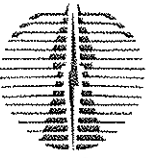


पावर ग्रिड कारपोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

POWER GRID CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)



पावरग्रिड

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संदर्भ संख्या/Ref. Number

C/ENGG/HVDC/339/1384

Date: 01.02.2010

SIEMENS AG

Power Transmission & Distribution

PHDH 121

Erlangen

Germany

Kind Attn.: Ms. Astrid Keste, Project Manager

Subject: ± 500 KV, 2500 MW HVDC Ballia Bhiwadi Bipole Terminal Package

LOA No.: C-46002-S656-1/CA-I/2316: CA-II/2317 & CA-III /2318 dated 12th March 2007.

Dear Madam,

In reference to your letter no PTDH121/P-004364/A1.1/DTS1473 dated 18.01.2010. We are herein conveying comments/ approval on the drawings/ documents listed in attached sheet. For approval/ comments code of each drawing/ documents, please refer the category indicated in remarks column.

In case of any modification other than those desired by us are carried out, the same shall be highlighted clearly in the Drawing/ Document with full justification thereof and resubmitted for approval.

Approval/ comments conveyed herein neither relieves the Contractor of his contractual obligation and his responsibilities for correctness of dimensions, material of constructions, weight, quantities, design details, assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the Purchaser's right under the Contract.

Thanking you,

Yours faithfully

(R.K. Chauhan)
GM (Engg-HVDC)

S.N.	Document No./ Drawing No.	Document Title	Category of Approval
1.	ED3.193.GAH/ TB-291-316-061	Equipment Specification – Silicon Rich Iron Electrodes	I

CATEGORIES: -


- * Comments to be incorporated.
- I Approved.
- II Approved with comments.
- III Returned for correction.
- IV For Information

SILICON RICH IRON ELECTRODES

Cat - I

Equipment Specification

Ground Electrode Station Ballia
Ground Electrode Station Bhiwadi

 (Signature) D. G. (Designation) 01/02/10 (Date)	I. Approved/Released for Fabrication/Construction.
	II. Approved/Released for Fabrication/Construction Subject to Incorporation of Comments, Modification as Noted. Revised Drawing Required.
	III. To Be Resubmitted for Approval after Incorporating the Comments.
	IV. For Information & Record.
Power Grid Corporation of India Ltd, Engineering (HVDC), Gurgaon (HR.)	

Ballia-Bhiwadi Project
Powergrid Corporation of India Ltd.

2500 MW HVDC Bipole Terminal Package
Contract Agreement No.: C-46002-S656-1/CA-II

Index of Revisions

Rev.	Date	Revised Items	Page	Remarks	Signature	
					Date Name of Reviser	Date Name of Approver
0	06.01.2010			First Issue	06.01.2010 Shobhna Singh	06.01.2010 A.K. Das /R. Koul

Copy

Siemens / BHEL	Quantity
PTD H121	1
Siemens Ltd.	1
BHEL	1

Owner	Quantity
Powergrid	2

Siemens, Power Transmission and Distribution

Bharat Heavy Electricals Limited

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1 Scope, Specific Technical Requirements and Quantities

1.1 Scope

This specification is intended to specify the requirements for manufacturing, inspection, testing before supply, packing and loading at works of **Silicon Rich Iron electrodes**, as mentioned in this section and in various other sections of this specification for ± 500 KV, 2500 MW HVDC Ballia - Bhiwadi Bipole Terminal Package.

Transportation from works and insurance shall be provided by SIL under separate contract.

The **Silicon Rich Iron electrode** is to be used as anode material (feeding rod) in ground electrode stations associated with both the converter stations.

The operation mode for the grounding electrode is as follows:

- Rated current (A): 2500 (ambient temperature 50°C)
- Continuous overload current (A) 2900 (ambient temperature 25°C)
- 2 hours overload current (A): 2800 (ambient temperature 50°C)
- 30 minutes overload current (A): 3100 (ambient temperature 50°C)
- 5 seconds overload current (A): 3925 (ambient temperature 50°C)
- Working life of anode design for Bhiwadi. is 40×10^6 Ah (40 Million Ampere hours)

The ground electrode design (*Bhiwadi earth electrode plane connection plot: dwg no.: B386C-A0101-002*) is enclosed herewith for reference showing the complete arrangement of Silicon rich iron electrodes in horizontal triple ring arrangement along with feeding cables of 16 sq. mm.

1.2 Bill of material

S. No.	Description	Quantity	
		Ballia	Bhiwadi
1.	Silicon Rich Iron electrodes as detailed below		
a.	Silicon Rich Iron electrodes Rod Dia= 35 mm Rod length= 2500 mm Connected with 1.1kV, 1C, 16 sq.mm. Cu conductor unarmoured, XLPE cable; cable length 4 metres.	224 Nos. #	224 Nos. #

S. No.	Description	Ballia	Bhiwadi
b.	Silicon Rich Iron electrodes Rod Dia= 35 mm Rod length= 2500 mm Connected with 1.1kV, 1C, 16 sq.mm. Cu conductor unarmoured, XLPE cable; cable length 7 metres.	224 Nos. #	224 Nos. #
c.	Silicon Rich Iron electrodes Rod Dia= 35 mm Rod length= 2500 mm Connected with 1.1kV, 1C, 16 sq.mm. Cu conductor unarmoured, XLPE cable; cable length 10 metres.	224 Nos. #	224 Nos. #
d.	Silicon Rich Iron electrodes Rod Dia= 35 mm Rod length= 2500 mm Connected with 1.1kV, 1C, 16 sq.mm. Cu conductor unarmoured, XLPE cable; cable length 13 metres.	224 Nos. #	224 Nos. #

Note: Quantity subject to a variation of $\pm 50\%$.

#224 Nos. = 218nos. (actual) + 6nos. (spare)

1.3 Terminology

The following terminology shall be applicable for the purpose of interpreting the Relevant clauses of the specification

Project title: \pm 500 KV, 2500 MW HVDC Ballia - Bhiwadi Bipole Terminal Package
Owner : Power Grid Corporation of India Limited (PGCIL)
Location of Electrode stations: 1. Mau, 30Km from Ballia
 2. Palwal, 65Km from Bhiwadi

2 Material specification

2.1 General Technical Requirements

The characteristic of silicon - rich iron electrode should be as follows:

1. Physical characteristic:
 - Resistivity at 20°C (Ωm): 0.72
 - Compressive strength (MPa): 690
 - Tensile strength (MPa): 103
 - Specific gravity (g/cm^3): 7
 - Melting point ($^{\circ}\text{C}$): 1260
 - Dilatability ($1/^{\circ}\text{C}$): 1.3×10^{-5}
2. Chemical contents:
 - Silicon: 14.20% to 15.25% (silicon content of 14.5% is preferred)
 - Manganese: $\leq 1.5\%$ (preferred $\leq 1\%$)
 - Carbon: 0.7% to 1.4%
 - Chromium: 3.25% to 5% (preferred 3.5-4.5%)
 - Molybdenum: $\leq 0.2\%$
 - Copper: $\leq 0.5\%$
 - Iron balance
3. Corrosion loss $\leq 1\text{kg/Aa}$
(1 kg per Ampere and year)

2.2 Shape & constitution

1. Cylinder cast-rods with a length of 2.5 meters and diameter shall be minimum 35 mm.
2. Each single electrode-rod must be assembled (prefabricated) at its centre or terminal spot with a current feeding cable including connectors. Cable lengths are given in table 2.2.1.7.
3. For this project the following values have been chosen:

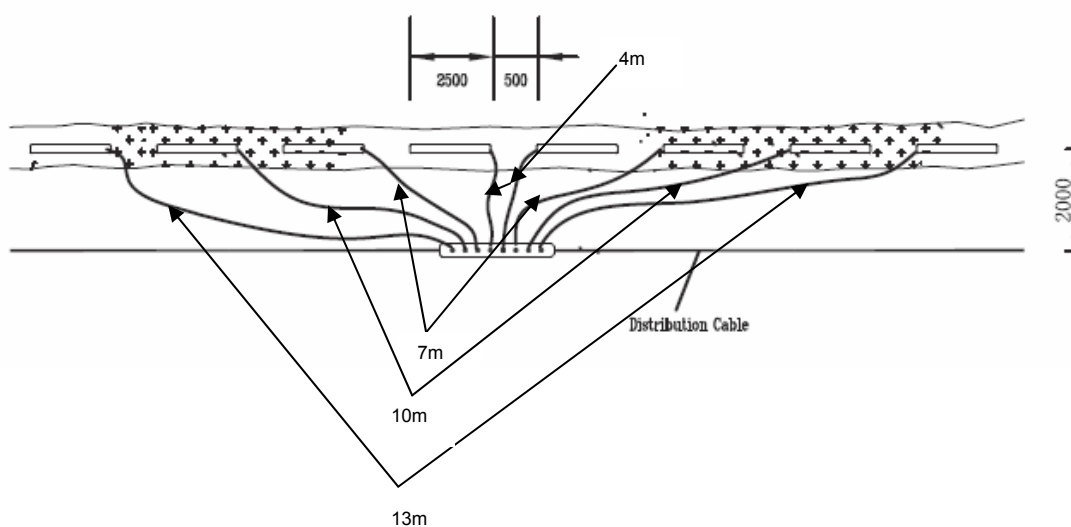
Table 2.2.1

S. no.	Parameter	Data
1.	Length of a single electrode rod	2.5 m
2.	Dia of a single electrode	35mm
3.	The assembled location for the cable on the single electrode rod	centre of front face or middle of rod length
4.	Number of single electrode rods (total per earth electrode)	872
5.	Number of single electrode rods grouped together	8
6.	Number of groups	109
7.	Cable-lengths required per group (length to be confirmed during order placement stage)	2 x 4 m 2 x 7 m 2 x 10 m 2 x 13 m

4. The rod-material surface must be smooth and shall be scratch-free and free of burr.

Figure 2.2.1

General arrangement of Single group of electrodes



Current feeding cable 16 mm² of different lengths as per table 2.2.1.7

2.3 Electrical characteristic

For each piece of single electrode rod (each 2.5 meter long) at the soil temperature at 90°C, the rod's rated load-current must not be less than 20A. Under overload conditions 35A are required. Hence a cable cross-section of minimum 16 mm² is recommended.

The cable insulation level shall be not less than 1.1 kV and its maximum working temperature tolerance not less than 90°C.

The joint-connection between the feeding piece of cable and the silicon-rich-iron electrode rod must be well firm and secure. The contact resistance has to be less than 4 mΩ and its tensile strength must be not less than 70% of the cable's failure stress.

The joint-connections must be toughly sealed without any cable cores exposed in order to avoid penetration of moisture into the insulation material and corrosion.

Each single electrode rod shall have a working life under normal conditions in anode operation of 69 kAh (kilo ampere hours).

2.4 Routine tests per lot

1. 10% or minimum 10 pieces of random sampling to be tested at their contacting resistance between the electrode rod and its assembled feeding cable.
2. 10% or minimum 5 pieces of random sampling to be tested at their resistance (R) between its two ends of the electrode rod, the results must meet: $R < 0.72 \times L \text{ (cm)} / S \text{ (cm}^2\text{)}$.
3. 5 pieces of random sampling to be tested for their damage tensile strength check.
4. During the tests of random sampling, if two pieces (or more) fail, this lot has to be abandoned; if only one piece fails, the second test (same quantity) is permitted, but all random sampling pieces for the second test must be completely passed.

2.5 Codes & Standards

Up to now there is no unique international standard or code on feeding-rod's specification (high silicon chromium steel or high silicon cast iron), for most HVDC projects purchasing efforts, reference to the following standards (cathodic protection) added with some practical engineering experience shall be made:

- ASTM B-8 and B-3, the latest edition;
- ASTM D-1248, Type I, Class C, Category 5, Grade E-4 and E-5.

2.6 Packing & delivery

1. Careful wrapping for each rod is required in order to avoid any collision or damage of single rods.
2. The rods should be packed with 40 pieces per crate fixed inside to avoid any movement.
3. Labels with item title, type, size, rods length, quantity and weight would be clearly marked on both sides of the crate.
4. Cautious handling is required during loading, shipping and unloading.

2.7 Technical data to be provided by vendor

Vendor to provide following documents/information with their offer:

- OGA of Silicon rich iron electrode (along with cable connection)
- Datasheet of 1C X 16 Sq. mm cables as per clause 1.2.
- General technical particulars confirming to clause 2.1.
- Single rod's maximum load current tolerance at 90°C.
- The rod's corrosion loss rate (Kg per ampere & year)
- Vendor to provide packing details

3 General Technical Requirements

This clause stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this clause are intended to supplement general requirements for the materials, equipments and services covered under other clause of tender documents and are not exclusive. However in case of conflict between the requirements specified in this clause and requirements specified under other clause, the requirements specified under respective clauses shall prevail.

3.1 Site Information

Table 3.1 - 1 Table for Site Information

	Particular	MAU	PALWAL
a)	Customer/ Purchaser/ Owner	Power Grid Corporation of India Ltd (PGCIL)	
b)	Project Title	±500 kV, 2500MW HVDC Ballia-Bhiwadi Bipole Terminal Package associated with Ballia Bhiwadi Transmission System	
c)	Location	MAU	PALWAL
d)	Nearest Rail Head	MAU	PALWAL
e)	Postal Address	To follow	To follow
f)	Design ambient temp.	50°C	50°C
g)	Seismic acceleration (horizontal)	Ah= 0.3g according to IS1893-part 1-2002, clause 6.4.2 for zone 4	

h)	Site Wind Pressure	As per IS-875 (Part III)-1987, Ballia and Bhiwadi converter stations lie in Zone IV with basic wind speed of 47m/s at 10m height above mean ground level. Risk level coefficient / factor = 1.07
i)	Isokeraunic Level	50 days per year
j)	Relative Humidity	Max. 100%
k)	Rain fall Intensity	In 24 hours: 250mm 30mm/hr (for drainage system Design)

3.2 Instruction to bidders

- 3.2.1 The bidders shall submit the technical requirements, data and information as per the technical data sheets provided in the appropriate clause of bid document.
- 3.2.2 The supplier shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification.
- 3.2.3 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard/substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided, shall be interchangeable with one another.
- 3.2.4 The Contractor shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the Contractor, along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the PURCHASER. The PURCHASER reserves the right to get any or all type/tests conducted/repeated.

3.3 Standards

- 3.3.1 The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.
- 3.3.2 The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards. In addition to meeting the specific requirement called for in clause 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification.

- 3.3.3 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.
- 3.3.4 The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. All equipments shall confirm to POWER GRID technical specifications and relevant IS/IEC standards as the case may be.
- 3.3.5 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
- 3.3.6 Other internationally accepted standards which ensure equivalent or better performance than the standards specified / other clauses for various equipments shall also, be accepted, however the salient points of difference shall be clearly brought out in the offer along with English language version of such standard. The equipment conforming to standards other than specified / individual clauses for various equipments shall be subject to Purchaser's/ owner's approval.
- 3.3.7 The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

3.4 Engineering data & drawings

- 3.4.1 The list of drawings/documents which are to be submitted to the purchaser shall be discussed and finalised. The contractor shall necessarily submit all the drawings/documents unless any thing is waived. The contractor shall submit 5 (five) sets of drawings/ design documents/ data/ test reports as may be required for the approval of purchaser.

3.4.2 Drawings

- 3.4.2.1 All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.
- 3.4.2.2 Each drawing submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.
- 3.4.2.3 Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

- 3.4.2.4 The review of these data by the Purchaser will cover only general conformance of the data to the specifications and documents interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Purchaser may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Purchaser shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.
- 3.4.2.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.
- 3.4.2.6 All engineering data submitted by the Contractor after final process including review and approval by the Purchaser shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Purchaser in Writing.

3.5 Approval Procedure

- 3.5.1 All technical description, specifications, literature, correspondence, prints, drawings, instruction manuals, test reports, photographs, booklets, schedules and all supplementary data or documents furnished in compliance with the requirements of the Contract, shall become the property of the Owner/Purchaser and the costs shall be considered as included in the Contract price.
- 3.5.2 The Contractor shall be responsible for any time delay, misinterpretation, error and conflict during design, manufacturing, testing and erection of the Works resulting from non-compliance with the requirements of this Specification.
- 3.5.3 The Owner/Purchaser shall have the right to make copies of any documents, data, reports, information and the like supplied by the Contractor in connection with the Works. The Owner/Purchaser shall not impart the information of these documents to any other manufacturer or competitor but he shall be free to use these for preparation of technical papers, reports etc.
- 3.5.4 The Contractor is not required to supply detailed drawings whose purpose is manufacture only but in case such information is specifically asked for by the Purchaser during evaluation of Bid, finalisation of Contract or during execution of the Contract, the Bidder/Contractor shall comply.
- 3.5.5 All drawings, documents manual etc. as specified in this clause shall have to be provided separately for each clause.

3.5.6 The Contractor shall submit consolidated list of all symbols used in any drawing, data and information under three (3) separate headings namely Civil, Mechanical & Electrical. If symbols other than IS or IEC are used the Contractor shall submit consolidated list of these symbols and their significance under a separate clause.

3.5.7 All documentation shall be in English language.

3.5.8 REQUIREMENTS FOR SUBMISSION OF DOCUMENTS, INFORMATION AND DATA BY THE CONTRACTOR

3.5.8.1 The Contractor shall submit to the Owner/Purchaser all documents in accordance with an approved schedule of submissions and shall submit any further information (in the form of drawings, documents, manuals, literature, reports etc.) when asked by the Owner/Purchaser while commenting/approving any drawings/documents etc. All applicable documents shall be provided for each converter/repeater station separately.

3.5.8.2 The documents which are subject to the approval of the Owner/Purchaser shall be identified by the Contractor with the stamp "FOR APPROVAL". All other documents shall be submitted to the Owner/Purchaser for information and shall be identified by the Contractor with the stamp "FOR INFORMATION". The schedule of submissions shall set forth which documents shall be subject to the approval of the Owner/Purchaser and which documents shall be for information & subject to comments by the Owner/Purchaser.

3.5.8.3 The sequence of submissions of all documents shall be such that the necessary information is available to enable the Owner/Purchaser to approve or comment the document, as the case may require when the documents are received.

3.5.8.4 The sequence of submission of the documents shall be subject to the approval of the Owner/Purchaser and shall be in accordance with the following procedures.

3.5.8.5 The Contractor in preparing the aforesaid schedule shall make an allowance of at least seven (7) calendar days for the delivery from the Contractor's office in India to the Purchaser and a further seven (7) calendar days for the delivery from the Purchaser to the Contractor's office in India. Otherwise the Contractor may arrange for delivery and acceptance of mail at/from Purchaser's office by hand.

3.5.8.6 The contractor shall supply the documentation system for Owner's/Purchaser's approval in five (5) hard copies for drawings and three (3) hard copies for technical reports as required. Soft copies of all documents shall also be sent by e-mail and the Purchaser will endeavour to give his approval/comments through e-mail also. On category I approval of soft copy, the contractor shall furnish five (5) sets of hard copies for stamping. After electronic approval of the documents in Category I (defined later in this clause), requisite number of hard copies of documents as detailed subsequently shall be provided. The final documentation for the project shall be supplied in five (5) sets of hard copies and seven (7) sets of CDs for each site.

3.5.8.7 The additional copies of some documents however shall be given by the contractor on demand

3.5.8.8 In case a "SUBSEQUENT" revision of any document is made due to any reason whatsoever, a revision of the same, highlighting the changes shall be submitted for Owner's/Purchaser's specific approval/ information in required number of copies as detailed earlier. After approval, such document shall be (re)submitted as per requirement of Clause 3.5

3.5.9 DOCUMENTS FOR APPROVAL

3.5.9.1 The Purchaser shall be allowed thirty (30) calendar days (exclusive of the aforesaid 14 days delivery time) to approve the Contractor's submissions. The submissions for approval shall be returned to the Contractor marked in one of the following ways:

Cat-I: Approved.

Cat-II: Approved with Comments.

Cat-III: Returned for correction.

Cat-IV: For information

3.5.9.2 The first notations "I" or "II" shall be deemed to permit the Contractor to proceed with the work shown on the document, except in the case of notation "II" the work shall be done subject to the corrections indicated thereon and/or described in the letter of transmittal. The Contractor shall bear the full responsibility for proceeding with the Works prior to receipt of the release in notation "I" from the Owner/Purchaser.

3.5.9.3 In case of notation "II", the Contractor shall include the alterations required & resubmit the document within Thirty (30) days from date of Purchaser's letter of transmittal.

3.5.9.4 In case of notation "III", the Contractor shall include the alterations required and resubmit the document to the Purchaser, within twenty one (21) days, from date of letter of transmittal, so that such document can be returned with the notation "I" or "II".

3.5.9.5 It may also be noted that the approval/commenting by the Owner/Purchaser does not relieve the Contractor of any of his contractual obligations & his responsibilities for correctness of dimensions, materials, weights quantities or any other information contained therein, as well as the conformity of designs with Indian Statutory laws and the Technical Specifications as may be applicable. The approval also does not limit the Owner's/Purchaser's rights under the Contract.

3.5.9.6 The Purchaser may notify the Contractor by telex or telefax of the approval of documents.

3.5.9.7 All copies of documents identified "FOR APPROVAL" shall bear owner's/ purchaser "APPROVED" stamp for use in the field.

3.5.9.8 When a drawing/document is approved/commented and as such stamped, a marked print shall be sent back to the Contractor. The Contractor shall then include the required alterations and resubmit prints to the Purchaser.

3.5.9.9 The following is a tentative list of the documents and drawings which shall require the approval of the Owner/Purchaser:

1. Schedule of drawings and data.
2. System Engineering studies including studies to finalize design criteria as well as equipment and station design.
3. Preliminary operating manuals.
4. Drawings and details for interfaces.
5. Equipment specifications and drawings.
6. Nameplates.
7. Quality/Inspection plans & Quality control programs.
8. Equipment test procedures.
9. Instruction manuals.
10. Control panel's, cubicle's and cabinet's master legend list.
11. Panel/cubicle layout.
12. Simplified one-line (electrical & flow) diagrams.
13. Detailed one-line diagrams.
14. Other building/equipment layout.
15. Civil work general layouts & other detailed drawings.
16. Civil works and structural design.
17. Outline general arrangement of equipments.
18. Sub-system testing, System testing & complete commissioning procedures.

3.5.9.10 These approved documents shall be considered as the working documents. However the Technical Specification and connected documents shall prevail over these documents in case a decision is required on interpretation.

3.5.10 DOCUMENTS FOR INFORMATION

Other documents required "for information" in accordance with specification shall be handled as follows and as detailed in Clause 3.5.9.

Eventual comments to such documents shall be forwarded to the Contractor through letter or telex and marked on one print, when necessary.

The Contractor shall not delay the Works pending the receipt by the contractor of the comments on documents submitted to the Owner/Purchaser for information. However, the Owner/Purchaser shall have the right to comment on all the documents submitted by the Contractor, when, in the opinion of the Owner/Purchaser the document does not comply with the Contract or otherwise. The Contractor shall satisfactorily demonstrate that the information contained in the aforesaid document does meet the requirements of the Contract or revise the document in order that the information shall comply with the requirements of the Contract.

3.5.11 DRAWINGS AND DATA

3.5.11.1 Drawings, as herein below set forth, shall be submitted to the Owner/Purchaser and shall be complete and include catalogues, leaflets and all information necessary for complete interpretation of the drawings by the Owner/Purchaser. All drawings shall show the materials, dimensions, finish, fits, clearances, tolerances, bolting and such other information as is necessary to demonstrate to the Owner / Purchaser that all items covered by the drawings are in compliance with the requirements of the Contract.

3.5.11.2 Not later than 90 (ninety) days after completion of the HVDC station commissioning and prior to take over of the Station by the Owner, the Contractor shall supply tracings of the last revision of all drawings produced for this project, stamped as "AS BUILT". These drawings, when applicable, shall show all corrections made during field commissioning.

3.5.12 INSPECTIONS PLANS AND DOCUMENTATION (for approval)

3.5.12.1 The Contractor shall submit in required number copies for the Owner's/Purchaser's approval an inspection plan (quality plan) describing the inspection system and comprising a flow chart indicating the inspections to be carried out and their sequence in the manufacturing stages.

3.5.12.2 The inspection plan shall be such that it can be related to the manufacturing program. The plan shall also include a description of the inspection methods employed with reference to the Contractor's written inspection procedures.

3.5.12.3 Separate inspection plans describing the inspection systems for equipment supplied by each sub-Contractor, in the same form as that of the Contractor, shall be submitted for the approval of the Owner/Purchaser.

3.5.12.4 In addition to the inspection plans referred to above, the Contractor shall submit complete and satisfactory evidence of possessing a working scheme assuring the control of all critical activities pertinent to the assurance of quality, and objective evidence (by means of quality manuals and appropriate forms, etc.) of this capability to employ and maintain quality control to meet the required quality level of the manufacture and construction of the Works.

3.5.12.5 Contractor's Quality Control Program in the context of this Clause means the implementation of a quality assurance program by means of which full conformance of material and workmanship to best quality standards can be achieved effectively and economically by the Contractor's control and surveillance of all essential inspection operations, and periodic verification of the results of the manufacture of equipment and the assembly, erection and installation of equipment at the sites.

3.5.12.6 Certified (by an independent authority) test reports of factory type tests for standard equipment may be accepted by the Owner/Purchaser. These certified reports of previous tests on essentially similar and identical standard equipment,

which may be accepted by the Owner/Purchaser at the Owner's/Purchaser's sole discretion, in lieu of one or more type tests, shall be submitted.

3.5.12.7 Required number of copies of all test reports, including those supplied by Sub-Contractors, and shall be submitted to the Owner/Purchaser for approval. The Contractor shall include in the report all additional data required by the Owner/Purchaser to permit a clear understanding of the reports.

3.5.12.8 All test reports shall be certified and shall contain the signature of the Inspector as having witnessed the test, unless such witnessing has been specifically waived by the Owner/Purchaser. A certified test report shall be issued for each test.

3.6 Material / workmanship

3.6.1 General Requirement:

3.6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

3.6.1.2 In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard, the Purchaser shall decide upon the question of similarity. When required by the specification or when required by the Purchaser the Contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

3.6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

3.6.1.4 Whenever possible, all similar parts of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be made interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Wherever feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All the equipment of the same type and rating shall be physically and electrically interchangeable.

- 3.6.1.5 All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
- 3.6.1.6 The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.
- 3.6.1.7 All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.
- 3.6.1.8 A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units, shall have a raised up all around and shall have threaded in air connections, if so required.

3.6.2 Provisions for Exposure to Hot and Humid Climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.7 Design improvement / coordination

- 3.7.1 The bidder shall note that the equipment offered by him in the bid only shall be accepted for supply. However, the Purchaser or the Contractor may propose changes in the specification of the equipment or quality thereof and if the Purchaser & contractor agree upon any such changes, the specification shall be modified accordingly.

- 3.7.2 If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.
- 3.7.3 The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.
- 3.7.4 The Contractor has to coordinate designs and terminations with the agencies (if any) who are Consultants/Contractor for the Purchaser. The names of agencies shall be intimated to the successful bidders.
- 3.7.5 The Contractor will be called upon to attend design co-ordination meetings with the Engineer, other Contractor's and the Consultants of the Purchaser (if any) during the period of Contract. The Contractor shall attend such meetings at his own cost at New Delhi or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.8 Quality Assurance Programme

- 3.8.1 To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Contractor's Works or at his Sub-contractor's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Contractor shall adopt a suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be broadly outlined by the Contractor and shall be submitted by the contractor after the award of contract and finally accepted by the Purchaser after discussions. However, in case detailed valid programme approved by purchase for the equipment already exist, same would be followed till its validity. A quality assurance programme of the contractor shall generally cover the following:
- (a) Contractor's organisation structure for the management and implementation of the proposed quality assurance programme;
 - (b) Documentation control system;
 - (c) Qualification data of bidder's key personnel;
 - (d) The procedure for purchases of materials, parts components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
 - (e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;

- (f) Control of non-conforming items and system for corrective actions;
- (g) Inspection and test procedure both for manufacture and field activities;
- (h) Control of calibration and testing of measuring instruments and field activities;
- (i) System for indication and appraisal of inspection status;
- (j) System for quality audits;
- (k) System for authorising release of manufactured product to the Purchaser
- (l) System for maintenance of records;
- (m) System for handling storage and delivery; and
- (n) A quality plan, detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and Procedure of the Contractor/ his vendors quality management and control activities.

3.8.2 Quality Assurance Documents

The Contractor shall be required to submit the following Quality Assurance Documents as stipulated in the Quality Plan at the time of purchaser's inspection of equipment/ material.

3.9 Inspection, Type testing & Inspection certificate

- 3.9.1 All equipment being supplied shall conform to type tests including additional type tests including additional type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective clauses. Purchaser reserves the right to witness any or all the type tests. The contractor shall intimate the purchaser the detailed program about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.
- 3.9.2 The reports for all type tests and additional type tests as per technical specification shall be furnished by the Contractor along with equipment / material drawings. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by the representative(s) of POWERGRID or Utility. The test reports submitted shall be of the tests conducted within last 5 (five) years prior to the date of bid opening. In

case the test reports are of the test conducted earlier than 5 (five) years prior to the date of bid opening, the contractor shall repeat these test(s) at no extra cost to the purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design / manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

- 3.9.3 The Purchaser intends to repeat the type tests and additional type tests on transformers, reactors, cables and battery chargers for which test charges shall be payable as per provision of contract. The price of conducting type tests and additional type tests shall be included in Bid price and break up of these shall be given in the relevant schedule of Bid Proposal Sheets. These Type test charges would be considered in bid evaluation. In case Bidder does not indicate charges for any of the type tests or does not mention the name of any test in the price schedules, it will be presumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected. Type tests reports need to be submitted as per requirements of POWER GRID.
- 3.9.4 The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractor's/sub-vendors premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, despatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
- 3.9.5 The Contractor shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for joint testing including contractor and POWERGRID. Such tests shall be to the Contractor's account except for the expenses of the inspector. The purchaser / inspector unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Contractor shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.
- 3.9.6 The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser /Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

- 3.9.7 When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Contractor from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should, it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.
- 3.9.8 In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser /Inspector or to his authorized representative to accomplish testing.
- 3.9.9 The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.
- 3.9.10 The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.
- 3.9.11 The Purchaser reserves the right for getting any field tests not specified in respective clauses of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Purchaser.

3.10 Tests

3.10.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed is given in respective chapters and shall be included in the Contractor's quality assurance programme.

3.10.2 Commissioning tests

3.10.2.1 The testing equipments required for testing and commissioning shall be arranged by the Contractor.

3.10.2.2 The specific tests requirement on equipment has been brought out in the respective chapters of the technical specification.

3.10.2.3 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by POWERGRID on production of requisite documents.

3.11 Packaging & protection

3.11.1 All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Purchaser, the Contractor shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Purchaser to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, warping and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

3.11.2 All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

3.12 Handling, Storing and Installation

3.12.1 In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

3.12.2 Contractor may engage manufacture's Engineer to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unloaded, transport, store, erect, test and commissioning the equipment as per instructions of the manufacture's supervisory Engineer(S) and shall extend full cooperation to them.

3.12.3 In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings / instructions correctly.

3.12.4 Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

3.12.5 Contractor shall be responsible for examining all the shipment and notify the Purchaser immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the Purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

3.12.6 The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of nature, corrosion, damages etc.

3.12.7 Where material / equipment is unloaded by Purchaser before the Contractor arrives at site or even when he is at site, Purchaser by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.

3.12.8 The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which requires indoor storage.

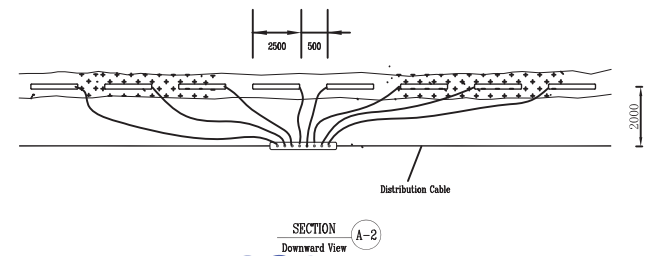
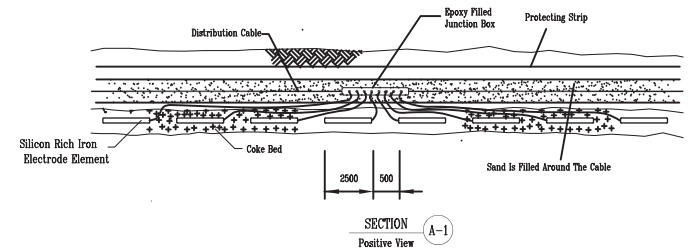
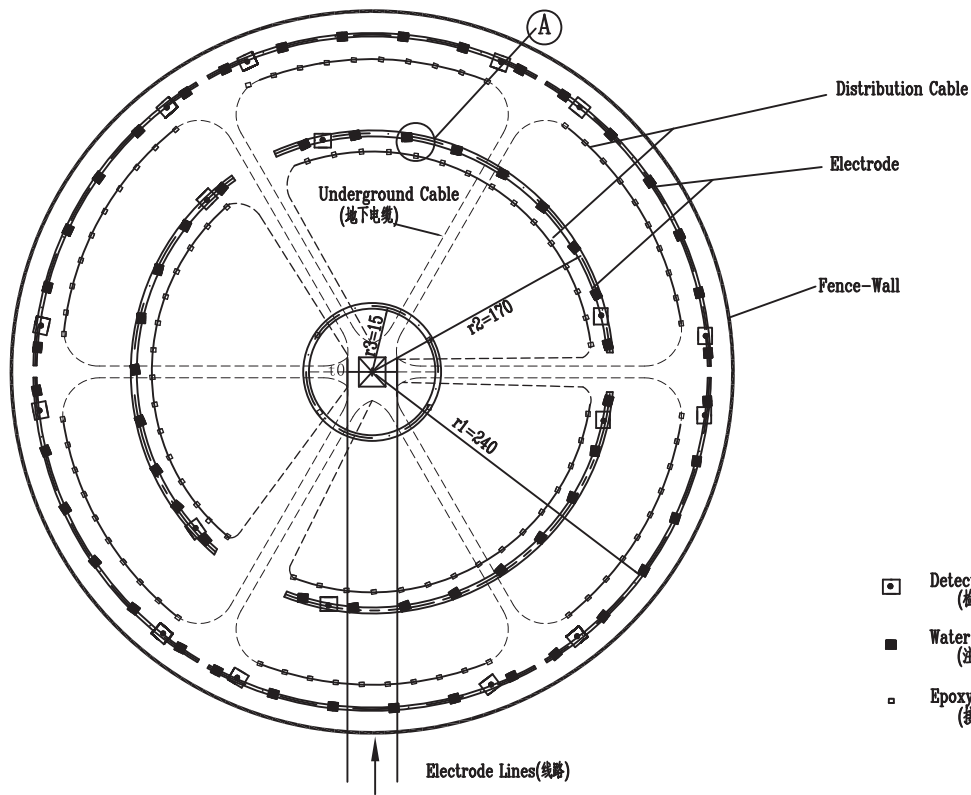
3.12.9 The words 'erection' and 'installation' used in the specification are synonymous.

3.12.10 Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

3.12.11 the design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances as given in clause 4.7.1 the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.12.12 Equipment Bases

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.



- Detection Well (检测井)
- Water-pouring Well (注水井)
- Epoxy Filled Junction-Box (接头盒)

Notice:

1. There are 18 detecting wells(middle 6/outer 12)located near the first junction-box connected with The Distribution Cable and the other places along the ring-routes.
2. There are 63 water-pouring wells(middle 27/outer 36)located along the the ring-routes at uniform intervals of 40m.
3. There are 112 epoxy-filled junction-boxes(inner 4/middle 45/outer 63).
4. Fence-wall shall adopt non-metal material,i.e,bricks,stones rocks,etc.

说明:

- 1.检测井18个(中阿环6个,外环12个),布置在主馈电缆接入的第一个接头盒附近和中环。
- 2.注水井共63个(中阿环12个,外环36个),按40m的间距均匀布置。
- 3.接头盒共112个(内环4个,中阿环45个,外环63个)。
- 4.围墙为非金属材料,为砖、石等。

		中南电力设计院	
Bhiwadi Terminal Earth Electrode of India Bhiwadi-Bhiwadi HVDC Projects		工程	Preliminary Design
批准		Bhiwadi Earth Electrode Plane Connection Plot (接地极平面布置图) ED2.190.GH-A_Appendix_D	
审核			
校核			
设计			
年月日	比例	图号	B386C-A0101-002