing after repair,as per the scope of work and to the entire satisfaction of EIC .Multiple patch repairing at one location with in one meter span shall be trated as single quantity only.(Compensation if required to land owners shall be in the scope of contractor)**	**M2**		5	5	5	15		0

58	**Repair & Rectification of TRUnit: To carry out break down maintenance of cathodic protection equipments likeTR units. EIC will issue instructions for breakdown maintenance to be carried out. Immediately upon receiving such orders, the contractor shall make necessary arrangements and submit schedules there of in line with the time frame given by the EIC.The scope of work includes tracing out the fault in the system, carrying out necessary repair and rectification, supply of component level spares for repairing the cards and making the unit operational in all respect. The contractor should attend the break down call within 24 Hrs.Break down maintenance will becarried out by the contractor under the guidelines and instructions of the EIC and as per drawing and manual.**	**EA**		8	2	2	12		0
59	**Quarterly Monitoring and Collection of dat are lated to CP System from Manual Test Stations along thepipelineroute including compilation and preperation of the reports in the office by a technically qualified person.Quarterly monitoring includes On-Off Potential Survey using current Interrupters once in a year. Total length of pipeline is approximately 45K mandrates to be quotedon quarterly basis. Monitoring of MTSs (approx. 60 Nos in Vijayawada CGD) are for eight quarters. Total length of pipeline is approximately 45K mandrates to be quoted on quarterly basis. Monitoring of MTSs (approx. 60 Nos in Kakinada CGD) are for eight quarters.**	**EA**		1080	400	480	1960		0
60	**Monthly Monitoring and Collection of data from TRU its including compilation and preperation of there ports in the office by a technically qualified person. Monitoring of TR units are for 24 (twenty four) months. TR unit is 3 (Three)-HYDERABAD**	**EA**		84	24	40	148		0

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61	**Half-yearly Monitoring and Collection of data related to CPSystem from Anode Ground bed including compilation and preperation of the reports in the office by a technically qualified person.Total number of anode beds in 3 NOS IN Hyderabad. and rates to be quoted on Quarter basis.Monitoring of Anode Bed sare for For Half-year.**	**EA**		6	4	4	14		0
62	**TR Unit Sapre Parts (25A/25V) :**						0		0
a	**Mandatory spares of Raychem System TRUnit: Control Card CEC 0103 A**	**EA**		5	3	3	11		0
b	**Mandatory spares of Raychem System TRUnit: Control Card CEC0104C1.**	**EA**		2	2	2	6		0
c	**Mandatory spares of Raychem System TRUnit: Control Card CEC0105D1.**	**EA**		5	4	3	12		0
d	**Mandatory spares of Raychem System TRUnit: Control Card CEC0106.**	**EA**		3	2	2	7		0
e	**Lightning Arrestors for Raychem make TRUnit.**	**EA**		7	5	5	17		0
f	**Transeducers for Raychem MAKE TRUnits (PSP, O/P Voltage, O/P Current, I/P Voltage , I/P Current)**	**EA**		1	5	3	9		0
c	**Mandatory spares of KristonSystemTRUnit:Control Card RRL-MB 01.**	**EA**		1	1	1	3		0
h	**Mandatory spares of KristonSystem TRUnit: Control Card KS-103A.**	**EA**		1	1	1	3		0
i	**MMandatory spares of KristonSystem TRUnit: Control Card KS-104C1.**	**EA**		1	1	1	3		0
j	**Mandatory spares of KristonSystem TRUnit: Control Card KS-105D1.**	**EA**		1	1	1	3		0
k	**Mandatory spares of KristonSystem TRUnit: Control Card KS-106.**	**EA**		1	1	1	3		0
l	**Mandatory spares of KristonSystem TRUnit: Control Card KS-118C.**	**EA**		1	1	1	3		0
m	**Lightning Arrestors for KristonSystemTRUnit.**	**EA**		1	1	1	3		0
n	**Transeducers for KRISTON MAKE TRUnits (PSP,O/P Voltage, O/P Current ,I/P Voltage, I/P Current)**	**EA**		1	1	1	3		0
o	**Panel Meters for KRISTON MAKE TRUnits.**	**EA**		1	1	1	3		0
p	**Mandatory spares of Raychem System TRUnit: Control Card CEC0107.**	**EA**		2	2	2	6		0

q	**Supply and Installation of mother board Suitable with TR Unit - 1KVA.**	**EA**		3	2	2	7		0
r	**Supply and Installation of Potentiometer Output/Reference voltage or current limit setter**	**EA**		3	2	2	7		0
s	**Supply and Installation of Aux / Power Transformer for TR Unit (upto 0.625 kVA)**	**EA**		3	2	2	7		0
t	**Mandatory spares of KristonSystem TRUnit: Control Card KS-118C.**	**EA**		5	5	5	15		0
u	**Supply and Installation of Ammeter suitable with TR Unit - AC 0-30 Amp.**	**EA**		3	2	2	7		0
v	**Supply and Installation of Voltmeter suitable with TR Unit - AC 0-300 Volts.**	**EA**		3	2	2	7		0
y	**Supply and Installation of reference PSP Volt Meter Suitable with TR Unit - DC 0- 30 V.**	**EA**		3	2	2	7		0
z	**Supply and Installation of GSM based ON/Off Current Intruptor with GPS interface**	**EA**		3	2	2	7		0
aa	**Supply and Installation of Contactors suitable with TR UnitAC 0-230 V.**	**EA**		3	2	2	7		0
ab	**Supply and Installation of Main Transformer for TR Unit (upto 5 kVA)**	**EA**		3	2	2	7		0
ac	**Supply and Installation of Auto Transformer for TR Unit (upto 5 kVA)**	**EA**		3	2	2	7		0
63	**Supply and Installation of Kristron Make Solid State Polarisation Cell for ACDe-coupling & AC Interference Suppression for Pipelines**	**EA**		2	2	1	5		0
64	**Design of Anode Ground Bed including Soil Resistivity Survey for specified locations**	**EA**		1	1	2	4		0

65	**CAT survey of Un-Piggable Pipelines at every 10M Interval with Field data analysis at every 500-meter interval by plotting Pipeline Map current v/s Distance on graph sheets / Field computer for immediate on-site review including recording of elevation profile of entire pipeline at 10M aswellas depth survey recording at every 10M . Submission of report along with data to BGL for each pipeline section, Dig Verification & Completion of Validation surveys, Completion of all survey work, submission of final reports and printed reports for all sections.**	**KM**		35	15	15	65		0
66	**Supply, Installation & Commissioning of Earth Pits as per scope of work & enclosed drawing and specifications including supply and installation of copper plate, GI Pipe, salt, charcoal, sand and brick masonry work,excavation and backfilling in all type of soils and MS cover at the top. (Earthing Cable/ strip extra).**	**EA**		2	2	2	6		0
67	**Supply & Laying/ Erection of 25 mm X 3 mm G.I strip at 0.50 metre below ground as strip including connection/ terminating with G.I. nut, bolt, spring, washer etc. as required.(Jointing shall be done by overlapping and with 2 sets of G.I. nut bolt & spring washer spaced at 50 mm) including all associated civil work / restoration and labour for Grid Fabrication of Existing Earth Pits as per IS 3043.**	**MTR**		100	100	100	300		0
68	**Supply and installation of Corrosion Coupon compatible to steel pipeline of 100*100 with 4 sq and 6 sq cable along with manetic switch for mrasyremen t of AC inflence on netrakized surorodingof pipeline (Polaize)**	**EA**		5	3	3	11		0
69	**Supply and installation of 1KVA, single-phase/three-phase AC-operated, automatic/manual Transformer Rectifier (TR) units for Cathodic Protection (CP) system from reputed makes such as Kristron or Raychem RPG. complete in all respects, including AC input 240V ±10% VAC, single phase, 1000 VA, frequency 50 Hz, DC output 25 Volts and 25 Amps, along with all required accessories, cabling, earthing, mounting arrangements, testing, and commissioning**	**EA**		1	1	0	2		0

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Date: 2026.04.18 18:23:04 IST

Total (Excl of GST)		0
GST%		
GST Amount		0
Grand Total Inclusive of GST		0

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Date: 2026.04.18 18:23:04 IST