



# BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP  
ENGINEERING MANAGEMENT, NEW DELHI

|                       |                                               |             |            |             |
|-----------------------|-----------------------------------------------|-------------|------------|-------------|
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| TB-235-509-125        | 04                                            | Name        |            |             |
| Type of Document      | STANDARD SPECIFICATION                        | Sign        | --sd--     | --sd--      |
| Title                 | GS FLAT & EARTH ELECTRODE FOR EARTHING SYSTEM | Date        | 17.08.07   | 17.08.07    |
|                       |                                               | Group       | TBEM       |             |
|                       |                                               | W.O. No     |            |             |
| Customer / Consultant |                                               |             |            |             |
| Tender                |                                               |             |            |             |

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|              |          |         |         |          |                                               |
|--------------|----------|---------|---------|----------|-----------------------------------------------|
| 04           | 26.11.12 |         |         |          | Sd QP included.                               |
| 03           | 09.11.12 | Sd/-    | Sd/     | Sd/-     | POWERGRID requirement & Cut Lengths included. |
| 02           | 10.06.09 | Sd/-    | Sd/     | Sd/-     | Documents updated                             |
| 01           | 14.08.07 | Sd/     | Sd/-    | Sd/      | Revised as per TBMM requirement.              |
| Rev No.      | Date     | Altered | Checked | Approved | REVISION DETAILS                              |
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|              |          |         |         | Copies   |                                               |

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# SECTION 1

## SCOPE AND SPECIAL TECHNICAL REQUIREMENT

### 1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Earthing Strips & Earthing Electrodes, complete with accessories.

This section covers the general technical requirements of Earthing Strips & Earthing Electrodes. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements.

### 1.1 TECHNICAL REQUIREMENTS:

#### 1.1.1 GALVANIZED MILD STEEL FLAT (Power grid Requirement)

- i) Chemical composition & mechanical properties: Grade –A (Item Designation – Fe410W) of IS: 2062.
- ii) Mass of protective zinc coating: 618 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For less than 6 mm, the thickness shall be as per clause 4.0 of IS 4759, 1984.
- iii) Sizes:

| Sl. No. | Description                      | Approx. Weight (kg) |
|---------|----------------------------------|---------------------|
| 1       | Galvanised Steel Flat 75 x 12 mm | 7.0663 kg/meter     |
| 2       | Galvanised Steel Flat 75 x 10 mm | 5.8893 kg/meter     |
| 3       | Galvanised Steel Flat 50 x 6 mm  | 2.4008 kg/meter     |
| 4       | Galvanised Steel Flat 25 x 3 mm  | 0.5894 kg/meter     |
| 5       | Mild Steel Flat 50 x 6 mm        | 2.3316 kg/meter     |

- iv) Length: 4 m to 6 m
- v) Raw Material: Vendor to procure the raw material from Power Grid approved Sources with PG stamp.

#### 1.1.2 GALVANIZED MILD STEEL FLAT (Other then Power grid Requirement)

- i) Chemical composition & mechanical properties: Grade –A (Item Designation – Fe410W) of IS: 2062.
- i) Mass of protective zinc coating: 1) 610 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For

less than 6 mm, the thickness shall be as per clause 4.0 of IS 4759, 1984.

ii) Sizes:

| Sl. No. | Description                     | Weight (kg)     |
|---------|---------------------------------|-----------------|
| 1       | Galvanised Iron Flat 75 x 12 mm | 7.065 kg/meter  |
| 2       | Galvanised Iron Flat 75 x 10 mm | 5.888 kg/meter  |
| 3       | Galvanised Iron Flat 75 x 8 mm  | 4.710 kg/meter  |
| 4       | Galvanised Iron Flat 65 x 10 mm | 5.10 kg/meter   |
| 5       | Galvanised Iron Flat 65 x 8 mm  | 4.082 kg/meter  |
| 6       | Galvanised Iron Flat 50 x 8 mm  | 3.140 kg/meter  |
| 7       | Galvanised Iron Flat 50 x 6 mm  | 2.4 kg/meter    |
| 8       | Galvanised Iron Flat 25 x 3 mm  | 0.589 kg/meter  |
| 9       | Mild Steel Flat 75 x 10 mm      | 5.7843 kg/meter |
| 10      | Mild Steel Flat 50 x 6 mm       | 2.3316 kg/meter |

iii) Length: 4 m to 6 m.

### 1.1.3 EARTH ELECTRODE (Mild Steel iron)

- |      |                            |                       |
|------|----------------------------|-----------------------|
| i)   | Applicable Standard        | IS:1239               |
| ii)  | Sizes of Pipe              | 40 NB                 |
| iii) | Grade                      | Medium                |
| iv)  | Thickness of zinc –coating | 460 gm/sq.m           |
| v)   | Reference Drg.             | SKETCH SK-1 (Typical) |

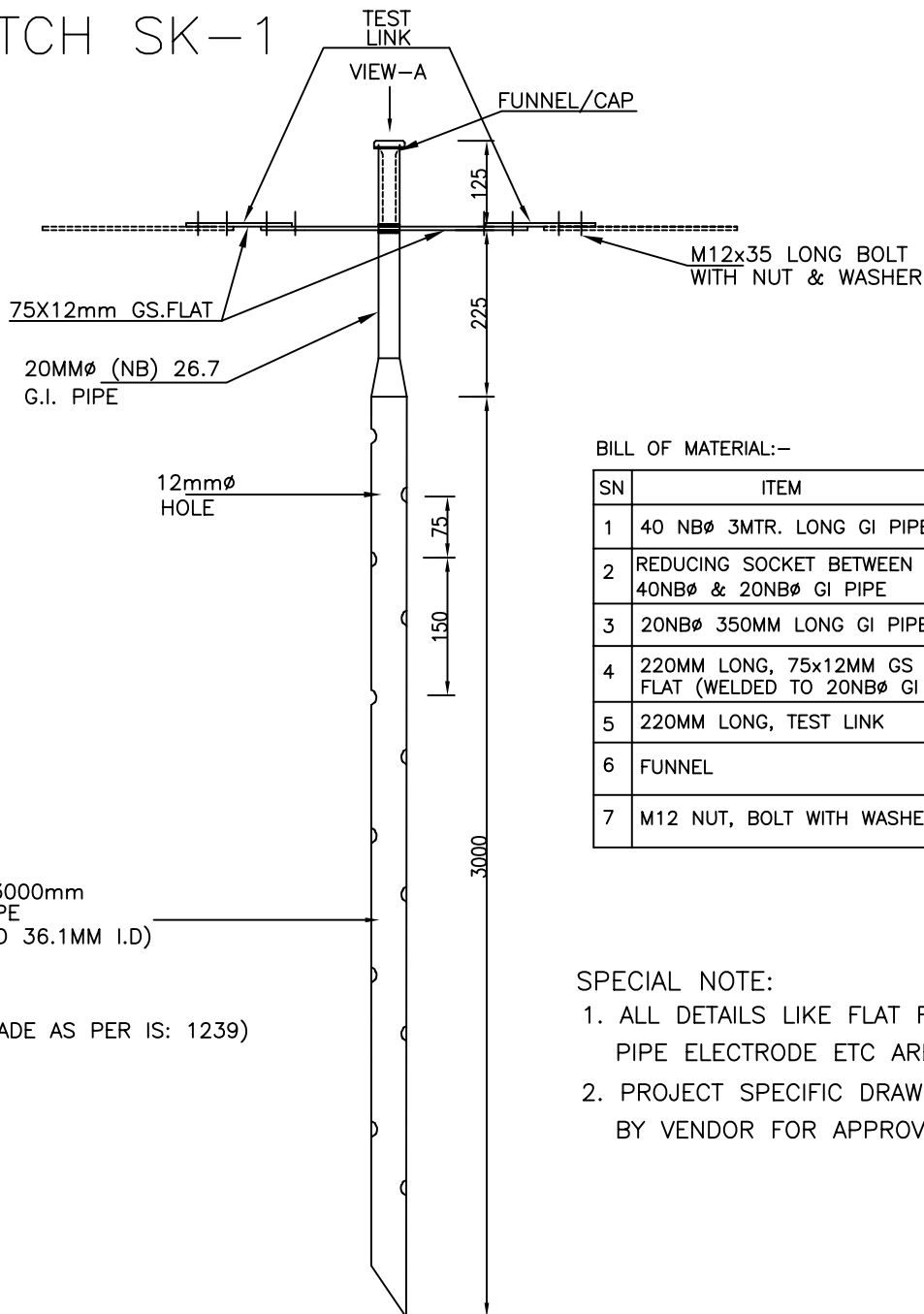
### 1.1.4 EARTH ELECTRODE (Cast Iron)

- |      |                        |                       |
|------|------------------------|-----------------------|
| i)   | Cast Iron pipe ID (mm) | 100/150 mm            |
| ii)  | Thickness (mm)         | 12/10/13 mm           |
| iii) | Reference Drg.         | SKETCH SK-2 (Typical) |

## 1.2 Manufacturing quality plan:

- i) Quality plan of GS flat is not required for power grid projects. Therefore, the inspection of GS flat & electrodes for power grid projects will be carried out as per relevant Indian Standards (latest version).
- ii) The QP enclosed with standard specification is to be followed for Non Power Grid projects.

# SKETCH SK-1



## BILL OF MATERIAL:-

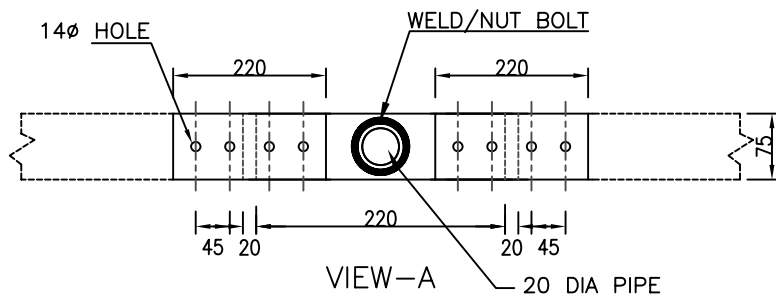
| SN | ITEM                                                        | UNIT | QTY. |
|----|-------------------------------------------------------------|------|------|
| 1  | 40 NB $\phi$ 3MTR. LONG GI PIPE                             | NOS. | 01   |
| 2  | REDUCING SOCKET BETWEEN 40NB $\phi$ & 20NB $\phi$ GI PIPE   | NOS. | 01   |
| 3  | 20NB $\phi$ 350MM LONG GI PIPE                              | NOS. | 01   |
| 4  | 220MM LONG, 75x12MM GS FLAT (WELDED TO 20NB $\phi$ GI PIPE) | NOS. | 01   |
| 5  | 220MM LONG, TEST LINK                                       | NOS. | 02   |
| 6  | FUNNEL                                                      | NOS. | 01   |
| 7  | M12 NUT, BOLT WITH WASHERS                                  | SETS | 08   |

## SPECIAL NOTE:

1. ALL DETAILS LIKE FLAT FIXING TO GI PIPE ELECTRODE ETC ARE TYPICAL.
2. PROJECT SPECIFIC DRAWING TO BE SUBMITTED BY VENDOR FOR APPROVAL.

## NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. STEEL TO CONFORM TO IS:2062, GRADE-A
3. ALL ITEMS TO BE HOT DIP GALVANISED.
4. SUPPLY OF FIXING BOLTS, NUTS, WASHERS FOR GI FLT EARTHING CONDUCTOR IS ALSO PART OF THE SCOPE
5. WASHER TO BE ELECTRO GALVANISED.



EQUIPMENT EARTHING DETAILS  
DETAILS OF PIPE ELECTRODE  
IN TREATED EARTH PIT

COMPUTERREF.NO.

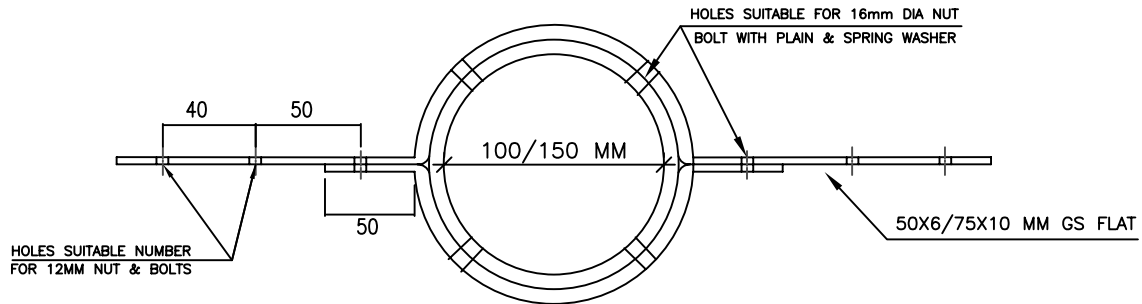
DRG. No.

SKETCH SK-1

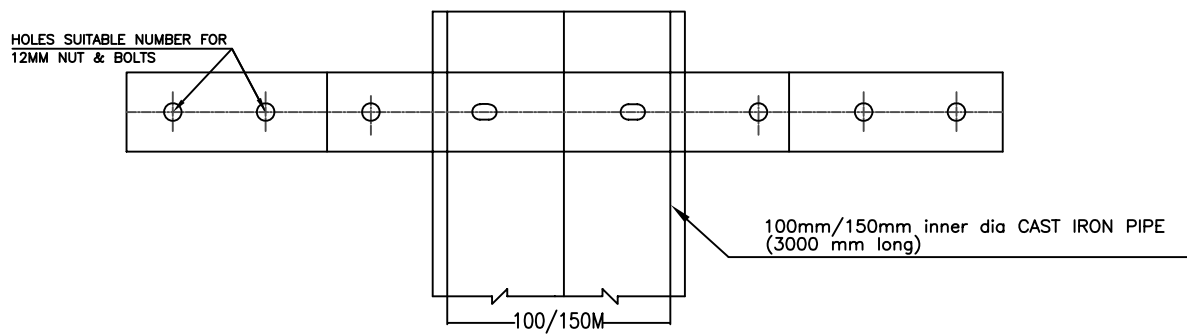
REV. 01

SHEET No.

# SKETCH SK-2



PLAN



ELEVATION

## BILL OF MATERIAL:-

| SN | ITEM                                                                | UNIT  | QTY. |
|----|---------------------------------------------------------------------|-------|------|
| 1  | 100/150MM INNER DIA CI PIPE CONFORMING TO IS :1536-1960             | NO.   | 01   |
| 2  | 16MM NUT, BOLT INCLUDING 1 NO. PLAN WASHERS AND 1 NO. SPRING WASHER | SETS. | 06   |
| 3  | 12MM NUT, BOLT INCLUDING 1 NO. PLAN WASHERS AND 1 NO. SPRING WASHER | SETS. | 04   |
| 4  | 50X6 OR 75X10 MM GS FLAT (HALF RING)                                | PAIR  | 01   |

## SPECIAL NOTE:

1. ALL DETAILS ARE TYPICAL.
2. PROJECT SPECIFIC DRAWING TO BE SUBMITTED BY VENDOR FOR APPROVAL.

## NOTE:-

1. ALL DIMENSIONS ARE IN MM
2. ALL NUT AND BOLTS ARE HOT DIP GALVANIZED.
3. WASHERS SHALL BE ELECTRO-GALVANIZED.



## **SECTION - 2**

### **STANDARD SPECIFICATION**

#### **2.1 APPLICABLE STANDARDS**

The materials shall strictly conform to the following Indian Standards, as appropriate:

The materials shall confirm to the latest editions of the following Indian Standards:

- IS 2062: 2011 Steel for general structural purposes
- IS 1730: 1998 Dimensions for steel plate, sheets, strips and flats for general engineering Purposes.
- IS 1731: 1971 Dimensions for steel flats for structural and general engineering purposes.
- IS 2629: 1985 Recommended practices for Hot-dip galvanizing on iron & Steel
- IS 2633: 1986 Methods for testing uniformity of coating of zinc- coated articles.
- IS 1852: 1985 Rolling & Cutting Tolerance for hot rolled steel products.
- IS 1239 (Part 1): 1990 Specification for mild steel tubes, tubular and other wrought steel fittings (Mild Steel tubes)
- IS 1239 (Part 2): 1992 Specification for Mild steel tubes, tubular and other wrought steel fittings (Mild Steel Sockets )
- IS 4826 – 1979 Hot-dipped zinc coatings on mild steel tubes
- IS 4759: 1984 Hot Dip Coatings on Structural Steel and other allied Products
- IS 6745: 1972 Determination of mass of Zinc Coating on Zinc Coated Iron and Steel Articles
- IS 1536: 1993 Cast Iron Pressure Pipe -Specification

#### **2.2 CONSTRUCTIONAL FEATURES**

##### **2.2.1 MILD STEEL FLATS**

All steel required for earthing material shall confirm to Grade –A (Item Designation – Fe410W) of IS:2062: 2011.

### **2.2.2 EARTH ELECTRODES**

- (1) The earth electrodes (Galvanised Iron) shall be perforated and fabricated out mild steel pipes and shall conform strictly to IS 1239 – 2004.
- (2) The earth electrodes (Cast Iron) shall be perforated and fabricated out cast iron pipes and shall conform strictly relevant IS: 3043-2006.

Note: Latest revisions shall be followed for all mentioned standard.

### SECTION-3

#### PROJECT DETAILS & GENERAL SPECIFICATION

#### SITE INFORMATION

|                 | Particular                                 | Details                                                                                               |                                |
|-----------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------|
| a)              | Owner                                      | POWERGRID                                                                                             |                                |
| b)              | Customer                                   | POWERGRID                                                                                             |                                |
| c)              | Project Title                              | 765/400kV Switchyard at Medinipur & Jeerat                                                            |                                |
| d)              | Location                                   | Medinipur<br>West Bengal                                                                              | Jeerat (new)<br>West Bengal    |
| e)              | Transport Facilities                       | Nearest rail head -<br>Medinipur                                                                      | Nearest rail head -<br>Kolkata |
| SITE CONDITIONS |                                            |                                                                                                       |                                |
| a)              | Max. ambient air temp.                     | 50°C                                                                                                  |                                |
| b)              | Min. ambient air temp.                     | 0°C                                                                                                   |                                |
| c)              | Max. design ambient temp.                  | 50°C                                                                                                  |                                |
| d)              | Design reference temp.                     | 50°C                                                                                                  |                                |
| e)              | Average Humidity                           | Max. 100%                                                                                             |                                |
| f)              | Special corrosion conditions               | No                                                                                                    |                                |
| g)              | Solar Radiation                            |                                                                                                       |                                |
| h)              | Atmospheric UV radiation                   | High                                                                                                  |                                |
| i)              | Altitude above sea level                   | Less than 1000 meter                                                                                  |                                |
| j)              | Pollution Severity                         | High Pollution level                                                                                  |                                |
| k)              | Seismic Zone                               | As per the seismic zone defined in the relevant BIS / IEC-62271-300 but not less than 0.3g horizontal |                                |
| WIND DATA       |                                            |                                                                                                       |                                |
|                 | Wind velocity                              | 50m/s                                                                                                 |                                |
|                 | Average No. of thunderstorm days per annum | As per IS                                                                                             |                                |



|  |                                    |                                                                                              |
|--|------------------------------------|----------------------------------------------------------------------------------------------|
|  | <b>Main Electrical Parameters:</b> |                                                                                              |
|  | <b>Fault Levels:</b>               | <b>765kV: 50kA for 1 sec</b><br><b>400kV: 63kA for 1 sec</b><br><b>66kV : 25kA for 3 sec</b> |
|  | <b>Creepage Distance</b>           | <b>31mm/kV</b> for string insulator hardware and<br><b>25mm/kV</b> for Equipment             |

## 1.0 GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

- a) 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 unless included in the list of exclusions.
- b) Material and components not specifically stated in this specification but which are necessary for satisfactory operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded and shall be supplied at no extra cost.
- c) Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition.
- d) In case any Deviation Schedule, Bid Proposal Sheet, Schedule of Data Requirements (DRS), test reports or any other document/information are not furnished along-with the bid, the bid is liable to be rejected. Unless brought out clearly, the Bid will be deemed to conform to the specification scrupulously. All deviations from the specification shall be clearly brought out in the respective deviation schedule.
- f) The Bidder shall clearly indicate in the bid, the specific standards in accordance with which the works will be carried out.
- g) The equipment must be new, of highest grade, the best quality of their kind, to best engineering practice and latest state of art, and in accordance with purpose for which they are intended and ensure satisfactory performance throughout the service life.
- h) All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same materials and workmanship as the corresponding parts of the equipment. Where feasible, common components, units shall be employed in different pieces of equipment in order to optimize the spare part stock-up and utilization.
- i) The requirement regarding external RIV as specified for equipment shall include the

terminal fittings and the equipment shall have been tested preferably with fittings, if any.

## **2.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED**

- a) The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc.
- b) The equipment shall be able to withstand forces due to wind load, short circuit, system over voltages, fluctuations, frequency variations etc., all forces considered together.

## **3.0 STANDARDS**

- a) The equipment to be furnished under this specification shall conform to latest issue with all amendments of standard specified under respective Chapters of this Specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other. 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. 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.
- b) Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.
- c) In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in additional information schedule along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to POWERGRID's approval.

## **4.0 ENGINEERING DATA AND DRAWINGS**

4.1 The list of drawings/documents which are to be submitted to the Purchaser shall be discussed and finalised by the Purchaser at the time of award. The supplier shall necessarily submit all the drawings/ documents unless anything is waived.

4.2 The Contractor shall submit 4 (four) sets of drawings/ design documents /data / detailed bill of quantity and 1 (one) set of test reports for the approval of the Purchaser. The contractor shall also submit the softcopy of the above documents in addition to hardcopy.

### **4.3 Drawings**

4.3.1 All drawings submitted by the Contractor 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.

4.3.2 Drawings 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. POWERGRID has standardized a large number of drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings alongwith type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.

4.3.3 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.

4.4 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.

4.5 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.

#### 4.7 Approval Procedure

The scheduled dates for the submission of the drawings as well as for, any data/information to be furnished by the Purchaser would be discussed and finalised at the time of award. The following schedule shall be followed generally for approval and for providing final documentation.

|      |                                                                                                                                     |                                                       |
|------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| i)   | Approval/comments/<br>Purchaser on initial                                                                                          | As per agreed by<br>schedule submission               |
| ii)  | Resubmission<br>(whenever<br>required)                                                                                              | Within 3 (three) weeks<br>from date of comments       |
| iii) | Approval or comments                                                                                                                | Within 3 (three) weeks of receipt<br>of resubmission. |
| iv)  | Furnishing of distribution<br>copies (5 hard copies per<br>substation and one scanned<br>copy (pdf format) for Corporate<br>Centre) | 2 weeks from the date<br>of approval                  |
| v)   | Furnishing of distribution copies of test reports                                                                                   |                                                       |

|                                                                                                                                                |                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| (a) Type test reports<br>(one scanned softcopy in<br>pdf format per substation plus one for corporate centre<br>& one hardcopy per substation) | 2 weeks from the date<br>of final approval |
| (b) Routine Test Reports<br>(one copy for each substation)                                                                                     | -do-                                       |
| vi) Furnishing of instruction/<br>(2 copies<br>per substation and one softcopy<br>(pdf format) for corporate centre<br>& per substation)       | As per agreed schedule operation manuals   |
| (vii) As built drawings (two sets of<br>hardcopy per substation & one<br>softcopy (pdf format) for<br>corporate centre & per substation)       | On completion of entire works              |

**NOTE:**

- (1) The successful bidder shall have to extend all possible support like timely submission/re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer's approval.
- (2) The supplier may please note that all resubmissions must incorporate all comments given in the earlier submission by BHEL/POWERGRID or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.
- (3) All drawings should be submitted in softcopy form, however substation design drawings like SLD, GA, all layouts etc. shall also be submitted in AutoCAD Version. SLD, GA & layout drawings shall be submitted for the entire substation in case of substation extension also.
- (4) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.
- (5) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the supplier to BHEL/POWERGRID.
- (6) The manufacturer shall furnish to the Purchaser catalogues of spare parts.
- (7) All As-built drawings/documents shall be certified by site indicating the changes before final submission.

## **6.0 QUALITY ASSURANCE PROGRAMME**

- 6.1 To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the supplier'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 supplier shall adopt suitable quality assurance programme to control such activities at all points necessary. The

detailed programme shall be submitted by the contractor after the award for reference. A quality assurance programme of the supplier shall generally cover the following:

- (a) His organization structure for the management and implementation of the proposed quality assurance programme;
- (b) Documentation control system;
- (c) Qualification data for 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.

POWERGRID/BHEL or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the supplier/his vendor's quality management and control activities.

## **6.2 Quality Assurance Documents**

The supplier would be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of POWERGRID/BHEL inspection of equipment/material

## **7.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE**

- 7.1 All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections.
- 7.2 The reports for all type tests as per technical specification shall be furnished by the supplier alongwith equipment / material drawings. However, type test reports of similar equipments/ material already accepted in POWERGRID shall be applicable for all project with similar requirement. 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 POWERGRID or representative authorized by POWERGRID or Utility or representative of accredited test lab or reputed consultant.

The test reports submitted shall be of the tests conducted within last 10 (ten) years prior to the date of bid opening i.e. **23.11.16**. In case the test reports are of the test conducted earlier than 10 (ten) years prior to the date of bid opening, the contractor shall repeat these test(s) at no extra cost to BHEL.

However, in case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to the date of bid opening.

- i) Lightning Impulse Test
- ii) Switching Impulse Test
- iii) Multiple Chopped Impulse Test (For CT)
- iv) Chopped Impulse Test (For CVT)

In case the test reports are of these tests (for instrument transformers) as mentioned above are conducted earlier than 10 (ten) years prior to the date of bid opening i.e. **23.11.16**, the contractor shall repeat these test(s) at no extra cost to the purchaser.

Further, 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 type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

The supplier shall intimate the BHEL/POWERGRID the detailed program about the tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

Further, in case type tests are required to be conducted/repeated and the deputation of Inspector/Purchaser's representative is required, then all the expenses shall be borne by the supplier.

7.3 The Purchaser intends to repeat the type tests on Power Transformer and Shunt Reactor except Dynamic short circuit tests on transformers, for which test charges shall be payable as per provision of contract. The price of conducting 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. BHEL/POWERGRID reserves the right to witness any or all the type tests. The BHEL/POWERGRID also reserves the right to waive the repeating of type tests partly or fully and in case of waiver, test charges for the same shall not be payable.

The Purchaser shall bear all expenses for deputation of purchaser's representative(s) for witnessing the type tests under this clause except in the case of re-deputation if any, necessitated due to no fault of the purchaser.

For outdoor receptacles, trefoil clamps, diesel engine, alternator, motors, cable glands, lighting fixtures, ACSR/AAC conductor, IPS aluminum tube and junction boxes, type test reports are not required to be submitted for the makes indicated at Annexure-E /POWERGRID approved list of subvendors. For the new makes(other than those indicated at Annexure-E / POWERGRID approved list of subvendors), type test reports as per relevant standard shall be submitted for POWERGRID's approval.

- 7.4 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.
- 7.5 The supplier shall give the Purchaser /Inspector fifteen (15) days written notice for on-shore and six (6) weeks notice for off-shore 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, will attend such tests within fifteen (15) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed alone with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of tests in triplicate.
- 7.6 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.
- 7.7 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 CIP by the Purchaser.

7.8 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 authorised 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 authorised representative to accomplish testing.

7.9 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.

7.10 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.

7.11 The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Purchaser.

## **8.0 PACKAGING & PROTECTION**

8.1 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, wharfage 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.

8.2 All coated surfaces shall be protected against abrasion, impact, discolouration 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 pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

## **9.0 FINISHING OF METAL SURFACES**

9.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts & bolts and spring washers shall be electro galvanized to service condition 4. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS:2629.



## **9.2 HOT DIP GALVANISING**

- 9.2.1 The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm and above. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.
- 9.2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.
- 9.2.3 After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.
- 9.2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.
- 9.2.5 Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.
- Coating thickness
  - Uniformity of zinc
  - Adhesion test
  - Mass of zinc coating
- 9.2.6 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

# SECTION - 4

## GUARANTEED TECHNICAL PARTICULARS for ELECTRODES

### **1.0 EARTH ELECTRODE (Galvanized iron)**

- 2.1 Mild Steel pipe OD (mm)
- 2.2 Mild Steel ID (mm)
- 2.3 Thickness of zinc –coating
- 2.4 Weight of zinc coating
- 2.5 Applicable standards

### **2.0 EARTH ELECTRODE (Cast Iron)**

- 3.1 Cast Iron Pipe OD (mm)
- 3.2 Cast Iron Pipe ID (mm)
- 3.3 Applicable standards

**CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER**  
**RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED**

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

**BHEL ENQUIRY. NO:**  
**BIDDER OFFER REFERENCE:**

| (1)   | (2)                                          | (3)                                                                                                                                             | (4)      | (5)                                    |
|-------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------|
| S.No. | Parameter                                    | Requirement                                                                                                                                     | Yes / No | Remarks in case reply in Col (4) is NO |
| 1.0   | Weight of Zinc coating                       | Weight of zinc coating shall be as per clause 2.4 of Section-2                                                                                  |          |                                        |
| 2.0   | Tolerance in the flat size                   | Tolerance in the flat size shall be as per IS:1852-1985                                                                                         |          |                                        |
| 3.0   | Chemical composition of flat/CI Pipe/GI Pipe | Certified copy of the chemical composition of the material as per the relevant standards shall be supplied before the dispatch of the material. |          |                                        |
| 4.0   | Earth electrode                              | Electrode arrangement shall be provided as per sketch no. SKTECH SK-1 / SKETCH SK-2                                                             |          |                                        |
| 5.0   | PG stamp                                     | Raw material shall be inspected at source by Powergrid/BHEL.                                                                                    |          |                                        |
| 6.0   | Length                                       | 4 to 6 mtrs                                                                                                                                     |          |                                        |
| 7.0   | Conformance                                  | With enclosed QP                                                                                                                                |          |                                        |

**Date:**

**Signature of the authorized representative of Bidder**

**Company Seal**



# QUALITY PLAN

ITEM: CI PIPE ELECTRODE

OP NO: TBQM-STD-CIE  
REV: 00  
DATE: 15-01-11  
Page 1 of 2

PROJECT:

PACKAGE/CONTRACT:

CONTRACTOR: BHEL

FORMAT OF RECORD

AGENCY

REMARKS

| S.NO. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | 9 | 10 | 11 | 12 | 13 |
|-------|-----------------------|------------------------|----------|---------------|-----------------|--------------------|-----------------|---|----|----|----|----|
|-------|-----------------------|------------------------|----------|---------------|-----------------|--------------------|-----------------|---|----|----|----|----|

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|                  |                                       |                                           |       |                                          |                |                                            |                                                     |                      |   |   |   |                                                                                                                         |
|------------------|---------------------------------------|-------------------------------------------|-------|------------------------------------------|----------------|--------------------------------------------|-----------------------------------------------------|----------------------|---|---|---|-------------------------------------------------------------------------------------------------------------------------|
| 1.0              | INCOMING MATERIALS:                   |                                           |       |                                          |                |                                            |                                                     |                      |   |   |   |                                                                                                                         |
| 1.1              | MS FLATS                              | Freedom from defects                      | Major | Visual                                   | 100%           | IS 2062                                    | IS 2062                                             | Internal Logbook     | M |   | C | a) MS Flat to be taken from BHEL approved Sources.                                                                      |
|                  |                                       | Dimensions                                |       | Measure ments                            | 10 %           | IS 1852                                    | IS 1852                                             |                      | M |   | C | b) Correlation of Material Test Certificates to be maintained.                                                          |
|                  |                                       | Mech. Properties                          |       | Mech                                     | As per IS 2062 | IS 2062                                    | IS 2062                                             | Lab Report / Mfr. TC | Y | M | C |                                                                                                                         |
|                  |                                       | A. Yield Strength                         |       |                                          |                |                                            |                                                     |                      |   |   |   |                                                                                                                         |
|                  |                                       | B) Tensile Strength                       |       |                                          |                |                                            |                                                     |                      |   |   |   |                                                                                                                         |
|                  |                                       | C) % Elongation                           |       |                                          |                |                                            |                                                     |                      |   |   |   |                                                                                                                         |
|                  |                                       | D) Bend Test                              |       |                                          |                |                                            |                                                     |                      |   |   |   |                                                                                                                         |
|                  |                                       | 4) Chem. Composition                      |       | Chem.                                    | As per IS 2062 | IS 2062                                    | IS 2062                                             | Lab Report / Mfr. TC | Y | M | C |                                                                                                                         |
| 1.2              | CI PIPES                              | Freedom from defects                      | Major | Visual                                   | 100%           | IS 1536                                    | IS 1536                                             | Internal Logbook     | M |   | C | a) CI Pipe to be taken from BIS licenses Manufacturer and a copy of valid licenses to be submit along with Test Report. |
|                  |                                       | Dimensions                                |       | Measure ments                            | 10 %           |                                            |                                                     |                      | M |   | C |                                                                                                                         |
|                  |                                       | Mech. Properties                          |       | Mech                                     | As per IS 1536 |                                            |                                                     | Lab Report / Mfr. TC | Y | M | C | b) Co-relation of Material Test Certificates to be maintained.                                                          |
|                  |                                       | c) Hydrostatic Test                       | -do-  | Mechani cal                              | As per IS 1536 | IS 1536                                    | IS 1536                                             | "                    |   | M | C |                                                                                                                         |
|                  |                                       | 4) Chem. Composition                      |       | Chem.                                    | IS 1536        | IS 1536                                    | IS 1536                                             | "                    | Y | M | C |                                                                                                                         |
| 1.3              | Hardware (Nuts, Bolts, Plane Washer & | Mechanical, Chemical and Galvanizing test | -do-  | Review                                   | IS 1367 - F-17 | IS 1367 - P-17, IS 1367, IS 3063 & IS 2016 | IS 1367 - P-17, IS 1367, IS 1363, IS 3063 & IS 2016 | Lab Report / Mfr. TC | Y | M | C | Hardware to be taken from BHEL approved Sources.                                                                        |
| BHEL SIGN & SEAL |                                       | LEGEND:                                   |       | M - MANUFACTURER / SUB CONTRACTOR        |                | P - PERFORMED BY                           |                                                     | NAME & SIGN OF       |   |   |   |                                                                                                                         |
|                  |                                       |                                           |       | C - BHEL / NOMINATED INSPECTOR AGENCY    |                | W - WITNESSED BY                           |                                                     |                      |   |   |   |                                                                                                                         |
|                  |                                       |                                           |       | N - CUSTOMER / CUSTOMER NOMINATED AGENCY |                | V - VERIFICATION BY                        |                                                     |                      |   |   |   |                                                                                                                         |

Signature of BHEL Representative









# QUALITY PLAN

ITEM : GI FLAT / GI PIPE ELECTRODE

OP NO : TBQM-STD-01F  
REV: 01  
DATE : 12-01-11  
Page 4 of 4

PROJECT :

PACKAGE / CONTRACT :

CONTRACTOR : BHEL

| S.NO. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY     | REMARKS |
|-------|-----------------------|------------------------|----------|---------------|-----------------|--------------------|-----------------|------------------|------------|---------|
| 1     | 2                     | 3                      | 4        | 5             | 6               | 7                  | 8               | 9                | D 10 11 12 | 13      |

|     |                                                      |                                                           |       |                       |                               |                                                          |                                                          |                         |   |   |   |                                                         |                           |
|-----|------------------------------------------------------|-----------------------------------------------------------|-------|-----------------------|-------------------------------|----------------------------------------------------------|----------------------------------------------------------|-------------------------|---|---|---|---------------------------------------------------------|---------------------------|
| 4.0 | FINAL INSPECTION                                     |                                                           |       |                       |                               |                                                          |                                                          | 1984                    |   |   |   |                                                         |                           |
| 4.1 | Calibration of measuring and testing eqpt..          | Calibration                                               | Major | Visual                | 100%                          | Periodicity of calibration not to exceed 12 months       | Periodicity of calibration not to exceed 12 months       | Calibration records     | M |   | C | Calibration should have been done in reputed laboratory |                           |
| 4.2 |                                                      | a) Visual & Dimensions                                    | -do-  | Visual                | 100%                          | IS 2629/802-10985-1978                                   | IS 2629/802-10985-1978                                   | Inspection report       | M | C |   |                                                         | Final inspection by BHEL  |
|     |                                                      |                                                           |       | Measurement           | as per IS 2500-1992 level S4  | Appd. Drgs.                                              | Appd. Drgs.                                              |                         | M | C |   |                                                         | Final inspection is a CHP |
|     |                                                      | b) Mech. And Chem. Test as indicate in Cl. 1.1 & 1.2      | -do-  | Mechanical & Chemical | As indicated in cl. 1.1 & 1.2 | As listed in 1.1 & 1.2                                   | As listed in 1.1 & 1.2                                   |                         | M | C |   |                                                         |                           |
|     |                                                      | c) Galvanizing. Tests as indicated in 3.3                 | -do-  | Mechanical & Chemical | SS/lot offered                | IS 6745-1972                                             | IS 6745-1972                                             |                         | M | C |   |                                                         |                           |
| 5.0 | Hardware (Nuts, Bolts, Plane Washer & Spring Washer) | Mechanical, Chemical and Galvanizing test                 | -do-  | Review                | IS 1367 - P-17                | IS 1367 - P-17<br>IS 1367, IS 1363,<br>IS 3063 & IS 2016 | IS 1367 - P-17<br>IS 1367, IS 1363,<br>IS 3063 & IS 2016 | Lab Report / Mfr. TC    | M |   | C | Hardware to be taken from BHEL approved Sources.        |                           |
| 6.0 | PACKING                                              | Material, Sturdiness, marking, checking with Packing list | -do-  | Visual                | 100%                          | BHEL Spec.                                               | BHEL Spec.                                               | Subcontract certificate | M |   |   |                                                         |                           |

BHEL

SIGN & SEAL

LEGEND:

M - MANUFACTURER / SUB CONTRACTOR

C - BHEL / NOMINATED INSPECTION AGENCY

N - CUSTOMER / CUSTOMER NOMINATED AGENCY

P - PERFORMED BY

W - WITNESSED BY

V - VERIFICATION BY

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH

Signature of Mr. P. S. SINGH