IOM

FROM:	Rajnish Goyal Manager PE- Bhilai TPS PEM -ELECT 5TH FLOOR, BHEL HOUSE	**TO:**	**Sh. KH Ramachandran** **SDGM (PSG-II), PEM** **3rd floor, BHEL House**
OUR REF:	PE-E20-239 -509 / AKR	**YR. REF.:**	
DATE:	14/03/2006	**DATE:**	

Subject: **BHILAI ELECTRIC SUPPLY COMPANY PVT. LTD., 2X250 MW, UNIT 1 & 2**

BELOW GROUND EARTHING & LIGHTNING PROTECTION SYSTEM

Enclosed pl. find 01 set of General Technical Requirement of Below Ground Earthing System specification no. PES-509-01, consisting of the following:

Sl. no.	Description	No. of sheets
1	General tech. Requirement of below ground earthing system	07
	(Installation)	
	Data sheet – A	02
	Data sheet – B	02
	Data sheet – C	01
2	Bill of quantities	01
3	"Typical details of below ground earthing" drg. no.PE-DG-239-509-E006	07

The above specification is for installation of below ground earthing system in the whole plant comprising of main power house building & auxiliary plant buildings, which may be included in specification of civil package of plant & buildings by PEM / PSWR.

It may may be noted that earthmat for the main power plant shall be designed on the basis of approved earthing system design memorandum from the customer.

CC: Sh. KAMAL DEV Sr. DGM (Civil), 4th floor | With one copy of above

SKR 14/3/06

O/C to SKR / ~~SK GKB~~ → AKR 14/3/06

For PE/ELECT/BHILAI

Copy of Ltr given to SRC

BHILAI ELECTRIC SUPPLY COMPANY LTD.
EXPANSION OF BHILAI POWER PROJECT
2X250MW (UNIT – 1 & 2)

GENERAL TECHNICAL REQUIREMENTS OF BELOW GROUND EARTHING SYSTEM

(INSTALLATION)

SPECIFICATION NO. PES - 509 - 01 (REV. NO. 02 DATED 04.02.95)

1.0 SCOPE

1.1 The scope under this specification shall cover furnishing of all labour, material and equipment, and performance of all operations necessary for complete installation of below ground earthing system in plant area of the project under consideration. Below ground earthing system shall include earthmesh/ earthing ring, electrodes, electrode test pits, riser pigtails, column earth connections and interconnection to other earthmesh(es) as per Purchaser's drawings.

1.2 Vendor's scope shall also cover the designing of exact layout of conductors to suit the location of various foundations/ underground facilities at site. Purchaser's drawings will cover the approximate location and depth of conductors, electrodes and riser pigtails.

1.3 The scope shall further include supply of all accessories including (but not limited to) anti-corrosive paints, bitumen compound required for joints, U-clamps, bolts, nuts, lugs, bimetallic washers etc.

1.4 The vendor shall also be responsible for estimation of Bill of Quantities on the basis of the inputs provided by Purchaser in the form of drawings etc. Any shortfall or surplus in the estimated quantities shall be intimated to the Purchaser periodically during project execution stages. The plan for reporting the estimated quantities shall be mutually agreed.

1.5 The scope of work shall also include

(a) Receipt of material from owner's stores and transportation to work site (for material supplied by Purchaser).

(b) Excavation, back filling and compacting of the earth, as required.

(c) Testing of earthing system.

2.0 CODES & STANDARDS

2.1 The earthing systems shall comply with the latest edition of following standards/ acts/ codes. However if Data Sheet A specifies conformance to any other international standard, the equivalent BS/ IEC/ other standard shall be applicable.

a)	IS : 3043	Code of practice for earthing.
b)	IS : 2062	Structural Steel (Standard Quality)
c)	IS : 2629	Recommended practice for hot dip galvanizing on iron and steel
d)	IS : 316	Code of practice for use of metal arc welding for general construction of mild steel.
e)	IS : 1363	Hexagon head bolts, screws and nuts.
f)	IEEE : 81	IEEE guide for measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
g)		Indian Electricity Rules

h) Indian Electricity Act

i) Any other codes and standards in force in the area

2.2 In case of any conflict between the above codes/ standards and this specification, the latter shall prevail.

3.0 TECHNICAL REQUIREMENTS

3.1 General

3.1.1 This specification shall be read and construed in conjunction with Purchaser's earthing drawings.

3.1.2 The below ground earthing system shall be

a) An earthmesh and/ or

b) A ring electrode system comprising a ring connecting the various earth electrodes as per Purchaser's drawings.

3.1.3 All below ground earthing materials and their respective sizes shall be as indicated in Data Sheet A

3.1.4 All connections shall be done as per the jointing details. Improper connections shall be remade at no extra cost to the Purchaser.

3.1.5 Back-filling shall be carried out with riddled earth.

3.1.6 Earth shall be properly rammed for compactness after back filling.

3.1.7 Steel material supplied by vendor such as steel flats, if required for column earth connection, shall be hot dip galvanized.

3.2 Earth Conductors

3.2.1 The main earth conductors shall be buried below grade level as indicated in the drawings. For crossing any sub-ground facilities such as trenches, drains, pipes, foundations, tunnels, building basements, buried cables, underground tanks, bunkers etc, the earth conductor shall be buried at minimum 300 mm or more clear depth below the facility.

3.2.2 Earth conductor shall be routed minimum 500 mm away from the existing foundations.

3.2.3 In power house building, boiler area and auxiliary buildings/ areas, the earth conductor shall be laid in virgin soil with a soil coverage of 300 mm or more, below lean concrete level.

3.2.4 Earth conductors shall be laid at the locations indicated in the earthing drawings. However in case of interference with any existing sub-ground facility, the conductor shall be rerouted to clear the facility and the criteria mentioned in aforesaid clauses shall be followed.

3.2.5 Bending of rods where necessary will be done preferably by gas heating.

3.3 Electrodes And Other Earth Connections

3.3.1 All earth electrodes shall be driven firmly into the earth with top of electrode upto a depth specified in Data Sheet - A.

3.3.2 All steel columns shall be bonded directly to the ground grid whether specifically shown or not in the drawings.

3.3.3 For interconnection of above ground equipment earthing system with the below ground earthing system, pigtails shall be brought out from the below ground earthing conductors, protruding 300 mm above the grade level. All riser pigtails shall be painted green for the above ground portion. Painting shall be done after backfilling and compacting of the earth.

3.3.4 A few number of disconnecting type test electrodes in test pits shall be provided at the locations marked in Purchaser's earthing drawings.

3.4 Welding

3.4.1 All earth conductor connections shall be made by electric arc welding. All welding work shall be carried out by qualified and experienced welders.

3.4.2 All arc welding shall be carried out with low hydrogen content electrode.

3.4.3 All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on them. No artificial cooling should be adopted to cool welded joints.

3.4.4 The welding required for earthing shall have adequate strength.

3.4.5 Before welding, the earth conductors shall be clamped tightly to ensure good surface contact at welding points.

3.4.6 Two coats of red oxide paint, followed by a coat of bitumen compound shall be applied on all welded joints.

4.0 UNIT PRICING

4.1 General

Unit prices quoted for various items shall include the following :

(a) Receipt of material from Purchaser's stores and handling (for the materials supplied by Purchaser).

(b) Installation, welding, painting and related jobs listed in the specification and as per the Purchaser's earthing drawings.

(c) All consumables (except the material supplied by Purchaser).

(d) All labour.

4.2 Items

Unit prices shall be quoted separately for different heads as under for item (a) through (f). The unit rate quoted shall be exclusive of the rate of excavation, back filling and compacting, which shall be quoted separately as per item (g).

(a) LAYING OF EARTH CONDUCTOR : Unit price quoted shall be applicable per unit length of conductor laid.

(b) TEST PIT : Unit price quoted shall be applicable per number of test pits constructed.

(c) TEST LINK : Unit price quoted shall be applicable per number of test links constructed.

(d) EARTH ELECTRODE : Unit price quoted shall be applicable per number of earth electrodes installed.

(e) COLUMN EARTH CONNECTION : Unit price quoted shall be applicable per number of steel-column earth connection made.

(f) RISER PIGTAIL : Unit price quoted shall be applicable per number of riser pigtail provided. Unit price shall be inclusive of price of painting.

(g) EARTH EXCAVATION AND BACK FILLING : Unit price quoted shall be applicable per cubic metre of earth excavated, back-filled and compacted, specifically for the purpose of below ground earthing system.

4.3 Other prices shall be applicable for the purpose of payment.

5.0 MEASUREMENT OF QUANTITIES

5.1 Measurement of quantities of installation shall be carried out as per the details given in clause 4.2 above.

5.2 Wastage allowance shall be permissible only on the materials supplied by the Purchaser. Waste materials shall consist of two parts.

(a) Scrap, which shall be duly accounted for and returned to the Purchaser.

(b) Invisible wastage.

Permissible limit in terms of percent of tonnage of the above two wastages shall be as indicated in Data sheet A.

5.3 In the event of wastage of material supplied by Purchaser exceeding the tolerable limits specified in Data Sheet-A, payment deductions shall be made for the excess wastage at the market rates prevailing at the time of payment.

5.4 Excavation, back filling and compacting of earth, as specifically required for below ground earthing system only, shall be accounted for the measurement which requires to be certified by the Engineer at site.

6.0 INSPECTION & TESTING

All tests and inspection, as per relevant standards and final field quality plan, shall be conducted to certify the effectiveness and other requirements of below ground earthing system to the satisfaction of Purchaser.

7.0 FACILITIES TO BE ARRANGED BY VENDOR

The following shall be arranged by vendor at no extra cost to the Purchaser.

(a) All labour, supervisory and commissioning staff.

(b) All facilities & equipment for site fabrication like cutting, bending, drilling, welding, painting etc.

(c) All equipment for testing.

(d) All material handling equipment & services.

8.0 ADDITIONAL POINTS OF CONSIDERATION

8.1 The vendor shall carry out total installation work as per the requirements of the specification and instructions of Engineer. The requirements of this specification are of general nature. Any additional requirements stipulated in Section - C shall be taken care of. In case any clause of contradictory nature arises, the requirements of Section - C shall prevail.

8.2 The installation work shall be carried out in a neat workman like manner by skilled, experienced and competent workmen.

8.3 Installation shall be properly coordinated at site with other services and wherever necessary, suitable adjustments shall be made in the location of earth conductors, electrodes and test pits etc, with a view to avoid interference with other equipment and to meet the requirement of specification. All such adjustment shall be done with the prior approval of Engineer.

8.4 All improper erection shall be removed and reerected promptly to comply with the design requirement and to the satisfaction of Engineer. This shall be done at no extra cost to the Purchaser.

9.0 All improper erection shall be removed and reerected promptly to comply with the design requirement and to the satisfaction of Engineer. This shall be done at no extra cost to the Purchaser.

9.0 DOCUMENTATION

9.1 The following shall be furnished with the bid.

(a) Filled up schedules of Volume III including Data Sheet B

(b) Purchaser's drawings enclosed with the tender for Earthing System Below Ground with bidder's signature and seal of acceptance.

(c) Recommended Field Quality Plan covering site handling, storing, laying, testing etc.

9.2 The following shall be furnished within two weeks of award of contract, for Purchaser's approval.

(a) Data Sheet C

(b) Final Field Quality Plan

(c) Bar Chart

(d) Billing Schedule

9.3 The following shall be furnished before closing of the contract.

(a) As built drawings.

BILL OF QUANTITIES

1.0	Length of Earth conductor including that of interconnections, if any.	: 19KM (Approximate 190 MT) 40mm dia. M.S. Rod		
2.0	No. of Test Pits	: 200	Tentative Quantity	
3.0	No. of Test Links	: 10		
4.0	No. of Earth Electrodes	: 300		
5.0	No. of column Earth Connections	: 500		
6.0	No. of Riser-Pigtails	: 500		
7.0	Quantum of earth excavation, back filling and compacting work.	:		
	a) For earth conductor depth upto 1 metre in soil	:	m^3	
	b) For earth conductor depth	:	m^3	more than 1.5 metre in soil
	c) For earth conductor in rocky terrain	:	m^3	

1.0	Applicable Standards	:	IS / IEEE		
2.0	Type of Earthing System				
	a) Main Power House	:	Earthmesh		
	b) Coal Handling Plant	:	Earthmesh/ Ring-electrode - Not Applicable		
	c) Other auxiliary plants	:	Ring-electrode		
	d) Electronic Earthing	:	Provided		
3.0	Scope of interconnection between main plant and auxiliary plants	:	Included		
4.0	Depth of burial of				
	a) Earthmesh	:	600	mm	
	b) Ring electrode system	:	600	mm	
5.0	Depth of burial of interconnection (if included in scope)	:	600	mm	
6.0	Materials and sizes				
				Material	Size
	a) Main Earth conductor	:		M.S. ROD	40mm Dia.
	b) Riser pigtails	:		M..S ROD	40mm Dia
	c) Column earth connections	:		M.S. ROD	40mm Dia
	d) Electrodes	:		M.S. ROD	40mm Dia
7.0	Aver. resistivity of soil	:	60	ohm-metre	
8.0	Wastage allowance	:			
	a) Scrap	:	2%	(to be returned)	
	b) Invisible	:	1%		
9.0	Material to be supplied	:	19 KM (Approximate 190 MT)		

from Purchaser's stores (*)

10.	Facility provided by Purchaser	:	one electric point at temporary power supply board.
11.0	Purchaser's reference drawing (Standard)	:	PE-DG-239-509-E004 (10 sheets)

(*) All other materials (consumable and non-consumable) shall be supplied by vendor to meet requirement of specification and earthing drawings.

12.0 Reference drawings of project :

i)

ii) After award of the contract to successful bidder, earthing layout drawings shall be furnished

iii)

iv)

v)

1.1 Name of bidder :

1.2 Address :

2.0 STANDARDS APPLICABLE

2.1	IS:3043	For installation of below ground ground earthing system	:	YES/NO
2.2	IS:800	For use of structural steel	:	YES/NO
2.3	IS:2062	For Structural steel	:	YES/NO
2.4	IS:2629	For hot dip galvanizing of steel	:	YES/NO
2.5	IS:316	For metal arc welding	:	YES/NO
2.6	IS:1363	For hexagonal bolts, nuts and screws	:	YES/NO
2.7	IEEE:81	For testing of below ground earthing system	:	YES/NO
2.8	Indian Electricity Rules		:	YES/NO
2.9	Indian Electricity Act		:	YES/NO

3.0 TECHNICAL REQUIREMENTS

3.1	Confirm compliance in toto with specification no. PES-509-01, Section C and Data Sheet A	:	YES/NO
	If no,		
	Whether "Schedule of Deviations" filled up	:	YES/NO
3.2	Confirm surface treatment (galvanizing / painting) as per specification	:	YES/NO

4.0 DOCUMENTATION

Whether following enclosed

4.1	All relevant drawings	:	YES/NO
4.2	Purchaser's drawings after putting bidder's signature and seal of acceptance	:	YES/NO
4.3	Purchaser's Quality Plan after	:	YES/NO

putting bidder's signature and seal of acceptance

4.4	Field Quality Plan of bidder	:	YES/NO
4.5	Schedules of Volume III of specification	:	YES/NO

	TITLE	SPECIFICATION NO. PES-509-01REV.02
BHEL	TECHNICAL SPECIFICATION FOR GENERAL TECHNICAL REQUIREMENTS OF BELOW GROUND EARTHING SYSTEM INSTALLATION **DATA SHEET - C**	VOLUME II B SECTION REV NO. / DATE 04.02.95 SHEET 1 OF 1

1.0 GENERAL

1.1 Name of vendor:

1.2 Address :

2.0 STANDARDS APPLICABLE

2.1	IS:3043 For installation of below ground earthing system	:	YES/NO
2.2	IS:800 For use of structural steel	:	YES/NO
2.3	IS:2062 For Structural steel	:	YES/NO
2.4	IS:2629 For hot dip galvanizing of steel	:	YES/NO
2.5	IS:316 For metal arc welding	:	YES/NO
2.6	IS:1363 For hexagonal bolts, nuts & screws	:	YES/NO
2.7	IEEE:81 For testing of below ground earthing system	:	YES/NO
2.8	Indian Electricity Rules	:	YES/NO
2.9	Indian Electricity Act	:	YES/NO

3.0 TECHNICAL REQUIREMENTS

3.1	Confirm compliance in toto with specification no. PES-509-01 and Data Sheet A	:	YES/NO
3.2	Confirm surface treatment (galvanizing/ painting) as per specification	:	YES/NO

4.0 DOCUMENTATION
Whether following enclosed

4.1	All relevant drawings	:	YES/NO
4.2	Final Quality Plan	:	YES/NO
4.3	Final Field Quality Plan	:	YES/NO
4.4	Bar chart	:	YES/NO
4.5	Billing Schedule	:	YES/NO

OWNER

BHILAI ELECTRIC SUPPLY CO. PVT. LTD.

PROJECT

EXPANSION OF BHILAI POWER PROJECT
2 x 250 MW – UNIT 1 & 2

CONSULTANTS

BLACK & VEATCH, USA

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

JOB NO.	: 239
STATUS	:
DISTRIBUTION	:
TO No.OF	

DEPT CODE		NAME	SIGN.	DATE
E	DRN	B.B		17/11/05
	DESN	G.K.R		17/11/05
	CHD	GS		17/11/05
	APPD	NPC		17/11/05

TITLE

TYPICAL DETAILS OF BELOW GROUND EARTHING

CV	ME	EL	C&I			DEPT.
						SIGN
						DATE

SCALE ---

DRAWING NO.
PE–DG–239–509–E004

SHT. No 1 OF 10 REV. A

DETAILS	CHECKED	DRAWN	REV.	DATE

TABLE OF CONTENTS

A. NOTES:

1. EARTHING INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION INCLUDING REVISIONS OF THE FOLLOWING:
   a) INDIAN ELECTRICITY RULES
   b) IS: 3043–1987 : CODE OF PRACTICE FOR EARTHING INSTALLATION
2. THE EARTHING SYSTEM SHALL HAVE AN UNDERGROUND EARTHING GRID FORMED AT DIFFERENT AREAS AS SHOWN IN THE EARTHING LAYOUT DRAWING.
3. THE LOCATION OF EARTHING GRID AND GROUND ELECTRODES SHOWN IN THE LAYOUT DRAWINGS ARE INDICATIVE AND CAN BE CHANGED LOCALLY TO SUIT SITE CONDITIONS IN CONSULTATION WITH ENGINEER IN CHARGE.
4. BURIED EARTHING CONDUCTORS IN OUTDOOR AREAS SHALL GENERALLY BE LAID AT A MINIMUM DEPTH OF 600mm BELOW THE FINISHED GROUND LEVEL UNLESS OTHERWISE SPECIFIED.
5. BURIED EARTHING CONDUCTORS SHALL BE OF 40mm DIA BARE, MILD STEEL ROD.
6. EARTH PITS SHALL HAVE DISCONNECTING LINK FACILITY FOR TESTING PURPOSE.
7. VERTICAL MILD STEEL ROD EARTH ELECTRODE SHALL BE OF 40MM DIA 3 METRE LONG.
8. SPACING BETWEEN EARTH ELECTRODES SHALL BE NOT LESS THAN 6M.
9. FOR AUXILIARY BUILDINGS, BURIED EARTHING CONDUCTORS SHALL BE LAID AT A MINIMUM DISTANCE OF 1500mm FROM THE OUTER BOUNDARY OF THE BUILDING WALL/COLUMN.
10. EARTH RISERS FROM MAIN EARTH GRID SHALL BE BROUGHT 300mm ABOVE FINISHED FLOOR LEVEL FOR EQUIPMENT EARTHING/STRUCTURE EARTHING.
11. EARTHING CONDUCTORS AT ROAD CROSSINGS SHALL BE LAID IN HUME PIPES OR LAID AT A DEPTH OF 1000mm (Min.) BELOW GROUND LEVEL.
12. CONNECTION OF BURIED EARTH CONDUCTORS SHALL BE CARRIED OUT BY ARC WELDING. ALL WELDED CONNECTIONS SHALL BE MADE BY ELECTRIC ARC WELDING. ARC WELDING SHALL BE DONE WITH LOW HYDROGEN CONTENT ELECTRODE. BURIED WELDED JOINTS SHALL BE PAINTED WITH BITUMINOUS COMPOUND TO PREVENT CORROSSION AND PROVIDED WITH JUTE COVERING. DURING WELDING, THE GROUND ROD SECTIONS BEING WELDED SHALL BE SUPPORTED BY A GUIDE TO ENSURE PROPER ALIGNMENT.
13. EARTHING CONDUCTOR IN CONCRETE FLOOR INSIDE THE BUILDING SHALL HAVE ATLEAST 50mm CONCRETE COVER.
14. A MINIMUM EARTH COVERAGE OF 300MM SHALL BE PROVIDED BETWEEN EARTH CONDUCTOR AND THE BOTTOM OF TRENCH/UNDERGROUND PIPES AT CROSSINGS.

15. EARTHING OF STEEL COLUMNS TO THE NEAREST GROUND GRID IS IN THE SCOPE OF THE CONTRACTOR.

16. RAILWAY TRACK WITHIN THE PLANT AREA SHALL BE BONDED ACROSS FISH PLATES AND CONNECTED TO EARTH GRID AT INTERVAL OF 1500mm.

17. EARTH PIT LINKS SHALL BE PROVIDED AT BOTH THE ENDS BETWEEN THE MAIN EARTH MAT AND AUXILIARY BUILDINGS EARTH MAT/EXISTING EARTH MAT.

18. THE CONTRACTOR SHALL OBTAIN THE CLEARANCE FROM CEIG PRIOR TO STARTING THE WORK.

19. ALL INSTRUMENTS, TESTING EQUIPMENT ERECTION TOOLS, WELDING EQUIPMENT, WELDING ELECTRODES AND OTHER MATERIALS, CONSUMABLES ETC., SHALL BE ARRANGED BY THE CONTRACTOR AT THEIR OWN COST.

20. ON COMPLETION OF INSTALLATION IT SHALL BE TESTED BY THE CONTRACTOR IN THE PRESENCE OF THE PURCHASER/CONSULTANT.
THE COST OF THE TEST SHALL BE BORNE BY THE CONTRACTOR.

21. EARTHING RESISTANCE OF THE GRID SHALL BE MEASURED AFTER CONNECTING ALL THE ELECTRODES TO THE GRID. THE RESISTANCE BETWEEN ANY POINT ON THE METALLIC EARTH GRID AND THE GENERAL MASS OF EARTH SHALL NOT EXCEED 1 OHM.

22. THE RESISTANCE TO EARTH SHALL BE MEASURED AT THE FOLLOWING:

    a) AT EACH ELECTRICAL SYSTEM EARTH OR SYSTEM NEUTRAL EARTH.

    b) AT EARTH PROVIDED FOR CHIMNEY LIGHTNING PROTECTIONS.

    c) AT ONE POINT ON EACH EARTHING SYSTEM USED TO EARTH ELECTRICAL EQUIPMENT ENCLOSURES.

    d) THE PERIMETER FENCE SHALL BE GROUNDED AT EACH FENCE POST WHENEVER IT IS LESS THAN 45 METERS FROM THE CENTERLINE OF A TRANSMISSION LINE.

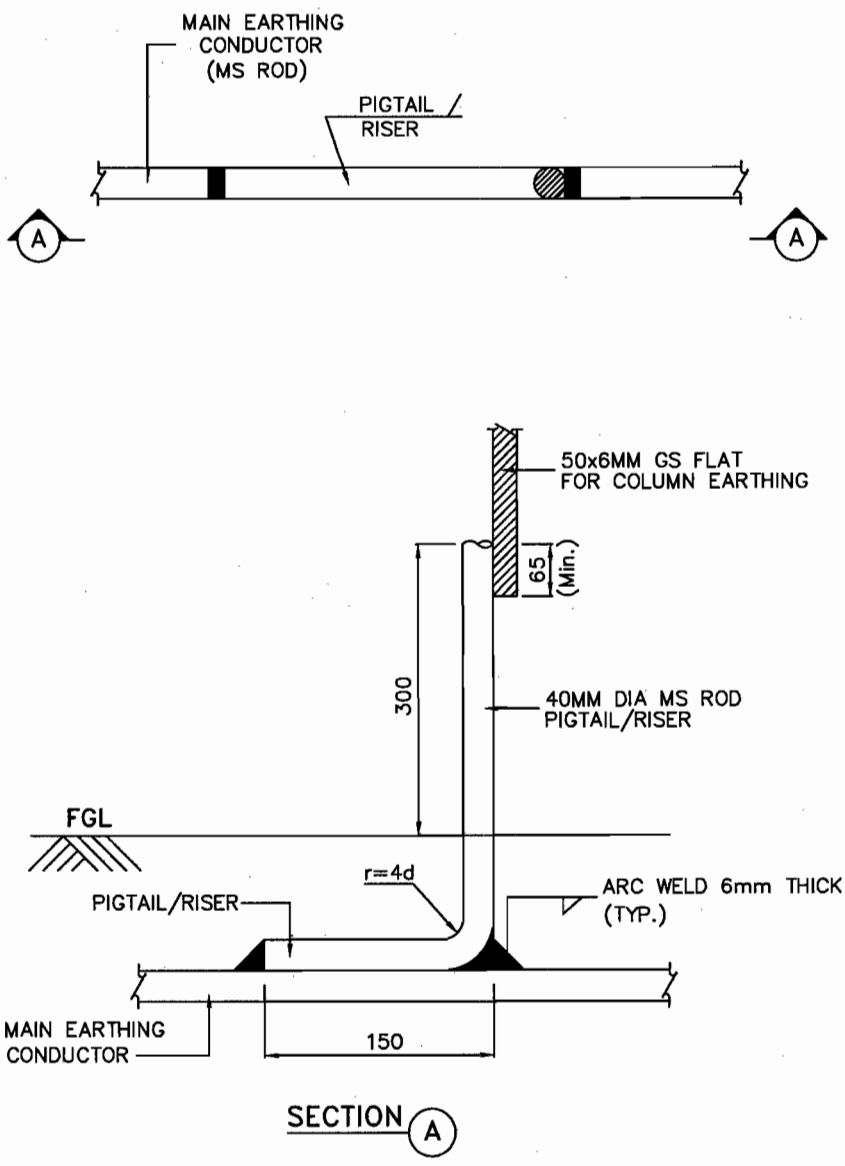
23. ASBUILT DRAWINGS AFTER ACTUAL ERECTION OF EARTHING SYSTEM SHALL BE FURNISHED BY THE CONTRACTOR. THE CONTRACTOR SHALL FURNISH MARKED UP COPIES IN REQUISITE NUMBERS.

B. LEGEND:

MS : MILD STEEL
GS : GALVANISED STEEL

NOTE:

1. ALL DIMENSIONS ARE IN MM.



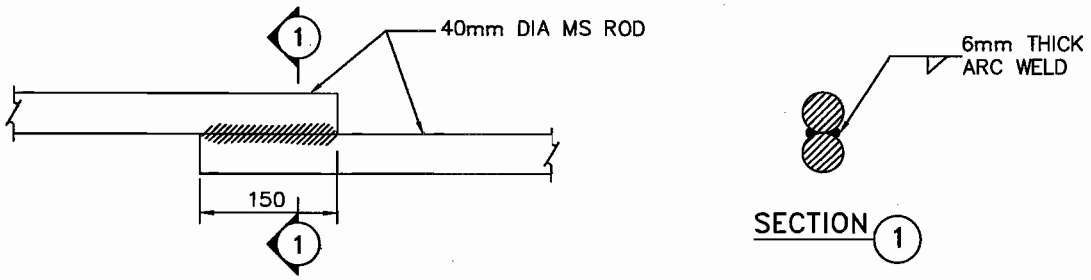
SECTION (A)

LAP JOINT FOR RISER/PIG TAIL

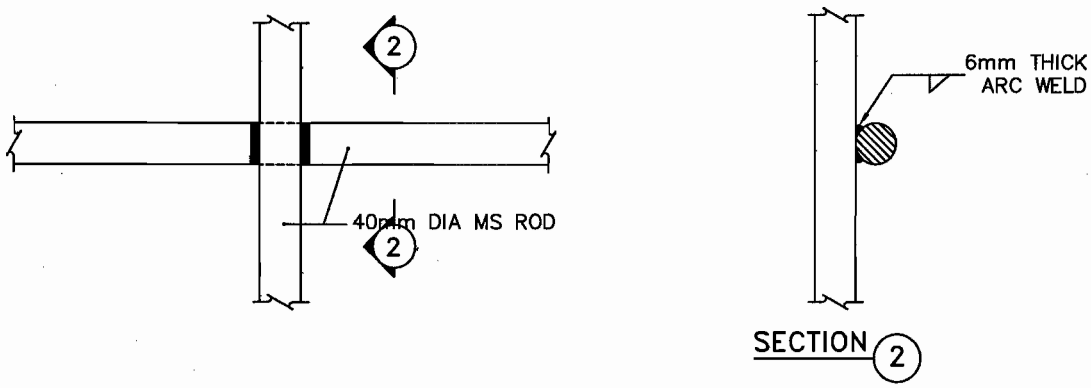
	EXPANSION OF BHILAI POWER PROJECT 2 x 250 MW – UNIT 1 & 2	DRG.NO: PE-DG-239-509-E004
	TYPICAL DETAILS OF BELOW GROUND EARTHING	REV. NO: A
		PAGE: 6 OF 10

NOTE:

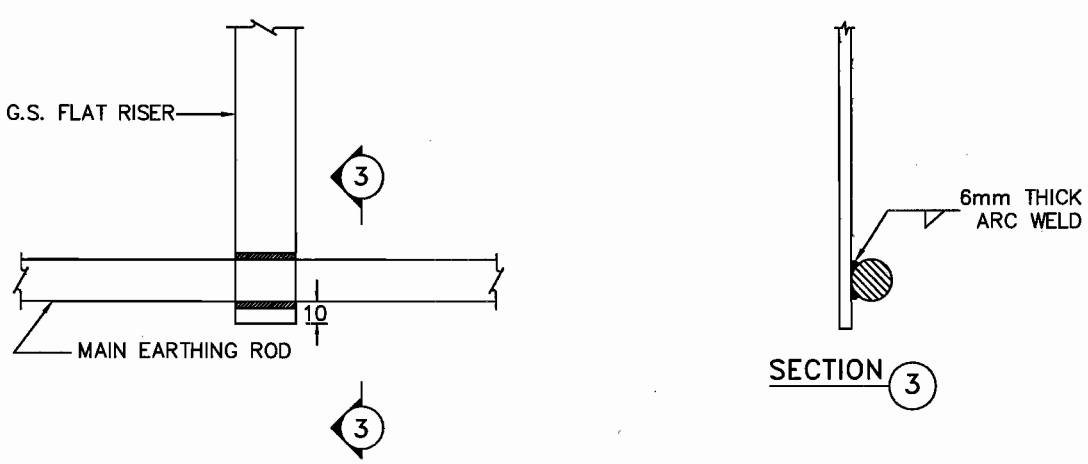
1. ALL DIMENSIONS ARE IN MM.



LAP JOINT BETWEEN MS RODS



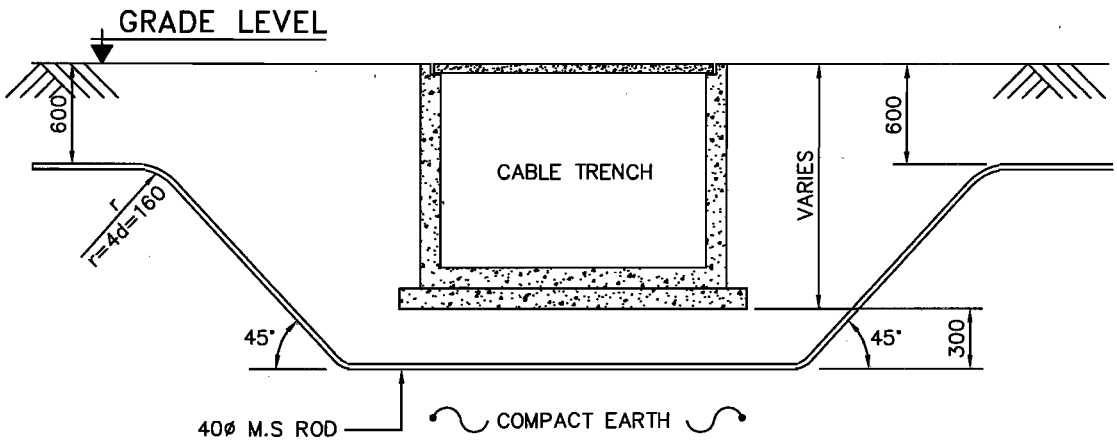
CROSS JOINT BETWEEN MS RODS



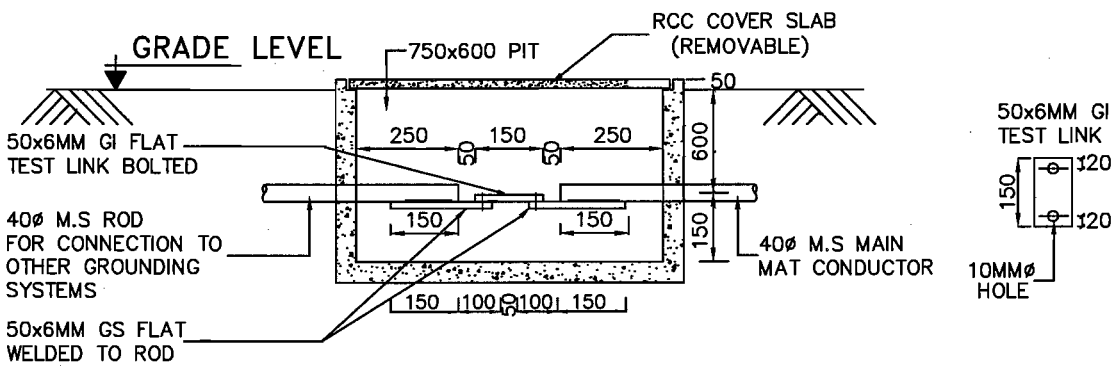
JOINT BETWEEN MS ROD AND GS FLAT

NOTE:

1. ALL DIMENSIONS ARE IN MM.



CABLE TRENCH/CROSSING

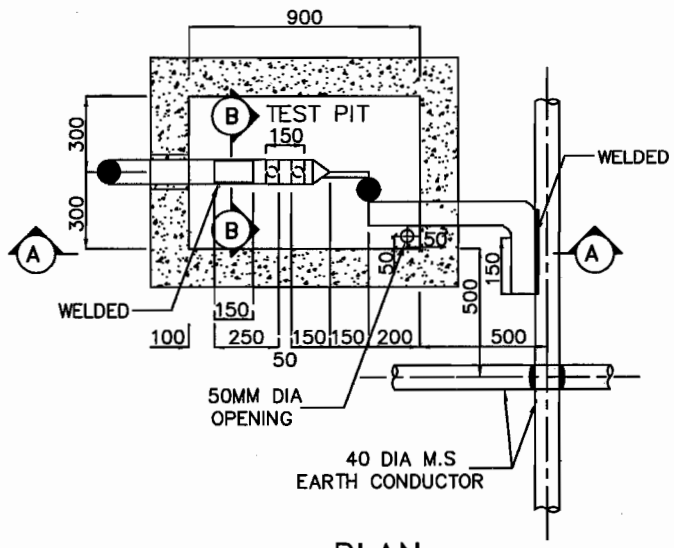


TEST LINK PIT

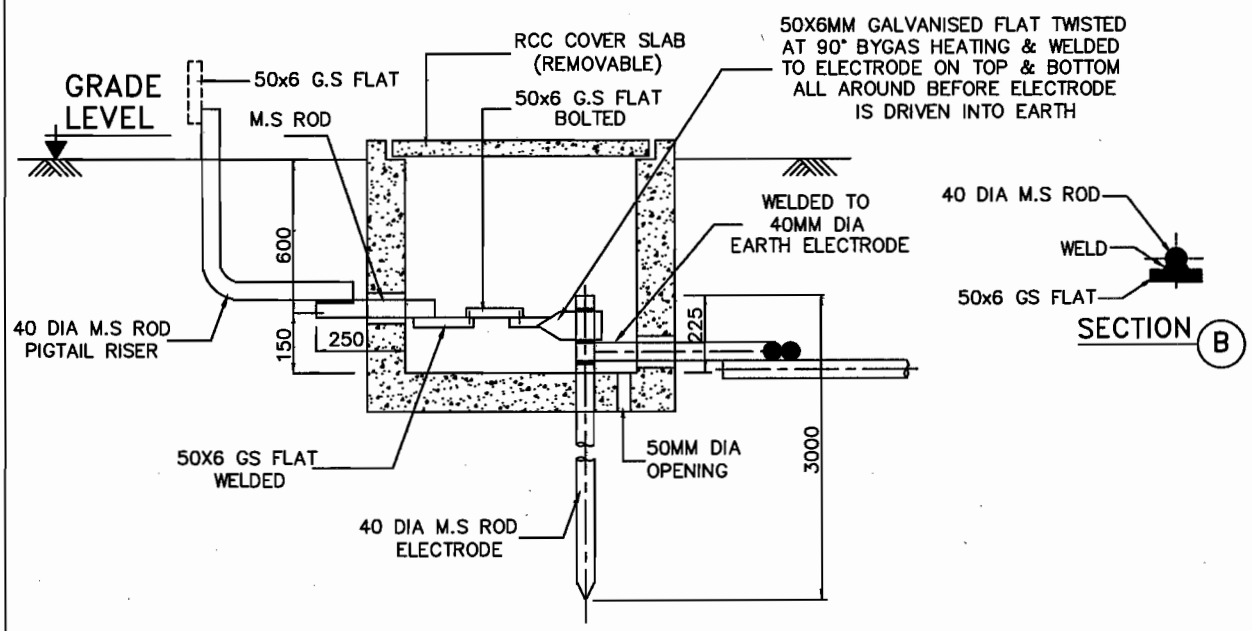
(PROVIDED FOR CONNECTION BETWEEN VARIOUS GROUNDING SYSTEMS)

NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. TOP OF PIT SHALL BE ALIGNED WITH GRADE LEVEL IN PAVED AREA.



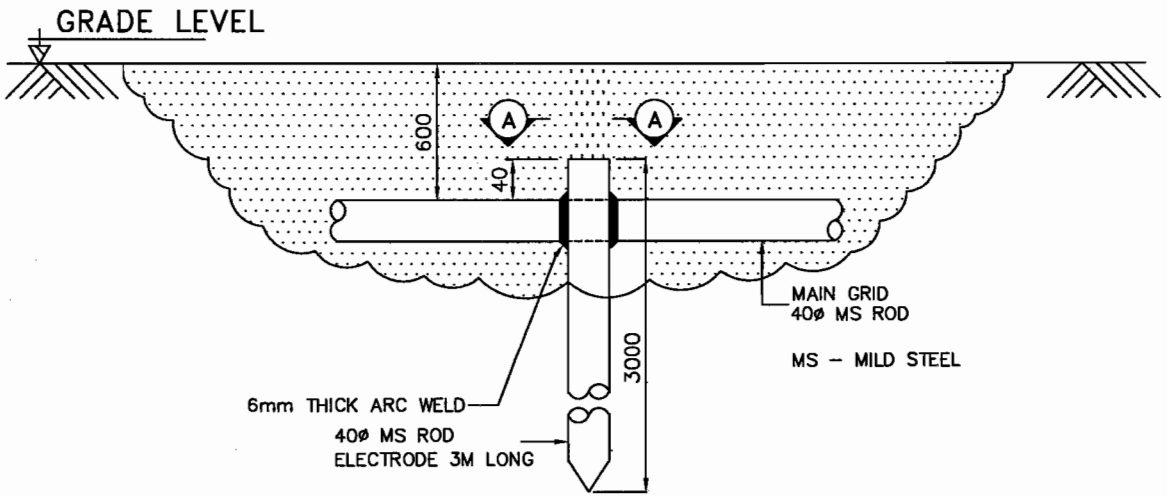
PLAN



SECTION A

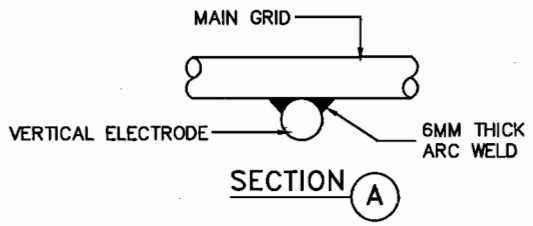
TYPICAL ARRANGEMENT OF EARTH TEST PIT

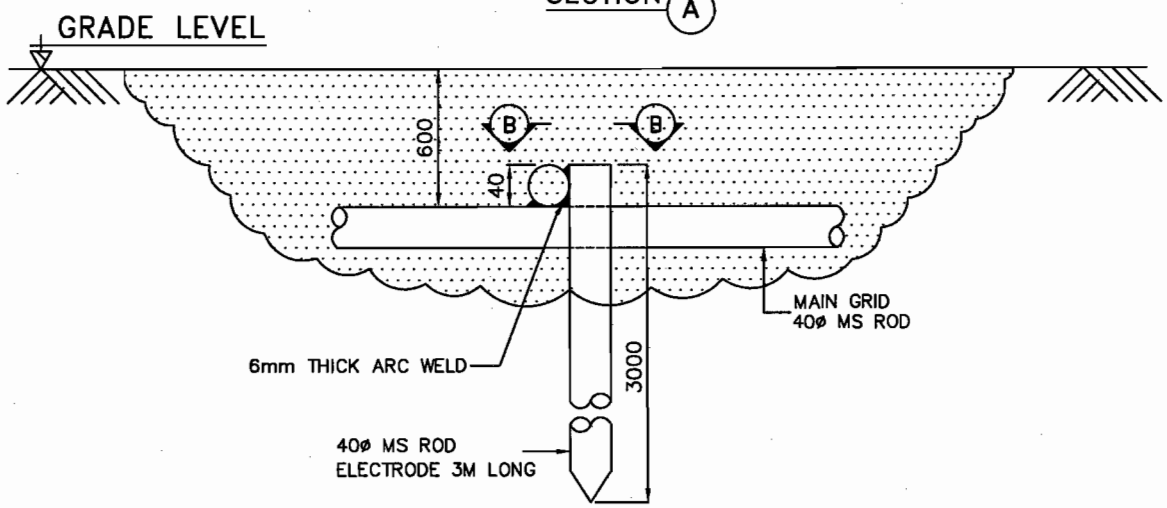
BHEL	EXPANSION OF BHILAI POWER PROJECT 2 x 250 MW – UNIT 1 & 2	DRG.NO: PE-DG-239-509-E004
	TYPICAL DETAILS OF BELOW GROUND EARTHING	REV. NO: A
		PAGE: 9 OF 10



VERTICAL EARTH ELECTRODE

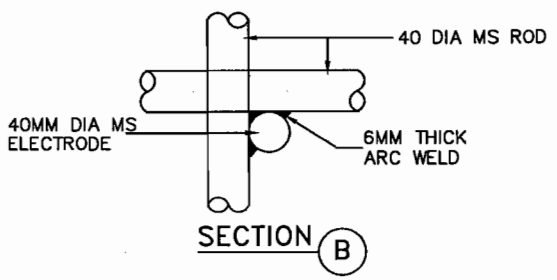
(LOCATED ALONG PERIPHERY OF EARTHING GRID FOR USE OTHER THAN EARTH TEST PIT)



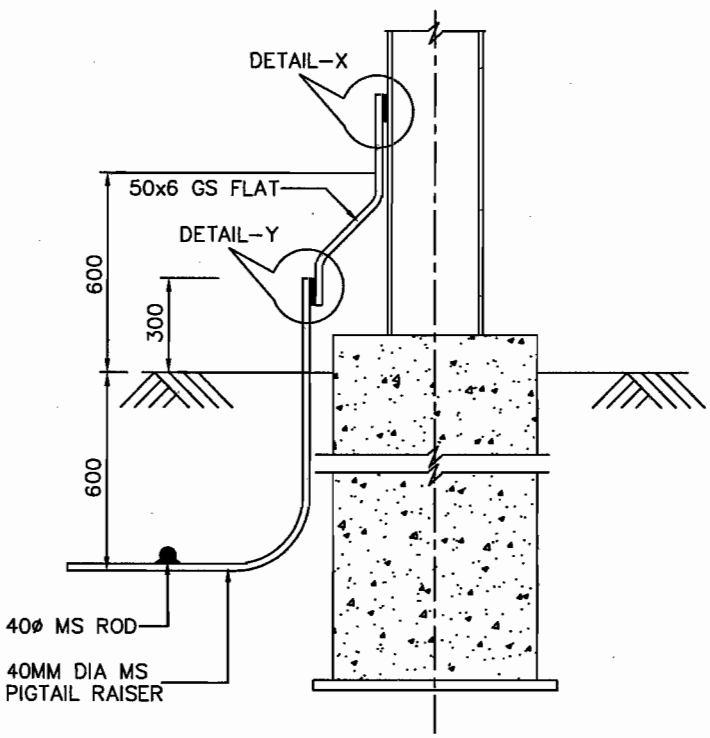


VERTICAL EARTH ELECTRODE

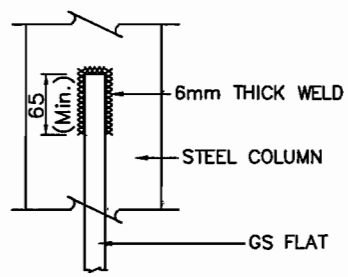
(LOCATED AT JUNCTION OF EARTH CONDUCTOR)



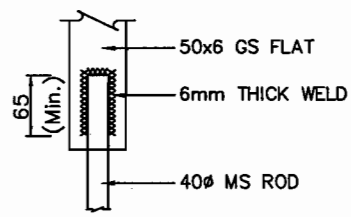
BHEL	EXPANSION OF BHILAI POWER PROJECT 2 x 250 MW – UNIT 1 & 2	DRG.NO: PE-DG-239-509-E004
	TYPICAL DETAILS OF BELOW GROUND EARTHING	REV. NO: A
		PAGE: 10 OF 10



STEEL COLUMN EARTHING



DETAIL–X



DETAIL–Y