2 x 660MW UDANGUDI STPP STAGE-I

TECHNICAL SPECIFICATION

FOR

NEUTRAL GROUNDING RESISTOR

SPECIFICATION NO: ***PE-TS-435-506-E001***

REVISION: **0**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301

CONTENTS

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same

2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'

3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.

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 description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE

SECTION –I

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF ENQUIRY

1.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of NEUTRAL GROUNDING RESISTOR conforming to this specification.

1.2 General technical requirements of the NEUTRAL GROUNDING RESISTOR are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.

1.3 **The requirements of Section-I shall prevail and govern in case of conflict between the corresponding requirements of Section-I and Section-II.**

1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

2.2 Supplier to also give the following undertaking in the BOM:
"The BoM provided herewith completes the scope (in content and intent) of material supply under PO No. ----------, dated ------. Any additional material which may become necessary for the intended application of the supplied item(s)/package will be supplied free of cost in most reasonable time."

3.0 SPECIFIC TECHNICAL REQUIREMENTS

3.1

S.No.	***Reference Clause No. of Section- II***	***Specific Requirement/ Change***
1.	5.1.10	Clause 5.1.10 shall be read as follows: "All the 11 kV & 6.6 kV NGR shall be connected to respective transformer neutral by cable (Cable size shall be as mentioned in Datasheet-A). Cable shall not be in bidder's scope."
2.	5.2.11	Clause 5.2.11 shall be read as follows: A low voltage bushing and stud shall be provided through the enclosure wall for the resistor earth connection. The low voltage bushing shall be suitable for receiving 2 numbers of 50X6 mm Galvanized steel flat. The cubicle shall be complete with mounting brackets, lifting hook etc. 2 nos. 50X6 mm GS flats shall be provided by Bidder for each NGR (length of the flat shall be such that from bushing it reaches up to 100mm above ground).
3.	7.0	In addition to clause 7.0: The NGR shall be provided with tropical finish to prevent fungus growth. All the fabricated surfaces shall be pre-treated by degreasing, de-rusting and chemically cleaned prior to application of synthetic resin red oxide primer to give a dry film thickness of 20-40 microns. The finishing paint shall be epoxy based. The paint shall be applied in two coats to give a minimum dry film thickness of not less than 50 microns. Final shade shall be 631 (light grey) of IS 5. All hardware shall be galvanized or cadmium plated.
4.	6.0	In addition to clause 6.0: Following tests shall be conducted on NGR Cubicle **1. Type Tests** • Temperature rise test

		• Power frequency voltage withstand test • Degree of Protection Test **(Note: The type test charges for carrying out the above mentioned type tests shall be quoted separately by bidder in unpriced price schedule.)** **2. Routine Tests** • Resistance Measurements • Dielectric Tests • Temperature rise tests • Visual inspection and verification of dimensions • Insulation resistance measurement • One minute power frequency high voltage test • Operational Check **3. Site Tests** • Power frequency voltage withstand test at 80% of routine test voltage. • Insulation resistance test for enclosure circuit • Measurement of DC resistance • Physical check
5.	6.4	This clause stands deleted.
6.	6.5	Clause 6.5 shall be read as follows: All materials & components shall be procured, manufactured, inspected, and tested by vendor/sub-vendor as per applicable clauses of Standard Quality plan (PE-QP-999-506-E001,REV.02) without any implication on cost and delivery. At contract stage, the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. There shall be no commercial implication to BHEL on account of any changes in QP during contract stage.
7.	4.0 (c)	Clause 4.0 (c) shall be read as follows: The enclosure shall have cable box with bushing suitable for receiving neutral cable from transformer.

3.2 All internal wiring between equipment and terminal block shall be carried out by fire resistance PVC insulated 1100V grade 2.5 Sq.mm Stranded copper conductor wires.

3.3 A set of special tools & tackle (if applicable) which are necessary or convenient for erection, commissioning, maintenance and overhauling of the equipment shall be supplied. The tools shall be shipped in separate containers, clearly marked with the name of the equipment for which they are intended.

3.4 All devices and terminal blocks within the terminal box shall be clearly identified by symbol corresponding to those used on applicable schematic/wiring diagram. 20% spare terminals shall be provided in terminal block.

3.5 Each cubicle shall be provided with 5A, 5 pin plug socket and door-switch controlled cubicle illumination lamp. Two pole switch fuse unit shall be provided for receiving 240 V single phase AC supply for cubicle lamp and illumination circuit.

3.6 Packing shall be as per Annexure -I to QP.

4.0 DOCUMENTATION

4.1 Documents required along with technical offer shall be as per attachment-I.

4.2 Documents required after award of LOI/PO shall be as per NIT (to be submitted by successful bidder).

ATTACHMENT – I

DOCUMENTS REQUIRED ALONG WITH TECHNICAL OFFER.

a] “Deviation Schedule” with “NO Deviations” and bidder’s signature and company stamp.

b] Unpriced Price Schedule as enclosed with NIT with ‘Quoted” word against items with bidder’s signature and company stamp.

c] A copy of the sheet “Compliance Certificate” with bidder’s signature and company stamp.

d] All PQR related documents.

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 435-506-E001	
	TECHNICAL SPECIFICATION FOR NEUTRAL GROUNDING RESISTOR	VOLUME II	
		SECTION I	
		REVISION - 0	DATE: 23.05.2022
		SHEET 1 OF 3	

DATA SHEET-A

1.0 SYSTEM DESIGN DATA

1.1	Design Ambient	:	[√] 50°C	[ ] 40°C
1.3	Reference Standard	:	IEEE – 32	
1.2	Rated Voltage	:	11.5 KV	6.9 KV
1.5	Location of NGR	:	Outdoor	
1.6	Rated short time current and time	:	300A for 10sec	
1.7	Net resistance of resistor unit	:	22.13Ω	13.28Ω
1.8	Resistance per resistor element	:	As per Requirement	
1.9	Material of resistor element			
	i) For high value of current (Say 300/400/500A)	:	[√] AISI-304 [√] ASTM-A240	[ ] AISI-406
	ii) For low value of current (say 1A)	:	[ ] AISI-406	
1.10	No. of parallel Path	:	[√] Two (2X2)	[ ] Six (6X6)
1.11	No. of resistance element par path	:	As per Requirement	
1.12	Total no. resistor elements	:	As per Requirement	
1.13	Current density of resistor element	:	As per Requirement	
1.14	Max. allowable temp. rise (over ambient) of resistor element	:	[√] 300° C	[ ] 350° C
			[ ] 500° C	[ ] 790° C
1.14	Max. allowable temp. rise (over ambient) of enclosure	:	[ ] 20° C	[√] 30° C

2.0 ENCLOSURE

2.1 Material and thickness : Aluminium and [√] 2.0 [ ] 2.5 [ ] 3.0 mm

2.2 Degree of Protection (As per IS/IEC-60529)

i) Enclosure : [ ] IP-33 with canopy [√] IP-55 with canopy

ii) Terminal Box : IP-55 Weather proof

3.0 SUPPORT INSULATORS

3.1 Material : Porcelain

3.2 Rated voltage

i) For 11/6.6kV NGR : 11.5kV / 6.9kV

3.3 One minute power frequency dry withstand voltage

i) For 11kV NGR : 75/28kV (peak/rms)

ii) For 6.6kV NGR : 60/20kV (peak/rms)

3.4 Creepage Distance : **[ ]** 25mm/KV **[√] 31** mm/KV

4.0 MOUNTING STRUCTURE (BOLTABLE TYPE)

4.1 Material : Hot dip galvanised standard steel section

4.2 Thickness/deposit of galvanisation : 85.4 microns/610 g/m2

4.3 Equipment mounting : Base of NGR enclosure at minimum 2.5m above ground

5.0 TERMINAL CONNECTION

5.1 Type : Bushing

5.2 Material : Porcelain

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 435-506-E001	
	TECHNICAL SPECIFICATION FOR NEUTRAL GROUNDING RESISTOR	VOLUME II	
		SECTION I	
		REVISION - 0	DATE: 23.05.2022
		SHEET 3 OF 3	

5.3 Rated voltage

i) For 11/6.6kV NGR : 11.5kV / 6.9kV

5.4 One minute power frequency dry withstand voltage

i) For 11kV NGR : 75/28kV (peak/rms)

ii) For 6.6kV NGR : 60/20kV (peak/rms)

5.5 Creepage Distance : [ ] **25mm/KV** [√] 31 **mm/KV**

5.6 Connection between NGR & transformer Neutral : [√] Cable [ ] GI Flat [ ] Copper Flat
* Cable size : 1C-300 sq.mm.

5.7 Cable box with bushing to be provided for receiving neutral cable from transformer. Cable box shall be provided with Bolted type removable aluminium gland plate for fixing cable glands. Cable box shall be suitable for receiving termination kits. All glands and lugs shall be in the scope of bidder.

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 435-506-E001	
	TECHNICAL SPECIFICATION FOR NEUTRAL GROUNDING RESISTOR	VOLUME II	
		SECTION-I	
		REVISION 0	DATE: 23.05.2022
		SHEET	

DATA SHEET-C
(To be filled up by bidder)

1.0	**General**		
1.1	Make/Type		:
1.2	*Quantity*	Nos.	:
1.3	Service		:
1.4	Reference Standard		:
2.0	**Resistor**		
2.1	Rated Voltage (Volt)		:
2.2	Net Resistance at 50 Deg. C (ohm)		:
2.3	Resistance per resistor element at 50 Deg. C		:
2.4	Tolerance limit on resistance at 50 Deg. C (%)		:
2.5	Total no. of resistor elements per path		:
2.6	No. of parallel path		:
2.7	Material of resistor element		:
2.8	Electrical Resistivity (Ohm-cm)		:
2.9	Temperature Co-efficient of resistance/ DegC		:
2.10	Current rating		
	a) Short time rating	Amps., Secs	:
2.11	Types of grid		:
2.12	Temperature rise (over Ambient 50 Deg. C)		:
2.13	Method of connecting elements		:
3.**0**	**Insulation level**		
3.1	One minute power frequency withstand volt. KVrms		:

4.**0**	**Support insulator**	
4.1	Make	:
4.2	Material	:
4.3	Creepage distance	:
4.4	Voltage rating	:
4.5	One minute power frequency withstand volt.(dry) KVrms	:
5.**0**	**Terminal connection**	
5.1	Type	:
5.2	Make	:
5.3	Material	:
5.4	Voltage rating	:
5.5	Power frequency withstand volt. KVrms	:
6.**0**	**Enclosure Cubcle**	
6.1	Enclosure material	:
6.2	Thickness of enclosure materials	:
6.3	Degree of protection	:
6.4	Reference standard	:
6.5	Painting shade	:
6.6	Thickness of paint (mm)	:
6.7	Dimension of NGR cubicle with resistor	:
6.8	Weight of complete NGR cubicle with resistors (W/O Mounting structure)	:
7.**0**	**Test Voltage**	
7.1	One minute power frequency withstand volt.(dry) KVrms	:
7.2	Impulse withstand voltage (peak) KV	:
8.0	**Mounting Structure**	
8.1	Materials	:

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 435-506-E001	
	TECHNICAL SPECIFICATION FOR NEUTRAL GROUNDING RESISTOR	VOLUME II	
		SECTION-I	
		REVISION 0	DATE: 23.05.2022
		SHEET	

8.2	Dimensions	:
8.3	Paints/Galvanisation	:
8.4	Wt. Of mounting structure	:
9.0	Whether space heater arrangement provided	:
10.0	Whether welded or bolted type	:

SECTION – II

GENERAL TECHNICAL SPECIFICATION

	TECHNICAL SPECIFICATION FOR NEUTRAL GROUNDING RESISTOR	SPECIFICATION NO. PE-TS- 435-506-E001	
		VOLUME II	
		SECTION - II	
		REVISION 0	DATE: 23.05.2022
		SHEET 1 OF 5	

1.0 SCOPE OF ENQUIRY

1.1 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing and despatch to site of neutral grounding resistor as described in the various sections of this specification.

1.2 Although 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

2.1 The material, constructional features and various processes involved in manufacture shall comply with latest revision of Indian Standards.

2.2 The design, material, construction, manufacture, inspection, testing and performance of Neutral Grounding Resistor shall conform to the latest revision of relevant standards and codes of practices mentioned in Datasheet – A.

2.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

3.1 The NGR is used for medium resistance grounding of MV (11 / 6.6 / 3.3KV) or LV (415 V) system. NGR shall be connected between earth pit and neutral point of applicable transformer.

3.2 The NGR shall be suitable for limiting the desired value of earth fault current and duty as specified in BOQ-Cum-Price Schedule in NIT.

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

3.4 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.

4.0 TERMINAL POINTS OF SUPPLY:

a) Neutral grounding resistor along with suitable cable glands and lugs for incoming cables from transformer neutral.

b) Supporting structure along with insulators and necessary foundation hardware.

c) Bushing along with tinned copper strip of suitable cross-section (as specified in Datasheet-A / BOQ-cum-Price Schedule in NIT) and connecting hardware for neutral connection of transformer. Copper strip will be applicable only when cable connection is not applicable and vice-versa.

d) All Civil works, Erection & commissioning of equipment are excluded from bidder's scope.

e) Termination and Jointing kits are excluded from bidder's cope.

5.0. SPECIFIC TECHNICAL REQUIREMENTS

5.1 NEUTRAL GROUNDING RESISTOR

5.1.1 Each Neutral Grounding Resistor shall be formed of non-aging (grade ASTM-A240/AISI-304 or better) corrosion resistant punched stainless steel elements ~~or FECRAL (AISI 406)~~ as specified in data sheet-A for high value (say 300A/400/500A/600A) of earth fault current. Resistance material mentioned above shall have high electrical resistivity and low temperature co-efficient of resistance.

5.1.2 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.

5.1.3 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. For Low value of earth fault current edge wound configuration of resistance material is also acceptable.

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

5.1.5 All the resistor elements consisting 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 specified fault current to earth.

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

5.1.7 Wet process type brown glass porcelain insulators shall be used for supporting resistor elements and used to insulate the resistor element from enclosure. Porcelain insulators shall have high creepage value (as specified in Data sheet-A) suitable for heavily polluted atmosphere charged with dust particles.

5.1.8 The resistor elements shall be provided with necessary installations and shall have maximum temperature rise as specified in Data Sheet-A.

5.1.9 The NGR shall be provided with suitable taps for cable/strip connection.

5.1.10 In case the connection between neutral terminal of transformer and NGR is through a copper strip, then copper strip shall be supplied by bidder. The required hardware for the termination of copper flat at both ends shall be supplied by the bidder.

5.2 ENCLOSURE:

5.2.1 Each neutral grounding resistor shall be housed in weather-proof enclosure having Degree of Protection as specified in Data Sheet-A. Enclosure shall be as specified in Data Sheet-A. Suitable ventilating louvers shall be provided on sides to ensure proper ventilation. The louvers shall be provided with fine wire mesh to make vermin proof.

5.2.2 The terminals for neutral and earthing connections shall be housed in separate vermin-proof, weather-proof terminal box with min. IP-55 degree of ingress protection.

5.2.3 A separate canopy shall be provided above enclosure roof with a suitable air gap between them. It shall also cover the terminal compartment. Suitable lifting arrangement shall be provided to lift the canopy.

5.2.4 The bottom of the enclosure shall be provided with a drain plug to remove water that may get collected in the enclosure.

5.2.5 The enclosure shall be supported on insulators placed on mounting structure in such a fashion that it is not easily accessible for man standing on ground level. Any part of insulator shall be at a min. height as specified in Data Sheet-A.

5.2.6 Each cubicle shall be complete with front access door with handles, lock and also a removable bolted cover. All doors and removable covers shall be properly gasketed with good quality neoprene gaskets.

5.2.7 All cubicle door hinges shall be concealed type. Each cubicle shall be complete with suitably mounted cable box fitted with removable gland plate of Aluminium of suitable thickness for fixing cable gland. Double compression brass Cable glands and cable lugs of tinned copper shall be in the scope of bidder.

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

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

5.2.10 Panel space heater arrangement along with thermostat, suitable for connection to 240V AC single supply, shall be provided at the bottom of the panel. The illumination arrangement and switch socket shall also be provided in the panel. The required cable glands, lug etc. required shall be supplied by the bidder.

5.2.11 For connection of other end of NGR to ground, 2 nos. earthing terminal/pad tapped holes and bolts for connection of 50X8 mm copper strip shall be provided. Copper strip/ copper ground wire for ground connection is in bidder's scope.

5.3 MOUNTING STRUCTURE

5.3.1 The Vendor shall supply and erect a galvanized structure to support the NG resistor enclosure so that the base of the enclosure shall be at a minimum height as specified in Datasheet –A. The NG resistor enclosure mounting and the neutral connection shall be such that it does not obstruct the busduct routing in any way. A heating circuit with Thermostat to be provided inside the enclosure to control humidity.

6.0 INSPECTION & TESTS

6.1 All tests shall be conducted as per relevant IS/IEC/ IEEE standards and shall be performed in the presence of purchaser's representative, if so desired by the purchaser. The bidder shall give at least 21 days advance notice of the date when the tests are to be carried out.

6.2 Bidder shall furnish Type Test certificates (temperature rise and DOP tests) conducted on similar type of equipment for purchaser's review at contract stage.

6.3 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 implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.

6.4 All materials & components and shall be procured, manufactured, inspected, and tested by vendor/sub-vendor as per applicable clauses of BHEL Quality Plan no. PE-QP-999-505-E001 (subject to approval of customer) enclosed.

6.5 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.

6.6 Test reports of the various tests conducted at the time of inspection shall be furnished by the vendor.

6.7 Bidder shall furnish unit prices of all items in the prescribed schedule of BOQ-cum-price schedule as part of NIT. 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.

6.8 All bought out items shall be procured from reputed manufacturers and shall be subject to approval of purchaser.

7.0 PAINTING

7.1 All bidders must have 7-tank or 8-tank painting procedure. Well documented painting procedure shall be submitted by bidder for purchaser's approval.

7.2 All metal parts, surfaces shall be degreased by dipping in hot alkaline solution and rubbed with wire brush to remove oil and scale and then rinsed in water. Alternatively, they may be shot blasted.

7.3 Parts shall be pickled by dipping in hydrochloric acid to remove the rust from the surfaces formed during storage of sheets and then rinsed to remove traces of the acid. The cleaning and pre-treatment of all metal parts shall be as per applicable standard.

7.4 The surfaces to be painted shall then be prepared by phosphatizing to protect them from further rusting and to create a good bond with the paint.

7.5 Electrostatic or powder painting shall be acceptable subject to purchaser's approval.

7.6 Finished parts shall be coated with peelable compound by spraying method to protect the finished product from scratches, grease, dirty and oily spots during handling and transportation.

8.0 PACKING

8.1 A detailed write up on the packing procedure as per manufacturer's practice shall be submitted by the vendor. Vendor shall incorporate all modifications as suggested by the purchaser. Final packing

procedure shall be to the approval of purchaser.

8.2 Specification for the sea worthy packing, if enclosed, for the export jobs shall form part of the specification.

9.0 SPARES

9.1 A list of Erection & commissioning spares (if required) along with quantities considered is indicated in BOQ-cum-price schedule as part of NIT.

11.0 GUARANTEED PERFORMANCE REQUIREMENTS

11.1 The vendor shall guarantee satisfactory performance of the equipment supplied under all conditions and requirement as laid down by this specification.

11.2 The vendor shall comply with the general requirements of performance guarantee specified elsewhere.

12.0 O & M MANUAL

O & M manual for installation, operation and maintenance of NGR shall be furnished before despatch of the equipment.

Draft O & M manual shall be submitted for purchaser's approval. Manual shall contain minimum 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) Test to be conducted at site.

vii) Commissioning procedure.

viii) Maintenance instructions.

13.0 DELIVERY

The delivery shall be as per NIT (Notice Inviting Tender).

SECTION – II

QUALITY PLAN

862616/2022/PS-PEM-EL

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-506-E001, REV. 02	DATE: 30.03.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: NEUTRAL GROUNDING RESISTOR	SYSTEM: NGR	SECTION: II	SHEET Page 1 of 6

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N				D	M	C	N	
1.0 RAW MATERIAL														
1.1	SHEET STEEL AND STRUCTURES	1. DIMENSIONS (THICKNESS)	MA	MEASUREMENT	100%	10%	APPD. DATA SHEET, IS-1079, IS-513	APPD. DATA SHEET, IS-1079, IS-513	QC RECORD	√	P	V	–	V - TO BE VERIFIED DURING FINAL INSPECTION
		2. SURFACE FINISH & WAVINESS/ FLATNESS	MI	VISUAL	100%	100%	IS-2062/ IS:1079/IS-513	NO VISUAL DEFECTS/ CORROSION/ PITTING	-DO-	√	P	V	–	
		3. DUCTILITY OF SHEET	CR	BEND TEST	SAMPLES	SAMPLES	-DO-	IS-2062/ IS-513	TEST CERT.	√	P / V	V	–	TEST CERT. FOR PLATING QUALITY TO BE PROVIDED
1.2	COPPER FLATS	1. DIMENSIONS (THICKNESS)	MA	MEASUREMENT	10%	10%	APPD. DATA SHEET	APPD. DATA SHEET	QC RECORD	√	P	V	–	V - TO BE VERIFIED DURING FINAL INSPECTION
		2. SURFACE FINISH	MI	VISUAL	100%	100%	IS-1897	NO VISUAL DEFECTS/ CORROSION/ PITTING	-DO-	√	P	V	–	
		3. CHEMICAL COMPOSITION	MA	CHEMICAL ANALYSIS	1/ SAMPLE/ LOT	1/ SAMPLE/ LOT	IS:440	IS:440	TEST CERT.	√	P / V	V	–	
1.3	RESISTOR GRIDS	1. SURFACE FINISH	CR	VISUAL	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	QC RECORD	√	P	V	–	
		2. DIMENSIONS (THICKNESS & AREA)	MA	MEASUREMENT	100%	1/ SAMPLE/ RESISTOR GRID ELEMENT	-DO-	-DO-	-DO-	√	P	W	–	W - ONE SAMPLE OF RESISTOR GRID ELEMENT SHOULD BE PROVIDED TO VERIFY THE DIMENSION AT THE TIME OF FINAL INSPECTION

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Megha 15-09-20	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	Kundan 15/09/2020	KUNDAN PRASAD		
Reviewed by:	Sandeep 15/09/2020	SANDEEP LODH	Reviewed by:	Ritesh 15/9/2020	RITESH KUMAR JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

862616/2022/PS-PEM-EL

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-506-E001, REV. 02	DATE: 30.03.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: NEUTRAL GROUNDING RESISTOR	SYSTEM: NGR	SECTION: II	SHEET Page 2 of 6

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	**			REMARKS
1	2	3	4	5	6		7	8	9					
					M	C/ N				D	M	C	N	
		3. RESISTANCE VALUE	MA	ELECTRICAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		4. CHEMICAL COMPOSITION	MA	CHEM ANALYSIS	1/ LOT	1/ LOT	MFR'S. STD.	MFR'S. STD.	TEST CERT.	√	P / V	V	_	
1.4	MICA INSULATED TIE-RODS, MICA WASHERS, STEEL WASHER	1. DIMENSIONS	MA	MEASUREMENT	100%	100%	MFR'S. STD.	MFR'S. STD.	QC RECORD	√	P	V	_	
		2. SURFACE	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
1.5	PORCELAIN INSULATORS (POST & BUSHING TYPES)	1. DIMENSIONS CHECK	MA	MEASUREMENT	100%	100%	IS-3347	IS-3347	TEST CERT.	√	P	V	_	
		2. SURFACE FINISH & DEFECTS	MA	MEASUREMENT	100%	100%	MFR'S. STD.	MFR'S. STD.	-DO-	√	P	V	_	
		3. DRY P.F. HV TEST	MA	ELEC.	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	-DO-	√	P	V	_	
2.0 FABRICATION														
2.1	CUTTING, BENDING, PUNCHING, DRILLING & WELDING ETC	1. DIMENSIONS	MA	MEASUREMENT	100%	100%	MFG. STAND.	MFG. STAND.	QC RECORD	√	P	V	_	
		2. WORK MANSHIP	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
2.2	SURFACE PREPARATION	1. SURFACE CONDITION	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
2.3	PAINTING	1. SURFACE FINISH & COVERAGE	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		2. FILM THICKNESS	MA	MEASUREMENT	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	-DO-	√	P	V	_	
		3. PAINT SHADE	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Megha 15.09.2020	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	Kundan 15/09/2020	KUNDAN PRASAD		
Reviewed by:	15/09/2020	SANDEEP LODH	Reviewed by:	15/9/2020	RITESH KUMAR JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

862616/2022/PS-PEM-EL

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-506-E001, REV. 02	DATE: 30.03.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: NEUTRAL GROUNDING RESISTOR	SYSTEM: NGR	SECTION: II	SHEET Page 3 of 6

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6		7	8	9					
					M	C/ N				D	M	C	N	
3.0 SUB-ASSEMBLY														
3.1	RESISTOR UNIT FRAME ASSEMBLED	1. HV TEST	CR	ELECTRICAL	100%	100%	DATA SHEET,	DATA SHEET,	QC RECORD	√	P	V	_	
		2.RESISTANCE VALUE	CR	ELECTRICAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		3. DIMENSIONS	MA	MEASUREMENT	100%	100%	MFG. STAND.	MFG. STAND.	-DO-	√	P	V	_	
3.2	FITTING OF RESISTOR UNIT FRAME, PORCELAIN BUSHING & POST INSULATOR	1. FITMENT	MA	VISUAL	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	QC RECORD	√	P	V	_	
		2. DIMENSION	MA	MEASUREMENT	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		3. CONNECTION	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		4. TERMINATION	MA	MEASUREMENT	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		5. RESISTANCE VALUE	MA	ELECTRICAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
3.3	ENCLOSURE & ITS PARTS	1. FINISH	MA	VISUAL	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	QC RECORD	√	P	V	_	
		2. DIMENSION	MA	MEASUREMENT	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
		3. PAINT SHADE	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	V	_	
4.0 FINAL ASSEMBLY														
3.1	COMPLETE NGR	1. HV TEST												
		(a) BETWEEN NEUTRAL BUS AND ENCLOSURE	CR	ELECTRICAL	100%	100%	APPD. DRG. / APPD. DATA SHEET, STD. IEEE 32	APPD. DRG. / APPD. DATA SHEET, STD. IEEE 32	TEST REPORT	√	P	W	_	Conductance of type test to be done if called for in technical spec & test report of the same to be furnished for verification by engineering.
		(b) BETWEEN RESISTOR ELEMENT AND END SUPPORT STRUCTURE	CR	ELECTRICAL	100%	100%	STD. IEEE 32 clause 10.3.2	STD. IEEE 32 clause 10.3.2	-DO-	√	P	W	_	
		2. MEAUSERMENT OF IR VALUE BEFORE & AFTER HV TEST	CR	ELECTRICAL	100%	100%	APPD. DRG. / APPD. DATA SHEET, STD. IEEE 32	APPD. DRG. / APPD. DATA SHEET, STD. IEEE 32	-DO-	√	P	W	_	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Megha 15-09-20	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	Kundan 15/09/2020	KUNDAN PRASAD		
Reviewed by:	15/09/2020	SANDEEP LODH	Reviewed by:	15/9/2020	RITESH KUMAR JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

862616/2022/PS-PEM-EL

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-506-E001, REV. 02	DATE: 30.03.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: NEUTRAL GROUNDING RESISTOR	SYSTEM: NGR	SECTION: II	SHEET Page 4 of 6

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	**			REMARKS
1	2	3	4	5	6		7	8	9					
					M	C/ N				D	M	C	N	
		3. RESISTANCE VALUE	CR	ELECTRICAL	100%	100%	-DO-	-DO-	-DO-	√	P	W	_	
		4. DIMENSIONS	MA	MEASUREMENT	100%	100%	-DO-	-DO-	-DO-	√	P	W	_	
		5. SHORT TIME RATING / TEMPERATURE RISE TEST	MA	HEAT RUN	1/TYPE/ VOL. GRADE	1/TYPE/ VOL. GRADE	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	TYPE TEST REPORT	√	P	V / W	_	V TYPE TEST CERTIFICATE OF SIMILAR RATING TO BE FURNISHED FOR VERIFICATION BY ENGINEERING. VALIDITY OF TYPE TEST REPORT IS 5 YEARS FROM DATE OF ISSUE OF REPORT W CONDUCTION OF TYPE TEST TO BE DONE IF CALLED FOR IN TECHNICAL SPECIFICATION & TEST REPORT OF THE SAME TO BE FURNISHED FOR VERIFICATION BY ENGINEERING
		6. DEGREE OF PROTECTION	MA	MEASURMENT	1/TYPE/ VOL. GRADE	1/TYPE/ VOL. GRADE	APPD. DRG. / APPD. DATA SHEET/ IEC:60529/ EQVT. STD.	APPD. DRG. / APPD. DATA SHEET/ IEC:60529/ EQVT. STD.	TYPE TEST REPORT	√	P	**V / W**	_	Conductance of type test to be done if called for in technical spec & test report of the same to be furnished for verification by engineering.
		7. PAINT FINISH	MA	VISUAL	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	TEST REPORT	√	P	W	_	
		8. PAINT THICKNESS	MA	MEASURMENT	100%	100%	-DO-	-DO-	TEST	√	P	W	_	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Megha 15/09/20	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	Kundan 15/09/2020	KUNDAN PRASAD		
Reviewed by:	15/09/2020	SANDEEP LODH	Reviewed by:	15/9/2020	RITESH KUMAR JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

862616/2022/PS-PEM-EL

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-506-E001, REV. 02	DATE: 30.03.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: NEUTRAL GROUNDING RESISTOR	SYSTEM: NGR	SECTION: II	SHEET Page 5 of 6

									REPORT					
		9. PAINT SHADE	MI	VISUAL-SHADE CARD	100%	100%	-DO-	-DO-	TEST REPORT	√	P	W	_	
S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N				D	M	C	N	
		10. PAINT ADHESION TEST	MI	MECHANICAL	FEW PLACES OF ALL NGR	FEW PLACES OF ALL NGR	-DO-	-DO-	-DO-	√	P	W	_	
		11. THICKNESS OF GALVANISINGS OF STRUCTURE	MI	VISUAL / MEASURMENT	100%	100%	APPD. DRG. / APPD. DATA SHEET	APPD. DRG. / APPD. DATA SHEET	-DO-	√	P	W	_	
		12. CHECKING OF EARTH CONNECTION	MA	ELECTRICAL	100%	100%	-DO-	-DO-	-DO-	√	P	W	_	
		13. CHECKING OF EARTHING MATERIAL (TINNED COPPER STRIP)	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	W	_	
		14. VERIFICATION OF BOM INCLUDING CABLE GLAND & LUGS (AS APPLICABLE)	MA	VISUAL	100%	100%	-DO-	-DO-	-DO-	√	P	W	_	
		15. PACKING	MA	VISUAL	100%	100%	AS PER SPECIFICATION	AS PER SPECIFICATION	SOFT COPY OF PHOTOGRAPH	√	P	W	_	REFER NOTE

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Megha	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	Kundan 15/09/2020	KUNDAN PRASAD		
Reviewed by:	15/09/2020	SANDEEP LODH	Reviewed by:	15/9/2020	RITESH KUMAR JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

862616/2022/PS-PEM-EL

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-506-E001, REV. 02	DATE: 30.03.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: NEUTRAL GROUNDING RESISTOR	SYSTEM: NGR	SECTION: II	SHEET Page 6 of 6

NOTES:

1. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST IF REQUIRED.
2. IN CASE OF FOREIGN SUPPLIER, ALL TEST CERTIFICATES SHALL BE FURNISHED BY THE SUPPLIER, DULY WITNESSED/ VERIFIED BY SUPPLIER'S TPI.
3. PHOTOGRAPHS OF COMPLETE NGR AFTER PACKING TO BE SENT TO BHEL PURCHASE GROUP FOR REVIEW BEFORE ISSUING MDCC.
4. IN CASE THERE ARE ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE, THE SAME SHALL BE CARRIED OUT BY THE BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.
5. PROJECT SPECIFIC QUALITY PLAN TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.
6. FOR EXPORT JOB, PACKING SHALL BE AS PER BHEL SEAWORTHY PACKING SPECIFICATION.
7. LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.
8. PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.

FOR PACKING DETAILS REFER ANNEXURE -I TO QP.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, **D**: DOCUMENTATION
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	Megha 15/09/2020	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	Kundan 15/09/2020	KUNDAN PRASAD
Reviewed by:	15/09/2020	SANDEEP LODH	Reviewed by:	15/9/2020	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

Packing:

A. Support Structure of NGR shall be despatched in open in such a manner there shall be no damage during transit.

B. NGR shall be despatched in "Crate Packing" using wood.

1.0 PREPARATION OF PACKING CASES:

1.1 **DIMENSIONS:**

1.1.1 Minimum number of planks shall be used for a shook.
1.1.2 Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm
1.1.3 Horizontal, vertical, diagonal planks shall be given for binding
1.1.4 Width of binding planks shall be minimum 100mm
1.1.5 Distance between any 2 binding planks shall be less than 750mm
1.1.6 Diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
1.1.7 Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
1.1.8 Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

1.2 JOINTING OF PLANKS:

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag

manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

1.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

1.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.
End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.
Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

1.5 OTHER MATERIALS

1.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

1.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

1.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust. If sufficient nailing is done for bigger boxes, strapping need not be done.

1.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

1.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of “L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

1.5.6 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polyethylene Film ———————— are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

1.5.6 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

1.5.7 FASTENERS

Bolts, double nuts, spring washers will have to be used to hold the job to the bottom plank of the box so that there shall be no jerk on the NGR during transit.

1.5.8 PACKING SLIP:

Packing slip kept in the polyethylene bag shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder shall be nailed to front / rear of case.

1.5.9 MARKING PLATE:

Marking on the packing case shall be done as per the manufacturer standard.

ANNEXURE – II

ANNEXURE TO QUALITY PLAN

Following tests shall also be conducted in addition to those mentioned in Quality plan (PE-QP-999-506-E001, Rev.02):

1. Type Tests:

a) Temperature rise test

b) Power frequency voltage withstand test

c) Degree of protection test

2. Routine Tests:

a) Dielectric Tests

b) Temperature rise tests

c) One minute power frequency high voltage test

d) Operational Check

3. Site Tests:

a) Power frequency voltage withstand test at 80% of routine test voltage

b) Insulation resistance test for enclosure circuit

c) Measurement of DC resistance

d) Physical check

862616/2022/PS-PEM-EL

	PRE-QUALIFYING REQUIREMENTS FOR NEUTRAL GROUNDING RESISTOR FOR 2 x 660MW UDANGUDI STPP STAGE-I	PE-PQ-435-505-E001	
		REV. 00	DATE: 23/05/2022
		SHEET	1 OF 1

ITEMS: Neutral grounding resistor *a/w* supporting structure	
SCOPE: Supply : YES ; Erection & Commissioning: No	
1	Availability of type test certificates conducted at independent Lab or witnessed by third party as per relevant IS/ International standard.
2	Vendor should have in-house facility for design and manufacturing of neutral grounding resistor.
3	Vendor should have in-house capability to carry out all routine and type tests. In case facilities for type test are not available with the vendor, these tests can be conducted at Govt. Lab/ Govt. approved independent Lab.
4	Manufacturing capacity of at least 10 nos. neutral grounding resistor per month.
5	Supplied at least 20 nos. of neutral grounding resistor in one or more orders.
6	Minimum two (2) nos. purchase orders for neutral grounding resistor shall be submitted which should not be more than five (5) years old from the date of techno-commercial bid opening for establishing continuity in business.

NOTES:

Supplier to comply to "General points of PQR", attached as Annexure-I.

In case supplier is not OEM, the offer shall be evaluated as per point no 1 of "General points of PQR".

PREPARED BY	CHECKED BY	REVIEWED BY	APPROVED BY
23/05/2022	23.5.22	23/05/2022	23/5/22
NIDHI RAWAT (DY.MANAGER)	AYAN SAHA (SR. MANAGER)	SANDEEP LODH (SR. D.G.M.)	DEBASISA RATH A.G.M. (DH-ELECT)

Annexure-I

General Points of PQR

1. Offers of the JV companies/ Joint Bidders/ bidders having collaboration/ licensing agreement/ MOU/ Indian subsidiaries shall be evaluated as follows:

   a. If bidder happens to be an Indian subsidiaries of foreign OEM, then the credentials of the foreign OEM can also be considered for meeting PQR.
   b. If bidder happens to be the Joint Venture Company, then the credentials of any of JV partners can be also considered for meeting PQR.
   c. If bidder happens to bid jointly with their partner, then credentials of both the partners will be considered for meeting PQR as per distribution of the work. In all such cases, lead bidder as specified in bid documents shall be responsible for overall execution of the contract and all guarantee/ warranty.
   d. If bidder happens to be the having valid collaboration agreement/ MOU/ licensing agreement with some other company, then the credentials of collaborator/ MOU partner/ licensing company can also be considered for meeting PQR.

   Note: If bidder(s) qualifies on the basis of credentials of his principal/ JV partner/ Collaborator/ joint bidder etc., then the principal/ JV partner/ Collaborator/ MOU partner/ joint bidder shall be responsible for overall design vetting and warranty/ guarantee of the package. The scope matrix clearly defining their respective roles including design vetting, manufacturing of critical component, E&C etc. etc. and warranty/ guarantee shall be submitted along with the offer.

2. Bidder to note that the arrangement of bidding (joint bid partners/ collaborator/ MOU partner/ licensing company etc.) once offered to BHEL as a part of bidding documents cannot be changed till the execution of the project.

3. Consideration of offer shall be subject to customer's approval of bidders, if applicable.

4. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.

5. Any other project specific requirement shall be as per Annexure-I and bidder shall submit relevant supporting documents.

6. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

7. After satisfactory fulfillment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

2 x 660MW UDANGUDI STPP STAGE-I

BOQ CUM PRICE SCHEDULE FOR NEUTRAL GROUNDING RESISTOR

SR. No.	DESCRIPTION	UNIT	QTY.	UNIT PRICE	TOTAL PRICE	REMARKS
MAIN ITEMS:						
1.0	NGR 11 KV (300A, 10 SEC, 22.13 OHMS)	NOS	8			
2.0	NGR 6.6 KV (300A, 10 SEC, 13.28 OHMS)	NOS	12			
3.0	HOT DIP GALVANISED MS SUPPORTING STRUCTURE WITH INSULATORS, FOUNDATION HARDWARES etc. FOR 11 kV NGR	NOS	8			
4.0	HOT DIP GALVANISED MS SUPPORTING STRUCTURE WITH INSULATORS, FOUNDATION HARDWARES etc. FOR 6.6 kV NGR	NOS	12			
5.0	TYPE TEST CHARGES	NOS	1			

Note:	
1.0	**The type test charges for carrying out the following type tests shall be quoted separately by bidder against Sr. no. 5 of unpriced price schedule:** **1. Temperature rise test,** **2. Power frequency voltage withstand test,** **3. Degree of Protection Test.**
2.0	**IN CASE ANY OF THE TYPE AND SPECIAL TESTS ARE REQUIRED TO BE REPEATED THE SAME SHALL BE CARRIED OUT BY THE VENDOR WITHOUT ANY COMMERCIAL / DELIVERY IMPLICATION TO BHEL.**
3.0	**Charges for all other tests as per Technical Specificaion / Quality plan (except those mentioned against note no1 above) are deemed to be included in the bid price**