BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

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CUSTOMER Doc. No.				NAME	RiS	SK/SKS	RS
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	400/220/132/33 kV Solid Core Insulator			DATE	22.08.14		
				GROUP	TBEM		
				W.O. No	83012		

CUSTOMER	**MADHYA PRADESH POWER TRANSMISSION LTD.**
PROJECT	**Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turnkey basis (Lot no. 1) Balaghat, Badnawar, Bhopal, Chhegaon and Nagda**

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Rev.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	CUSTOMER	TBMM	O/C	
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SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1. SCOPE:-

This specification covers requirements of design, manufacture, assembly and testing at the Manufacturer's premises/works and packing and supply of 400kV, 220kV, 132kV & 33kV Solid Core Insulators to site complete in all respects and including all fittings and accessories required for efficient and trouble-free operation.

This section covers the scope and quantities of 400kV, 220kV, 132kV & 33kV Solid Core Insulators. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification. For environmental conditions, refer Section-3 carefully.

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.
Section-2: Equipment specifications
Section-3: General technical requirements for all equipments under the project.
Section-4: Guaranteed Technical Particulars

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

The equipment is required for the following projects:

Name of the Customer : Madhya Pradesh Power Transmission Company Ltd.

Name of the Project : Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turnkey basis (Lot no.- 1) - Balaghat, Badnawar, Bhopal, Chhegaon and Nagda

The term 'Owner' appearing in this specification shall refer to MPPTCL, the term 'Purchaser/Employer' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.

2. SPECIFIC TECHNICAL REQUIREMENTS:-

As per Appendix-A of Section-2.

3. BILL OF QUANTITIES:-

As per Annexure-1

4. TYPE TESTING:-

The offered equipments should be fully type tested as per the relevant standards. In case the equipment of the type and design offered, has already been type tested, Bidder shall invariably furnish type test reports from the reputed and approved national/international laboratory/Government approved test houses to prove that specifications of equipments offered conform to the relevant standard.
Test certificates shall clearly indicate the type and model number etc., so that relevant details of offered equipments could be verified. While submitting bids the model and type etc., shall be clearly indicated.

Type test reports furnished with the offer should not pertain to the period earlier than five years from the **date of opening of Bid which is 20.11.13.**

In case the type tests were carried out earlier than five years, the manufacturer will have to conduct these tests, without any commercial & delivery implication to BHEL, before commencement of supply. In both the above cases type test certificate must be submitted with the bid. The Bidders have to submit one complete set of Type Test reports for the offered equipments.
All the tests as per relevant IS/IEC shall be carried out.

5. TECHNICAL QUALIFYING REQUIREMENT :-

5.1. The manufacturer for supply of plant and equipment not covered in approved vendor list of customer should have a minimum experience as specified below for supply of respective item (which must have been type tested) and must be an approved vendor of Electricity Boards/ Power Grid/ Transmission utility or a regular supplier of MPPTCL. The certificate of Electricity Boards/ Power Grid/ Transmission utility towards supply of respective item will have to be submitted by the bidder for obtaining approval of such manufacturer from MPPTCL. The equipment/ material manufactured and supplied should be in operation for a period **of two years** as on the date of Bid opening, **which is 20.11.13,** for which performance report is required to be submitted. The performance

report should be issued within last two years from the date of bid opening. The Performance report issued by the Power Utilities or User Agencies clearly indicating the Order No. & Date, Ordered quantity and the quantity for which the performance report has been issued, shall only be acceptable.

S. No.	Equipment/ Material	Minimum experience required
1.	Power Transformers, 400kV Reactor, 400kV & 220kV SF6 Circuit Breakers, CT, CVT, Isolator, LA, C&R Panels, PT, 36kV Capacitor Bank, Transformer oil, Carrier Cabinet, Protection coupler, Wave Trap, Copper Control and Aluminum Power Cable, Station Batteries, Station Transformer, Transformer oil and 132kV SF6 Circuit Breakers	Five Years as on the date of Bid opening
2.	Other equipments and materials for construction of the Facilities	Three Years as on the date of Bid opening
3.	Equipment/ Material covered in the Bid : Manufacturing Capacity	100% quantity of Equipment/ Material covered in the Bid should have been manufactured & supplied in any one year during the past three years by the manufacturer of that Equipment/ Material covered in the Bid, as on the date of Bid opening
4.	To substantiate above requirement indicated in S. No. 1, 2 & 3, Bidder may please note that the design, type, rating & class of equipments/ material must be similar to the design, type, rating & class or higher rating & class, as specified in the Bid. For substantiating requirement at Sr. no 3, CA certificate is acceptable.	

5.2. In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the manufacturer's authorization, using the form to be provided by BHEL, showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in India. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed above for that item.

6. INSPECTION & TESTING:-

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on equipment in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and MPPTCL in accordance with agreed quality plan with 3 weeks advance information.

7. QUALITY PLAN:-

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / MPPTCL approval within 1 week of P.O. placement.

Annexure-1

Bill of Quantities

A. Main Quantity

Sl. no.	Description	Unit	Quantity.					Total
			Balaghat	Badnawar	Bhopal	Chhegaon	Nagda	
1	400KV Solid Core Post Insulators with corona Ring (8kN)	Nos.	293	377	17	13	0	700
2	400KV Solid Core Post Insulators without corona Ring (8KN)	Nos.	171	243	30	15	18	477
3	400KV Solid Core Operating Rod Insulators without corona Ring (2.4kN)	Nos.	9	9	6	9	0	33
4	220 kV Solid core Insulators without corona Ring (8kN)	Nos.	0	400	54	75	0	529
5	132kV Solid core Insulators without corona Ring (6kN)	Nos.	231	0	0	0	0	231
6	33kV Solid core Insulators without corona Ring (6kN)	Nos.	199	54	25	25	0	303

B. Mandatory Spare

Sl. No.	Particulars of spares	Unit	Quantity
1	400KV Solid Core Post Insulators with corona Ring (8kN)	Nos.	3
2	400KV Solid Core Post Insulators without corona Ring (8KN)	Nos.	12
3	400KV Solid Core Operating Rod Insulators without corona Ring (2.4kN)	Nos.	6

Accessories Required

Nut, Bolts & Spring Washers for following must be supplied with each Insulator.

(1) For interconnecting insulator units.

(2) For fixing BPI on support structure (Steel Structure Thickness is 12mm)

Note:-

1. Total quantity may vary upto ±50% at contract stage. However, individual quantities may vary upto any extent.
2. Exact dispatch destination site of mandatory spares shall be intimated during ordering stage.
3. Prices of accessories to be included in the equipment price.

Section-2

1.0 SCOPE :

The scope of this specification covers design, manufacturing and supply of equipment as per Section-I. The bidder mentioned in the Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The Purchaser means the "BHEL".

In case bidder is not OEM, sole responsibility of offering equipment/material of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS :

Applicable Standards for the offered equipments / items shall be as per Annexure-2.

3.0 CLIMATIC CONDITIONS :

Applicable climatic conditions shall be as per Section – 3.

4.0 SYSTEM PARTICULARS :

Applicable System Particulars shall be as per Section-3.

5.0 GENERAL TECHNICAL REQUIREMENT :

5.1 The insulators shall conform to the latest applicable Indian or IEC Standard and in particular to IS-2544.

5.2 Porcelain used for the manufacture of insulators shall be homogenous, free from flaws or imperfections that might affect the mechanical or di-electric quality. They shall be thoroughly vitrified, tough & impervious to moisture. The glazing of the porcelain shall be of uniform brown colour, free from blisters, burnsters and other similar defects. Insulators of the same rating and type shall be interchangeable.

5.3 The porcelain and metal parts shall be assembled in such a manner that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature variation shall not loosen parts or create undue internal stresses, which may affect the electrical or mechanical strength and rigidity. Each cap and base shall be machine faced and smoothly hot dip galvanized. The cap and base of the insulators shall be interchangeable with each other.

5.4 Special care shall be taken for cementing the hardware into the porcelain insulators and also for using proper cementing for forming solid core insulators assembly. The bidder must specify the type of cementing used and should give proper explanation duly supported with necessary test certificates to justify that the cementing used is of the highest quality to ensure trouble free performance of solid core insulators.

5.5 The metallic flanges, nuts, bolts & washers shall be hot dip galvanized. The nuts, bolts & washers for making one complete insulator stack and also for fixing the isolators shall be included alongwith insulators.

5.6 The tapped holes shall be of standard size except that the diameter may be oversize by not more than 0.25 mm. They shall be suitable for steel bolts having standard dimensions after galvanizing. The length of full thread shall not be less than the nominal bolt diameter. The threads of tapped holes in galvanized fittings shall be cut after galvanizing.

6.0 TESTS :

6.1 Type Test :

All the insulators offered, shall be fully type tested as per relevant Indian Standards or any equivalent International Standard (as specified in clause-2) during the last five years from the date of bid opening. Copy of test reports shall be enclosed with the bid. For any change in the design / type already type tested and the design / type offered against this bid, the Purchaser reserves the right to demand repetition of same or all type tests without any extra cost.

6.2 Acceptance And Routine Tests :

6.2.1 The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or equivalent International Standards in presence of Purchaser's representative.

6.2.2 Immediately after finalisation of the program of type/ acceptance/ routine testing, the manufacturer shall give sufficient advance intimation to the Purchaser, to enable him to depute his representative for witnessing the tests.

7.0 **INSPECTION :**

i. The Purchaser shall have access at all times to the works and all other places of manufacture, where the solid core insulators are being manufactured and the Bidder shall provide all facilities for unrestricted inspection of the Bidder's works, raw materials, manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii. The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of insulator in its various stages, so that arrangements could be made for inspection.

iii. No material shall be dispatched from the point of manufacture unless the material has been satisfactorily inspected and tested.

iv. The acceptance of any quantity of the insulator shall in no way relieve the successful bidder of his responsibility for meeting all the requirement of this specification and shall not prevent subsequent rejection if such insulator are later found to be defective.

8.0 QUALITY ASSURANCE PLAN & STAGE INSPECTION :

QAP & stage inspection shall be as per Section – I

9.0 DOCUMENTATION :

9.1 All drawings shall conform to latest version of International Standards Organization's (ISO's) 'A' series of drawing sheet / Indian Standards

Specification IS-11065. All drawings shall be in ink and suitable for microfilming. All dimensions and data shall be in S.I. Units.

9.2 List of Drawings And Documents :

The Bidder shall furnish two sets of following details and drawings along with his bid.

a. General outline and assembly drawings of the insulators together with technical particulars.

b. Sectional views showing top and bottom portion of insulator alongwith depth of threaded portion on metal cap, details of bottom flange etc.

c. Shed profile with complete details of various parameters.

d. Details of flanges joining upper and lower stack of insulator.

e. Details of nuts and bolts to be provided on top and bottom portion of insulator included in the scope of supply.

f. Mounting details of top and bottom portion.

g. Type Test reports in case the insulator has already been type tested.

h. Test reports, literature, pamphlets of the bought out items and raw material.

9.3 The successful Bidder shall within two weeks of placement of order, submit four sets of final versions of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments / approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 20 prints and two good qualities reproducible of the approved drawings for Purchaser's use.

9.4 The Bidder before commencement of supply shall submit six sets of the type test reports, duly approved by the Purchaser. Two copies of acceptance and routine tests certificates, duly approved by the Purchaser shall accompany the dispatched consignment.

9.5 The manufacturing of the insulator shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the insulator prior to the approval of the drawing shall be at the Bidder's risk.

9.6 Ten (10) copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English Language, for each type and rating of insulator supplied shall be submitted by the Bidder for distribution to field officers, prior to the dispatch of the insulator. The manual shall contain all the drawings and information required for erection, operation and maintenance of the insulators. The manual shall also contain a set of all the approved drawings, type test reports etc.

9.7 Approval of drawings / work by Purchaser shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The

insulator shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

10.0 PACKING AND FORWARDING :

Bidder shall ensure that the equipment shall be packed in crates suitable for vertical / horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit.

11.0 DISCREPANCY IN TECHNICAL PARTICULARS :

Regarding discrepancy in technical particulars, stipulation under Section-I, shall be applicable.

APPENDIX - A

PRINCIPAL PARAMETERS OF SOLID CORE INSULATORS

S No.	PARTICULARS	400 KV		220 KV	132 KV	33 KV
1	Type	Outdoor Cylindrical Porcelain Solid Core Post Insulator	Outdoor Porcelain Solid Core Operating Rod Insulator	Outdoor Cylindrical Porcelain Solid Core Post Insulator		
2	Rated Frequency (Hz)	---50---				
3	System Neutral Earthing.	--Effectively Earthed--				
4	Suitable for:- Rated Voltage (KV) Rated Frequency (Hz)	 420 50	 420 50	 245 50	 145 50	 36 50
5	One minute power frequency with stand voltage(Wet) (KV)	680	680	460	275	70
6	Lightning Impulse withstand test voltage (KV)	1550	1550	1050	650	170
7	Switching Impulse withstand Voltage (KV)	1050	1050	-	-	-
8	Minimum creepage distance Total (mm).	10500	10500	6125	3500	900
9	Visible discharge voltage (KV)	320	-	154	105	27
10	Mechanical strength. Ultimate Bending Strength (Nm) Torsional Strength (Nm) Compression Strength (N)	 8000 4000 320000	 2400 2500 80000	 8000 4000 260000	 6000 3000 140000	 6000 1500 60000
11	Height of Insulator (mm).	3910	3910	2500	1500	508
12	Top metal fitting pitch circle dia (mm).	127	127	127	127	76
13	Bottom metal fitting pitch circle dia (mm).	300	127	254	225	76
14	No. of holes & diameter. i) Top flange ii) Bottom flange	 4 holes of M16 8 holes of Ø18	 4 holes of M16 4 holes of Ø18	 4 holes of M16 8 holes of Φ18	 4 holes of M16 8 holes of Φ 18	 4 holes of M12 4 holes of M12
15	No. of units per stack	3	3	2	1	1

Annexure-2

LIST OF APPLICABLE STANDARD

S. No.	Indian Standard No.	Title	International & Internationally recognised standard
1	IS:2165	Insulation Co-ordination for equipment of 100 KV and above	-
2	IS:2544	Insulators	-
3	IS:5350	Post Insulators	-
4	-	Test on Post Insulators of nominal voltage greater than 1000 Volt	IEC – 168
5	-	Indian Electricity Rules 1956	

SECTION-3

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Madhya Pradesh power Transmission company Ltd.				
b)	Project Title	Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turn key basis (Lot no. 1) – Balaghat , Badnawar, Bhopal, Chhegaon and Nagda substation				
c)	Location	Balaghat	Badnawar	Bhopal	Chhegaon	Nagada
		Balaghat is Located in district of Balaghat of Madhya Pradesh. Distance between Jabalpur to Balaghat is 232 km by Road and 130 km by Rails.	Badnawar is Located in district of Dhar of Madhya Pradesh. Distance between Badnawar to Ujain is 70 km by Road .	Bhopal site is located 20 kM away from Bhopal city.	Chhegaon is located in Khandwa district of Madhya Pradesh . Distance between Chhegaon to Khandwa is 15 km by Road.	Nagda is located in Ujjain district of Madhya Pradesh. The road distance between Nagda to Ujjain is 47 km
d)	Transport Facilities	Road/Rail				
e)	Postal Address	To follow				

SITE CONDITIONS		
a)	Maximum ambient air temperature	50°C
b)	Minimum ambient air temperature	1°C
c)	Average daily ambient temperature	35°C
d)	Maximum Relative humidity	95 %(sometimes approach saturation)
e)	Pollution Severity	Heavily Polluted
f)	Seismic level (horizontal acceleration)	0.3g
g)	Wind zone as per IS 802 (PART 1) - 1995velocity	4
h)	maximum wind pressure	150kg/sq.mts
i)	Average annual rainfall	1250 mm
j)	Maximum altitude above mean see level	1000m
k)	Isolceraunic level	90 days per year
l)	Climate	Moderately hot & humid tropical climate , conductive ti rust & fungus growth

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V 50 Hz, 3-phase 4 wire, solidly earthed
1 phase A.C power supply	240V ,50 Hz, 1-phase , 2 wire
D.C. power supply	**220V , 2-wire ungrounded**, for all equipments and panels except PLCC of 400kV /220kV /132kV /33kV substation
D.C. power supply	48V , 2 wire system positively earthed for PLCC

The above supply voltage may vary as below and all devices shall be suitable for continuous operation over entire range of voltage.

i.	AC supply	Voltage + 10 % to -25% , frequency ± 4%
ii.	DC supply	Voltage + 10 % to -20%

SYSTEM PARAMETERS

Description parameters	**400kV System**	**220kV System**	**132kV System**	**33kV System**
System operating voltage	400 kV	220kV	132kV	33kV
Maximum operating voltage(rms)	420 kV	220kV	145kV	36 kV
Rated frequency	50Hz			
Full wave impulse withstand voltage (1.2/50 micro second)	1425kVP	1050kVP	650kVP	250kVP/ 170kVP
One minute Power frequency dry/wet withstand voltage (rms)	630kV/ 520kV	460kV	275kV	95kV/70kV
Switching Impulse withstand voltage (250/2500 micro sec.) dry and wet	1050kVP	-	-	-
Corona extinction voltage	320kV	156kV	105kV	-
Maximum radio interference voltage for frequency between 0.5MHz and 2 MHz at 320kV rms phase for 400kV system , 156kVrms for 220kV system & 92 kV rms for 132kV system	1000 Micro volt	1000 Micro volt	500 Micro volt	-
Rated short time current	40 kA for three seconds/one second as applicable			25 kA for three seconds/2 6.2kA for two second
Creepage distance @25mm/kV	10500mm	6125mm	3625mm	900mm
System Earthing	Effectively Earthed			

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of bid opening (i.e. 20.11.13)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type

test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

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

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

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

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modem practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to

previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.
All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

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

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

Painting process shall be of powder coating type.All surface shall be cleaned , phosphated and given two coats of rust –resistant primer followed by two coats of finish paints . The interior of all panels cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey

shade(697 of IS-5) shall be given to exterior surface of all the panels. Sufficient quantities of touch paint shall be furnished for application at site. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

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

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for paintaing shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitabley wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 697 of IS:5.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support

channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 & or 4759 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvasized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Net weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

Mandatory spares shall be packed in separate packing with clear identification.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any

demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

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

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area IP:52

d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41

e) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor

marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be **1100 V grade box** –clamp type and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be **non-disconnecting stud type equivalent to Elmex type CATM4**, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm, copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible..

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. **At**

least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publictions, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of **CRCA** sheet steel of minimum 2.5 mm thickness. The thickness of door s/covers shall not be less than 2.5 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box

shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required

3.16 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant ,the unit designation, contract no. , and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings

2) Guaranteed Technical Particulars

3) Type Test Reports

4) Manufacturing Quality Plan

3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1.	Drawings and Data Sheets	1	6	21	7 nos of all drawings/documents
2.	Drawings "As Built "	-	-	21	
3.	Type Test Reports	1	6	21	
4.	Erection Manuals	-	6	21	
5.	Operation and Maintenance Manuals	-	6	21	
6.	Manufacturing Quality Plan	1	6	21	
7.	Field Quality Plan	1	6	21	
8.	Inspection Test Reports	-	-	21	

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

FIRST ANGLE PROJECTION

DWG NO.

REV.	DATE	REASONS FOR REVISION	DRN	PREPARED BY	CHECKED BY	APPROVED BY

OWNER

MADHYA PRADESH POWER TRANSMISSION COMPANY LIMITED

PROJECT

CONSTRUCTION OF NEW 400kV SUB STATION , TRANSMISSSION LINES AND AUGMENTATION WORK/FEEDER BAY WORK ON TOTAL TURN KEY BASIS (LOT NO. -I) -BALAGHAT, BADNAWAR, BHOPAL, CHHEGAON AND NAGDA

EPC PURCHASER

BHARAT HEAVY ELECTRICALS LTD
TRANSMISSION BUSINESS GROUP

DEPT. CODE		NAME	SIGN.	DATE
	DRN			
	DESN			
	CHD			
	APPD			

TITLE

CV	ME	EL	MEC			DEPT.	SCALE	BHEL/SUB VENDOR DRG NO.
						SIGN		
						DATE		SHT. No REV.

SECTION 4
GUARANTEED AND TECHNICAL PARTICULARS OF POST INSULATORS

For each type and rating of insulator proposed, the bidder shall provide the following information

S. No	PARTICULAR	UNIT	400kV (post Insulator)	400kV (operating Rod Insulator)	220kV	132kV	33kV
1.	Manufacturer's Name and address						
2.	Type of insulator unit						
3.	Applicable standard						
4.	No. of units per stack						
5.	Whether Corona ring provided or not	Yes/No					
6.	Diameter	mm					
7.	Bolt circle diameter	mm					
8.	Spacing between two units	Mm					
9.	Creepage Distance						
	a)Total	mm					
	b)Protected	mm					
10.	power frequency withstand voltage of Insulator	kV rms					
	a)One unit						
	(i)Dry	kV rms					
	(ii) Wet	kV rms					
	b)One complete stack						
	(i) Dry	kV rms					
	(ii) Wet	kV rms					
11.	1.2/50 micro sec. Impulse With Stand Voltage						
	a)One unit	kV peak					
	b)Complete stack without Corona Ring	kV peak					
	c) Complete stack with Corona Ring	kV peak					
12.	Visible discharge voltage for falling Power frequency voltage for complete stack						
13.	Radio Interference Voltage of Complete stack						
	i)Test voltage	kV rms					
	ii)Radio Interference Voltage	micro volts					
14.	Weight of complete stack	kg					
15.	Cantilever strength (a) Each Unit						
	i)Upright	Kg					

	ii)Underhung	kg					
	b) Complete Stack						
	i)Upright	kg					
	ii)Underhung	kg					
16.	Tensile Strength	Kg					
17.	Torsional Strength	kg					
18.	Compression Strength	kg					
19.	250/2500 micro second switching surge Withstand voltage						
	a) One unit						
	(i)Dry	kV peak					
	(ii) Wet	kV peak					
	b) Complete stack						
	(i) Dry	kV peak					
	(ii) Wet	kV peak					
20.	Whether shed profile of insulator is Conforming tolEC-815?	Yes/No					
21.	Whether calculations characterizing shed profile as per IEC-815 are enclosed with bid?	Yes/No					
22.	Whether offered B.P.I is if alternate Shed type?	Yes/No					

SECTION – 5

Check List

Put a tick mark (√) in 'YES/NO' Column if the specified requirement is met, or put a (X) mark, if the specified requirement is not met and give comments in the "Remarks" column.

1. TECHNICAL REQUIREMENTS

S No.	PARTICULARS	400 KV		220 KV	132 KV	33 KV	Yes/No	Remarks
1	Type	Outdoor Cylindrical Porcelain Solid Core Post Insulator	Outdoor Porcelain Solid Core Operating Rod Insulator	Outdoor Cylindrical Porcelain Solid Core Post Insulator				
2	Rated Frequency (Hz)	---50---						
3	System Neutral Earthing.	--Effectively Earthed--						
4	Suitable for:- Rated Voltage (KV) Rated Frequency (Hz)	 420 50	 420 50	 245 50	 145 50	 36 50		
5	One minute power frequency with stand voltage(Wet) (KV)	680	680	460	275	70		
6	Lightning Impulse withstand test voltage (KV)	1550	1550	1050	650	170		

7	Switching Impulse withstand Voltage (KV)	1050	1050	-	-	-		
8	Minimum creepage distance Total (mm).	10500	10500	6125	3500	900		
9	Visible discharge voltage (KV)	320	-	154	105	27		
10	Mechanical strength. Ultimate Bending Strength (Nm) Torsional Strength (Nm) Compression Strength (N)	 8000 4000 320000	 2400 2500 80000	 8000 4000 260000	 6000 3000 140000	 6000 1500 60000		
11	Height of Insulator (mm).	3910	3910	2500	1500	508		
12	Top metal fitting pitch circle dia (mm).	127	127	127	127	76		
13	Bottom metal fitting pitch circle dia (mm).	300	127	254	225	76		
14	No. of holes & diameter. i) Top flange ii) Bottom flange	 4 holes of M16 8 holes of Ø18	 4 holes of M16 4 holes of Ø18	 4 holes of M16 8 holes of Φ18	 4 holes of M16 8 holes of Φ 18	 4 holes of M12 4 holes of M12		
15	No. of units per stack	3	3	2	1	1		

2. TYPE TESTS

a) Whether Type test reports of the tests conducted earlier (not more than 5 years earlier as per clause no.4 of section-1) submitted. **YES/NO**

b) Whether Type test reports are as per mentioned IS & IEC and Clause No. 6 of section-2 attached. **YES/NO**

c) If type test report submitted, make a table indicate report number and date. **YES/NO**

d) In Case the type test reports are more than 5 years old (from the date of Technical bid opening or the reports are found to be technically unacceptable, type tests shall be conducted by the vendor without cost & delivery implication to BHEL. **YES/NO**

3. Technical Requirement

a) Whether bidder is fulfilling Technical requirements as per Clause no. 5 of section-1. **YES/NO**

b) If Technical requirements are fulfilled attach supporting documents. **YES/NO**