

RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD.

2 X 660 MW SURATGARH STPS, STAGE-V, UNIT # 7&8

VOLUME – II

***TECHNICAL SPECIFICATION FOR
NEUTRAL GROUNDING RESISTOR***

BHEL DOCUMENT NO. : PE-TS-392-506-E002, REV-0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA – 201301**



**TECHNICAL SPECIFICATION FOR
NEUTRAL GROUNDING RESISTOR**

2X660 MW SURATGARH STPS, UNIT#7&8

SPECIFICATION NO. PE-TS-392-506-E002

VOLUME II B

SECTION

REVISION 0 | DATE: 06.05.2014

SHEET 1 OF 1

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TOTAL NO. OF SHEETS =26 (INCLUDING COVER/ SEPARATOR SHEETS)

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

**BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')**

**TECHNICAL SPECIFICATION FOR
NEUTRAL GROUNDING RESISTOR****2X660 MW SURATGARH STPS, UNIT#7&8****SPECIFICATION NO. PE-TS-392-506-E002****VOLUME II B****SECTION****REVISION 0 DATE: 06.05.2014****SHEET 1 OF 1****INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS**

1. In line with clause no. 10.1 of Section-C, Volume-II-B of the specification, two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a. Unpriced BOQ-Cum-Price Schedule with 'QUOTED' word against each item with bidder's signature and company stamp.
 - b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.
 - c. A copy of previous sheet ("List of Contents"), with bidder's signature and company stamp.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the NGR description/ quantities, notes etc. from those given in BOQ-Cum-Price Schedule of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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PREAMBLE

1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 VOLUME - I CONDITIONS OF CONTRACT

This consists of four parts as below:-

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial conditions for Erection & Commissioning site work, as applicable.

1.2 VOLUME – II TECHNICAL SPECIFICATION

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.3 VOLUME – IIB

This volume is sub-divided in to following sections:-

Section – A This section outlines the Intent of Specification

Section – B This section provides “Project Information”.

Section – C This section indicates Technical Requirements specific to Contract.

Data sheet - A :- Specific data and other requirements pertaining to the equipments.

Data sheet - C: - Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)



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SEC-A

SCOPE OF ENQUIRY

- 1.0 This specification covers design, manufacture, assembly, inspection & testing at manufacturer's works, proper packing, delivery to site of Neutral Grounding Resistor as mentioned in different sections of this specification, complete with all accessories for efficient and trouble-free operation of **2X660 MW SURATGARH STPS UNIT # 7 & 8**.
- 2.0 It is not the intent to specify completely herein all details of the design and manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 3.0 The general terms and conditions, instruction to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.
- 4.0 The Bidder shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Bidders shall confirm total compliance to the specification without any deviations from the technical/ quality assurance requirements stipulated..
- 6.0 The documents shall be in English language and MKS system of units.



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SECTION - B

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	Climatic conditions	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 2 OF 3

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:		
	a) Basic wind speed = 47 m/sec		
	b) Factor K1 = 1.07		
	c) Category of terrain = Category 2		
	d) K3 – as per IS 875		
8.0	Seismic data (As per IS: 1893 latest issue)		
	a) Zone	Zone II	
	Designs & design coefficients shall be based on IS 1893:2002		
	Design condenser cooling water inlet temperature	33 Deg C	
9.0	Auxiliary power supply:		
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:		
	a)	For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b)	For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c)	For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d)	For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e)	DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f)	AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g)	Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
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		supply (For all instrumentation and control system equipment and solenoid valves)
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g) Lighting fixtures and space heaters 240 V, 1 phase, 2 wire, 50Hz,solidly earthed system

h) Construction supply 415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.

i) The above voltages may vary as follows :

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

AC supply	Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
DC supply	Combined voltage & frequency variation 10% Voltage variation +10% , -15%

j) For instrument and control system of steam generator and steam turbine generator. 230 V $\pm 5\%$ AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0 All the electrical equipment shall be designed for 50° C reference ambient temperature.

ISSUE
R1



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1.0 SCOPE OF ENQUIRY

This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing and despatch to site of 11 kV and 6.6 kV NEUTRAL GROUNDING RESISTOR (NGR) as described in the various sections of this specification. The equipment shall generally conform to IS/IEEE. In this specification though erection and commissioning is not included in vendor's scope, the vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.

2.0 CODES & STANDARDS

The equipment and accessories covered under this specification shall be designed, manufactured and tested in accordance with latest revision of applicable Indian & international standards.

3.0 BILL OF QUANTITY

Refer BOQ-Cum-Price Schedule.

4.0 EXCLUSIONS

All civil works and erection & commissioning of equipment are excluded from scope of vendor.

5.0 TERMINAL POINTS OF SUPPLY

5.1 Neutral grounding resistors along with suitable cable glands & lugs for incoming cables.

5.2 Supporting structure along with insulators & necessary foundation hardware.


6.0 DESIGN CRITERIA

6.1 The NGR is used for medium resistance grounding of MV (11 & 6.6 kV) system of the power plant. NGR shall be connected between earth and neutral point of transformers.

6.2 The NGR shall be used to limit the magnitude of the earth fault to 400A.

6.3 The duty rating of NGR shall be 30 sec.

6.4 The bidder shall quote the NGR with final temperature rise of 350 °C over an ambient of 50 °C.

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6.5 The resistor unit shall be natural air-cooled type suitable for installation at outdoor locations.

6.6 The NGR will be installed in hot humid and tropical atmosphere. All equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

7.0 SPECIFIC TECHNICAL REQUIREMENTS

7.1 NEUTRAL GROUNDING RESISTOR

7.1.1 Each Neutral Grounding Resistor shall be formed of non-aging (grade ASTM-A240/AISI-304 or better), corrosion resistant punched stainless steel grid elements of high Electrical Resistivity and low temperature co-efficient of resistance. Resistor bank shall be provided in series and parallel combination to achieve the overall resistance value. Minimum two banks in parallel shall be provided in the system, unless specified otherwise.

7.1.2 Neutral grounding resistor shall conform to IEEE 32. The resistor unit shall consist of suitable no. of elements. All the elements shall be mounted inside the cubicle so as to ensure ease of inspection and replacement of individual element.

7.1.3 Each Resistor element shall possess a balanced combination of both Mechanical and Electrical properties over the entire intended operating temperature range without any harmful effect on the elements and their accessories.

7.1.4 All the resistor elements constituting the NGR shall be assembled and supported inside the cubicle in such a way that no distortion or breakage will occur during the passage of through fault current to earth.


7.1.5 All element connection shall be bolted type to ensure stable resistance value throughout the working life of the unit.

7.1.6 Wet process type brown glass porcelain insulators shall be used for supporting resistor elements. Porcelain insulators shall have high creepage value (25mm/kV), suitable for heavily polluted atmosphere charged with dust particles. The NGR shall be provided with suitable taps, fully equipped for cable termination as per details furnished in Data Sheet-A.

7.1.7 All conductor termination shall be bolted, welded or brazed. Low melting alloy used to join connectors, which would adversely affected by the resistor operating temperatures shall not be used. All conductor termination must be mechanically secure to provide continuous electrical conductivity.

7.1.8 The resistor cubicle shall be located in transformer yard at a height of 2.5m.

7.1.9 Minimum degree of protection for resistor element shall be IP 34.

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7.1.10 The NGR cubicle shall comprise the following:

a) One resistor of suitable rating provided with terminals. Resistor shall be assembled in rows with insulators on steel frame, natural air cooled and shall withstand operation at specified voltage and current without exceeding a final temperature of 350°C.

b) Cylinder type of lock.

c) One earth bus.

d) Standoff insulators

7.2 ENCLOSURE

7.2.1 Each neutral grounding resistor shall be housed in weather proof enclosure having DOP of IP-55. The cubicle shall be fabricated from 2 mm thick cold rolled sheet steel. The cubicle shall be suitable for floor mounting. Base channels along with anti-vibration pads shall be furnished. The cubicle shall be of dust-tight, vermin and weather proof construction.

7.2.2 The enclosure shall be supported on insulators placed on mounting structure of height 2500mm in such a fashion that it is not easily accessible for a man standing on ground level.


7.2.3 Each cubicle shall be complete with a front access door with handles, cylinder type lock and also a removable bolted cover. All cubicle door hinges shall be concealed type. All doors and removable covers shall be properly gasketed with neoprene rubber gaskets.

7.2.4 Provision shall be made on NGR cubicle for terminating suitable size cables from transformer neutral.

7.2.5 Cable gland shall be Double compression type of Tinned Brass conforming to BS: 6121 and cable lugs shall be heavy duty aluminium tubular terminal end for solder less crimping.

7.2.6 All necessary galvanised bolts, nuts washers etc. shall be included by the BIDDER for installation of Cubicle at site.

7.2.7 Panel space heater arrangement alongwith thermostat, suitable for connection to 240V AC single-phase power supply, shall be provided at the bottom of the enclosure. The illumination arrangement and switch socket shall also be provided in the panel. The required cable gland, lugs etc required shall be supplied by the bidder.

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7.2.8 The enclosure shall not be earthed to prevent bypassing of resistor in case of any inadvertent shorting of resistor from inside.

7.3 GROUNDING

7.3.1 All parts of enclosure, supporting structures, equipment frames etc. shall be properly grounded at two points.

7.3.2 For connection of other end of NGR to ground, 2 Nos. GS flat of size 50x10 with Fork connector, 2 nos. earthing terminal/per flat, tapped holes and bolts suitable for connection to earth grid shall be provided.

7.4 PAINTING

7.4.1 When fabricated from sheet steel, the surfaces shall be cleaned, phosphate and applied with two coats of ready mixed, stoving type zinc chromate primer. After application of primer, two coats of finishing epoxy paint shall be applied, with each coat followed by stoving. The colour of the finished surface shall be glossy white inside and for outside the cubicle Shade-631 of IS-5 for outdoor application. The minimum thickness of paint shall be 70-80 microns.

8.0 RECOMMENDED O&M SPARES

8.1 O & M spares are those, which may be required for operation & maintenance of the equipment.


8.2 The bidder shall supply with the equipment, one unused complete set of all special tools & tackles required for the erection, assembly, disassembly and proper maintenance of the equipment. A list of such tools & tackles shall be submitted by the bidder alongwith the offer. The price of special tools & tackles shall be deemed to be included in the bid price.

8.3 Alongwith equipment, bidder shall supply E&C spares. A list of such E&C spares shall be submitted by the bidder alongwith the offer. The price of E&C spares shall be deemed to be included in the bid price.

9.0 QUALITY ASSURANCE, TESTING & INSPECTION


9.1 Bidder shall furnish Type Test certificates conducted on similar type of equipment for purchaser's review at contract stage.

9.2 For all components / materials, for which type test reports have been asked for in the specification, such Type tests should have been carried out on identical components / materials. In absence of such type tests reports or in case such reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery

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implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval. The cost of type tests deemed to be included in the price of NGR. (Type test charges as per clause 9.3 shall not be applicable in such cases).

- 9.3 The bidder shall indicate cost of carrying out all the Type tests as specified in the specification. The charges for each of the Type tests shall be given separately in price schedule as optional. These prices will be applicable in case a type test is required to be conducted by purchaser despite availability of satisfactory type test report as per clause 9.3 above.
- 9.4 All materials & components and shall be procured, manufactured, inspected, and tested by vendor/sub-vendor as per applicable clauses of BHEL Quality Plan no. PED-505-00-Q-002/01, R01 (subject to approval of customer) enclosed.
- 9.5 All acceptance and routine tests as per relevant standards shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price. Following routine tests shall be conducted on each resistor covered in this package:
- Ohmic value measurement (for resistance & reactance separately).
 - Insulation resistance measurement before & after HV test.
 - HV test for 1 min. at a voltage corresponding to the insulation level of the resistor.
- 9.6 Test reports of the various tests conducted at the time of inspection shall be furnished by the vendor.
- 9.7 **Bidder shall furnish unit prices of all the major items in the prescribed schedule of unit prices. Purchaser reserves the right to add/delete the quantity during detailed engineering as finally required for the project. Unit rate quoted shall be applicable for price adjustment in such cases.**
- 9.8 All bought out items shall be procured from reputed manufacturers and shall be subject to approval of purchaser.
- 10.0 **DOCUMENTATION**
- 10.1 By all Bidders as technical offer:
- Unpriced BOQ-Cum-Price Schedule with 'QUOTED' word against each item with bidder's signature and company stamp.
 - A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" with bidder's signature and company stamp.
 - A copy of sheet "List of Contents" with bidder's signature and company stamp.

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10.2 Final documents to be submitted after award of contract shall be decided during kick-off meeting and bidder to agree the same without any commercial/ delivery implications. However, tentative list of documents is given below:

- a) Data sheet-C duly filled up
- b) GA & foundation details of NGR & mounting structure
- c) Temperature rise calculations as per IEEE 32
- d) QP duly stamped & signed
- e) Painting & surface preparation procedure for purchaser's acceptance
- g) Type Test reports for
 - i) Temperature rise test
 - ii) Degree of Protection Test: IP: 55 (both digits) for enclosure.
 - iii) Degree of Protection Test: IP: 34 (both digits) for resistor element.
- h) Final Distribution prints of documents
- i) Routine / Acceptance test certificates
- j) O & M manual

10.3 No. of prints to be submitted by vendor after award of contract shall be as under:

S. NO.	DESCRIPTION	No. hard /soft copies	No. of CD-ROMs	REMARKS
1	Docs. /drgs. for approval (First submission)	PDF File + 2 Hard copies	NIL	
2	Drgs. / docs. for approval (Second & subsequent submission till approval)	PDF File + 2 Hard copies	NIL	
3	Final approval drgs. / docs. for Distribution after CAT-1.	PDF File + 5 Hard Copies	NIL	
4	As Built drgs./doc.	6 Hard Copies	4 CD-ROMS	
5	Operation, Erection & Maintenance manual for approval	PDF File + 2 Hard Copies	NIL	
6	Approved Operation & Maintenance Manual for distribution	PDF File + 6 Hard Copies	4 CD-ROMS	
7	Type Test Certificates/ Reports for approval	PDF+ 2 hard Copies	NIL	
8	Type Test Certificates/ Reports for distribution	6 hard Copies	6 CD-ROMS	

10.4 O&M MANUALS

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Instruction manuals for the installation, operation and maintenance of NGR to be supplied shall be furnished before the date of despatch of equipment. The installation and maintenance manual of battery shall contain the following details:

- i) Description of the equipment.
- ii) Salient construction features.
- iii) Packing details.
- iv) Instructions to be followed on receipt at site for storage.
- v) Erection procedure & checks
- vi) Tests to be conducted at site.
- vii) Commissioning procedure.
- viii) Maintenance instructions.
- ix) List of spares.
- x) Approved GA drawing.
- xi) Approved Datasheet.
- xii) Technical leaflets of all important components.

11.0 **AS-BUILT DRAWINGS**

Though only supply of equipment is under bidder's scope, bidder may note that all as-built correction (as given by purchaser to vendor) shall have to be incorporated in the originals by the vendor and copies of the as-built corrected drawings / documents as per requirement shall be submitted by the vendor.



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DATA SHEET-A

S.NO.	DESCRIPTION	UNIT	PARTICULARS
1.0	Service		Outdoor
2.0	Reference Standard		IEEE – 32
3.0	Design ambient temperature	°C	50
4.0	Resistor:		
	Rated voltage	kV	11 & 6.6
	Rated current	A	400
	Time rating	Sec.	30
	Total Resistance	Ω	16.6 for 11 kV
	Total Resistance	Ω	9.96 for 6.6 kV
	Resistance material		Punched grid, stainless steel
	Maximum allowable temperature rise (over 50°C ambient)	°C	350
	No. of parallel paths		Min two nos.
	Degree of protection for resistor element		IP: 34
5.0	Taps		
	Taps to be provided at	%	25%, 50% & 75%
6.0	Enclosure		
	Degree of protection		IP: 55, weather proof
	Reference standard		IS: 13947
	Enclosure material & thickness		Cold rolled sheet steel & 2mm
	Tank Type weatherproof with Aluminium Cover required		YES
7.0	Support Insulator:		
	Material		Porcelain
8.0	Mounting Structure		
	Material		Hot dip galvanised M.S



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9.0 Terminal Box

Degree of protection

IP: 55, weather proof

Reference standard

IS: 13947

Enclosure material
& thickness

Cold rolled sheet steel
2mm

10.0 Paint Shade

Exterior-Shade 631 of IS: 5
Interior- Glossy White



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DATA SHEET-C

S. No.	Description	Unit	Particulars	
1.0	Quantity	Nos		
2.0	Service		----- Outdoor-----	
3.0	Reference Standard		-----IEEE – 32/Relevant-IEC-----	
4.0	Resistors:		11KV	6.6KV
4.1	Name of manufacturer		: -----	-----
4.2	Rated voltage	V	: -----	-----
4.3	Rated short time current & time	I sec	: -----	-----
4.4	Resistance per resistor element	(Ω)	: -----	-----
4.5	Net Resistance of unit	Ω	: -----	-----
4.6	Material of resistor element		: -----	-----
4.7	No. of parallel paths		: -----	-----
4.8	No. of resistor elements per path		: -----	-----
4.9	Total no. of resistor elements		: -----	-----
4.10	Method of connecting elements		: -----	-----
4.11	Design ambient temperature		: -----	-----
4.12	Maximum allowable temperature rise (over ambient temp.)	(°C)	: -----	-----
4.13	Specific resistance of resistor	(μΩ-cm)	: -----	-----
4.14	Temperature coefficient of resistor (°C)		: -----	-----
4.15	Type of grids		: -----	-----
4.16	Degree of protection		: -----	-----
5.0	Support Insulator:			
5.1	Make		: -----	-----
5.2	Material		: -----	-----
5.3	Creepage Distance		: -----	-----
5.4	Voltage rating		: -----	-----
5.5	Power frequency withstand voltage (dry)		: -----	-----



TECHNICAL SPECIFICATION FOR NEUTRAL GROUNDING RESISTOR

2X660 MW SURATGARH STPS, UNIT #7&8

SPECIFICATION NO. PE-TS-392-506-E002

VOLUME II B

SECTION C

REVISION 0

DATE: 06.05.2014

SHEET 11 OF 11

6.0 Terminal connection:

6.1	Type	:	-----	-----
6.2	Make	:	-----	-----
6.3	Material	:	-----	-----
6.4	Voltage rating	:	-----	-----
6.5	Power frequency withstand voltage (dry)	:	-----	-----

7.0 Enclosure cubicle:

7.1	Enclosure material	:	-----	-----
7.2	Thickness of Enclosure material	mm :	-----	-----
7.3	Degree of protection	:	-----	-----
7.4	Reference standard	:	-----	-----
7.5	Whether lifting lugs provided	Yes/No :	-----	-----
7.6	Painting shade	:	-----	-----
7.7	Thickness of paint	:	-----	-----
7.8	Dimensions of NGR	:	-----	-----

-
cubicle with resistors

8.0 Test voltage:

8.1	One minute power frequency withstands voltage (dry)	:	-----	-----
8.2	Impulse withstands voltage (peak)	:	-----	-----

9.0 Mounting structure:

9.1	Material	:	-----	-----
9.2	Dimensions	:	-----	-----
9.3	Paint/Galvanisation	:	-----	-----
9.4	Weight of mounting structure	:	-----	-----

10.0 Whether space heater arrangement provided :

11.0 Whether Recommended O & M spares for
two years of operation quoted :

12.0 Whether commissioning spares quoted :

13.0 Whether special tools & tackles quoted :

ANNEXURE-A


2X660 MW SURATGARH STPS


BOQ-CUM-PRICE SCHEDULE NEUTRAL GROUNDING RESISTOR


SR. No.	ITEM CODE.	DESCRIPTION	UNIT	QTY.	UNIT PRICE	TOTAL PRICE
<u>MAIN ITEMS:</u>						
1.0	506-15025-A	NGR 11 KV (400A, 30 SEC, 16.6 OHMS)	NOS	8		
2.0	506-15026-A	NGR 6.6 KV (400A, 30 SEC, 9.96 OHMS)	NOS	12		
3.0	506-15019-A	HOT DIP GALVANISED MS SUPPORTING STRUCTURE WITH INSULATORS, FOUNDATION HARDWARES etc. FOR 11 kV NGR	NOS	8		
4.0	506-15020-A	HOT DIP GALVANISED MS SUPPORTING STRUCTURE WITH INSULATORS, FOUNDATION HARDWARES etc. FOR 6.6 kV NGR	NOS	12		


NOTES

- 1.0 ADDITION- DELETION OF QUANTITY SHALL BE APPLICABLE AT THE QUOTED PRICE.THE UNIT RATE OF SUPPLY QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES , WHICH MAY BE TO THE EXTENT OF +/- 30% OF THE TOTAL CONTRACT VALUE DERIVED ON THE BASIS OF ORDERED QUANTITY.

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : SURATGARH STPS		SPECIFICATION : PE-TS-392-506-E002				
				BIDDER / VENDOR		TITLE		NUMBER				
				BIDDER / VENDOR WORK ADDRESS		QUALITY PLAN NUMBER PED-505-00-Q-002/01, REV01		SPECIFICATION : TITLE				
SHEET 1 OF 4						ITEM NEUTRAL GROUNDING RESISTOR		SECTION				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	MATERIALS											
1.1	SHEET STEEL AND STRUCTURES	1. DIMENSIONS (THICKNESS) CHECK	MA	MEASUREMENT	10%	IS-1079 IS-2062 (2006) IS-513	IS-1079 IS-2062 (2006) IS-513	QC RECORD	3/2	-	2	TEST CERT. FOR PLATING QUALITY TO BE PROVIDED
		2. SURFACE FINISH & CHECK FOR WAVINESS / FLATNESS	MI	VISUAL	100%	-DO-	NO VISUAL DIFECTS	-DO-	3/2	-	2	
		3. DUCTILITY OF SHEET	CR	BEND TEST	SAMPLES	-DO-	IS-1079 IS-2062 (2006) IS-513	TEST CERT.	3/2		2	
1.2	COPPER FLATS	1. DIMENSIONS (THICKNESS) CHECK	MA	MEASUREMENT	10%	IS-1897	IS-1897	-DO-	3/2	-	2	
		2. SURFACE FINISH	MI	VISUAL	100%	-DO-	-DO-	-DO-	3/2	-	-	
		3. CHEMICAL COMPOSITION	MA	CHEMICAL ANALYSIS	1/ MELT	-DO-	-DO-	TEST CERT. FROM SUPPLIER	3/2	-	2	
1.3	RESISTOR GRIDS	1. SURFACE FINISH	CR	VISUAL	100%	BHEL DRG./SPEC. MFG. DRAWING	BHEL DRG./SPEC. MFG. DRAWING	INSPN. REPORT	3/2	-	-	1 SAMPLE RESISTOR GRID ELEMENT SHOULD BE PROVIDED TO VERIFY THE DIMENTION AT THE TIME OF FINAL INSPECTION.
		2. DIMENSIONS (THICKNESS & AREA) CHECK	MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	3/2	-	1	
		3. RESISTANCE VALUE	MA	ELECTRICAL	10%	-DO-	-DO-	-DO-	3/2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDOR'S COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : SURATGARH STPS			SPECIFICATION : PE-TS-392-506-E002			
				BIDDER / VENDOR		TITLE			NUMBER			
				BIDDER / VENDOR WORK ADDRESS		QUALITY PLAN NUMBER PED-505-00-Q-002/01			SPECIFICATION : TITLE			
SHEET 2 OF 4				ITEM NEUTRAL GROUNDING RESISTOR			SECTION					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.4	MICA INSULATED TIE-RODS MICA WASHERS, STEEL WASHER	4. CHEMICAL COMPOSITION	MA	CHEM ANALYSIS	1/ LOT	BHEL DRG./SPEC. MFG. DRAWING	BHEL DRG./SPEC. MFG. DRAWING	TEST CERTIFICATE	3/2	-	1	PORCELAIN INSULATORS SHALL BE OF APPROVED MAKE
		5. CURRENT DENSITY OF RESISTANCE MATERIAL	MA	ELECTRICAL	10%	-DO-	-DO-	-DO-	2	1	1	
		1. DIMENSIONS	MA	MEASUREMENT	100%	MFR'S. STD.	MFR'S. STD.	-DO-	2	-	-	
		2. SURFACE	MA	VISUAL	100%	DRAWING	DRAWING	-DO-	2	-	-	
1.5	PORCELAIN INSULATORS (POST & BUSHING TYPES)	1. DIMENSIONS CHECK	MA	MEASUREMENT	10%	MFR'S. STD.	MFR'S. STD.	TEST CERT.	3/2	-	-	
		2. SURFACE FINISH & DEFECTS	MA	MEASUREMENT	100%	DRAWING	DRAWING	-DO-	3/2	-	1	
		3. DRY P.F. HV TEST	MA	ELEC.	100%	BHEL SPECN.	BHEL SPECN	-DO-	2	-	1	
2	FABRICATION											
2.1	CUTTING, BENDING, PUNCHING, DRILLING ETC	1. DIMENSIONS	MA	MEASUREMENT	100%	APPD. MFG. STAND	APPD. MFG. STAND.	INSPN REPORT	2	-	-	
		2. FINISH	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-	
2.2	SURFACE PREPARATION	1. SURFACE CONDITION	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-	
2.3	PAINTING	1. SURFACE FINISH & COVERAGE	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDOR'S COMPANY SEAL			

		QUALITY PLAN SHEET 3 OF 4		CUSTOMER : RRVUNL		PROJECT : SURATGARH STPS			SPECIFICATION : PE-TS-392-506-E002			
				BIDDER / VENDOR		TITLE			NUMBER			
				BIDDER / VENDOR WORK ADDRESS		QUALITY PLAN NUMBER PED-505-00-Q-002/01			SPECIFICATION : TITLE			
						ITEM NEUTRAL GROUNDING RESISTOR			SECTION			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3	SUB-ASSEMBLY	2. FILM THICKNESS	MA	MEASUREMENT	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	INSPECTION REPORT	2	-	-	
3.1	RESISTOR UNIT FRAME ASSEMBLED	1. HV TEST	CR	ELECTRICAL	100%	BHEL SPECN/ BS-587	BHEL SPECN BS-587	TEST REPORT	2	-	-	
		2.RESISTANCE VALUE	CR	ELECTRICAL	100%	-DO-	-DO-	-DO-	2	-	-	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	2	-	-	
4	FINAL ASSEMBLY											
4.1	COMPLETE NGR	1. HV TEST	CR	ELECTRICAL	100%	BHEL SPECN/ BS-587	BHEL SPECN BS-587	TEST REPORT	2	1	-	
		2.RESISTANCE VALUE	CR	ELECTRICAL	100%	-DO-	-DO-	-DO-	2	1	-	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	2	1	-	
			PARTICULARS			BIDDER/VENDOR						
BHEL			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDOR'S COMPANY SEAL			

		QUALITY PLAN SHEET 4 OF 4		CUSTOMER : RRVUNL		PROJECT : SURATGARH STPS			SPECIFICATION : PE-TS-392-506-E002				
				BIDDER / VENDOR		TITLE			NUMBER				
				BIDDER / VENDOR WORK ADDRESS		QUALITY PLAN NUMBER PED-505-00-Q-002/01			SPECIFICATION : TITLE				
						ITEM NEUTRAL GROUNDING RESISTOR			SECTION				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
		4. SHORT TIME RATING / TEMPERATURE RISE TEST	MA	HEAT RUN	1/TYPE	BHEL SPEC./ BS:587	BHEL SPEC./ BS:587	TEST REPORT	2	1*	1		* IF CALLED IN TECHNICAL SPECIFICATION / PURCHASE ORDER
		5. DEGREE OF PROTECTION	MA	AS PER IS:12063 IEC:60529	1/TYPE	BHEL SPEC./ APPD DRG	BHEL SPEC./ APPD DRG	TEST REPORT	2	1*	1		
		6. PAINT FINISH	MA	VISUAL	100%	BHEL SPEC./ APPD DRG IS-5	BHEL SPEC./ APPD DRG IS-5	INSPECTION REPORT	2	1	-		
		7. PAINT THICKNESS	MA	MEASUREMENT	ALL	-DO-	-DO-	-DO-	2	1	-		
		8. PAINT SHADE	MI	VISUAL-SHADE CARD	ALL	-DO-	-DO-	-DO-	2	1	-		
		9. PAINT ADHESION TEST	MI	MECHANICAL	FEW PLACES OF ALL NGR	-DO-	-DO-	-DO-	2	1	-		
		10. CHECKING OF EARTH CONNECTION	MA	ELECTRICAL	100%	BHEL SPEC./ APPD DRG	BHEL SPEC./ APPD DRG	-DO-	2	1			
		11. CHECKING OF EARTHING MATERIAL (GS STRIP)	MA	VISUAL	100%	BHEL SPEC./ APPD DRG	BHEL SPEC./ APPD DRG	-DO-	2	1			
		12. VERIFICATION OF BOM INCLUDING CABLE GLAND & LUGS (AS APPLICABLE)	MA	VISUAL	100%	BHEL SPEC./ APPD DRG	BHEL SPEC./ APPD DRG	-DO-	2	1			
			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDOR'S COMPANY SEAL				

LEGEND

P - Performed by CR - Critical
 W - Witnessed by MA - Major
 V - Verified by MI - Minor

1 - BHEL / CUSTOMER REPRESENTATIVE

2 - VENDOR

3 - SUB-VENDOR