



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 420 KV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER :		NAME & ADDRESS OF THE INDIAN AGENT :	
SCOPE: SUPPLY OF 420 KV, 1250 A, CTL-400 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/420/27 Rev 00	
		Date: 24.09.2018	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : 420 KV, 1250A, CTL-400 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 47530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting and oil end dimensions of bushing shall be as per drawing no 000-T-E-A-001-R02. (Refer Annexure - I)	Vendor to confirm and submit the drawing alongwith the bid	

Signature

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SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		
2.7.1	The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm	
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm	
2.7.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm	
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm	
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm	
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm	
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm	
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm	
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm	
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm	
2.7.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to Confirm	

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SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm	
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm	
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrink, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	In case of RIP bushing with polymer housing, Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	

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SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm	
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warranty period w.r.t. pre-commissioning values, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
2.22	Valid type test report for all type tests as per IEC : 60137 for 420 KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted alongwith the bid.	Vendor to Confirm	
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm	
2.24	Type Tests reports should include the following tests also, (i) Seismic Test (ii) Snap back Test / Free Oscillation test	Vendor to Confirm	
2.25	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm	

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Date: 24.09.2018

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED	REMARKS
	Technical Parameters			
3	Rated Voltage	420 kV	Vendor to specify	
3.1	Rated Current (Min.)	1250 A	Vendor to specify	
3.2	Lightning Impulse withstand voltage	1425 kVp	Vendor to specify	
3.3	Switching Impulse Withstand Voltage	1050 kVp		
3.4	One minute power frequency withstand voltage	695 kVrms	Vendor to specify	
3.5	Minimum total creepage distances	10500 mm	Vendor to specify	
3.6	Tan delta of bushings	< 0.004	Vendor to specify	
3.7	Max partial discharge level at Um	< 10 pC	Vendor to specify	
3.8	Test tap voltage withstand level	2 kVrms	Vendor to specify	
3.9	CT space min.	400 mm	Vendor to specify	
3.10	Maximum Oil End Length (without shield)	1640mm	Vendor to specify	
3.11	Maximum Flange diameter	720mm	Vendor to specify	
3.12	Mounting Flange Hole PCD	660mm	Vendor to specify	
3.13	Mounting Flange PCD Hole dia & qty	24mm x 12 nos.	Vendor to specify	
3.14	Maximum oil end diameter	350mm	Vendor to specify	
3.15	Type of Lead	Bottom Palm type	Vendor to confirm	
3.16			Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:			
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.			Vendor to note
4.2	The other technically qualified vendors , who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.			Vendor to confirm
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.			Vendor to note

Date: 24.09.2018

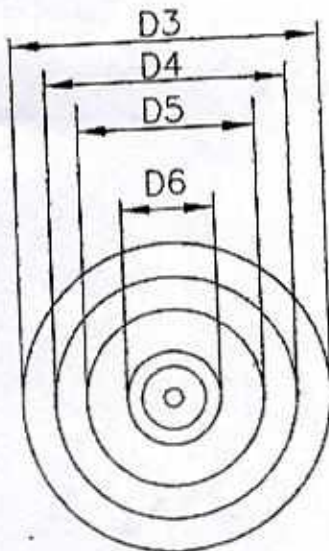
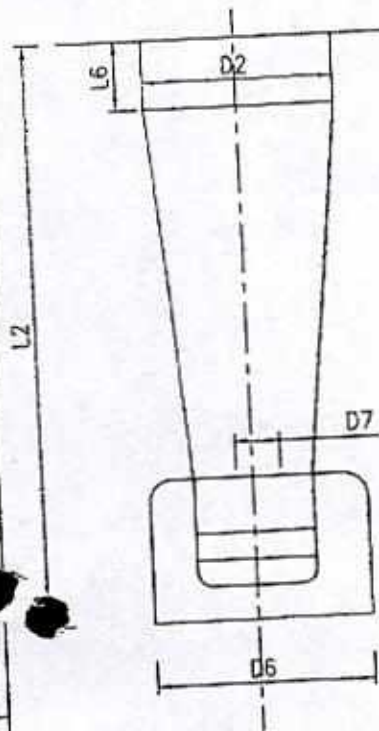
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
5.0	DOCUMENTATION: Following documents in English language should be submitted along with the bid for our evaluation	Vendor to Confirm	
5.1	OGA Drawing	Vendor to submit	
5.2	Guaranteed Technical Particulars	Vendor to submit	
5.3	Manufacturing Quality Plan	Vendor to submit	
5.4	Type test reports	Vendor to submit	
5.5	Catalogues, O&M Manuals	Vendor to submit	
6.0	GUARANTEE:		
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests may be witnessed by BHEL / POWERGRID representatives at supplier's works.	Vendor to confirm	
7.2	Air-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL / POWERGRID.	Vendor to note	
7.3	Competent, English speaking experts shall be arranged by the vendor during inspection.	Vendor to Confirm	

Prepared By: Singiren.E.Kandulna
Dy. Mgr (CIE)

Checked By: Maheshwari Kurre
AGM (BCE & CIE)

Approved By: Aseem Dhamija
AGM (BCE, CIE & TRX)

ANNEXURE-I TO SPEC NO BCE/PS/420/27



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (KV)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2±5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600/800	695
L6 (MIN.)	400	300	100/300	300	100
D2 (Max.)	350	270	165	115	165
D3±2	720	450	335	225	335
D4±1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	-	38	-

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

Signature

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 245 KV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER:		NAME & ADDRESS OF THE INDIAN AGENT:	
SCOPE: SUPPLY OF 245 KV, 2000 A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW:			
Spec No. : BCE/PS/245/28 Rev 00			
Date: 24.09.2018			
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : 245 KV, 2000A, CTL-300 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 42530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting and oil end dimensions of bushing shall be as per drawing no 000-T-E-A-001-R02. (Refer Annexure - I)	Vendor to confirm and submit the drawing alongwith the bid	

Signature

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SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/ POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		
2.7.1	The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm	
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm	
2.7.3	Polymer / composite Insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm	
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm	
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm	
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm	
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm	
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm	
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm	
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm	
2.7.12	The vulcanization for extrusion process shall be at high temperature and for Injection moulding shall be at high temperature & high pressure.	Vendor to Confirm	
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm	

Signature

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Date: 24.09.2018

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm	
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrink, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non-returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	In case of RIP bushing with polymer housing, Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	



SR.NO.	DESCRIPTION FOR BIHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm	
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warranty period w.r.t. pre-commissioning values, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
2.22	Valid type test report for all type tests as per IEC : 60137 for 245KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted alongwith the bid.	Vendor to Confirm	
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm	
2.24	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm	
3	Technical Parameters		
3.1	Rated Voltage	Vendor to specify	245 kV
3.2	Rated Current (Min.)	Vendor to specify	2000 A
3.3	Lightning impulse withstand voltage	Vendor to specify	1050 kVp
3.4	Switching impulse Withstand Voltage		850 kVp
3.5	One minute power frequency withstand voltage	Vendor to specify	505 kVrms
3.6	Minimum total creepage distances	Vendor to specify	6125 mm

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED	REMARKS
3.7	Tan delta of bushings	< 0.004	Vendor to specify	
3.8	Max partial discharge level at Um	< 10 pC	Vendor to specify	
3.9	Test tap voltage withstand level	2 kV/rms	Vendor to specify	
3.10	CT space min.	300 mm	Vendor to specify	
3.11	Maximum Oil End Length (Without shield)	1230mm	Vendor to specify	
3.12	Maximum Flange diameter	450mm	Vendor to specify	
3.13	Mounting Flange Hole PCD	400mm	Vendor to specify	
3.14	Mounting Flange PCD Hole dia & qty	20mm x 12 nos.	Vendor to specify	
3.15	Maximum oil end diameter	270mm	Vendor to specify	
3.16	Type of Lead	Bottom Palm type	Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:		Vendor to confirm	
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.		Vendor to note	
4.2	The other technically qualified vendors, who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.		Vendor to confirm	
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.		Vendor to note	
5.0	DOCUMENTATION: Following documents in English language should be submitted along with the bid for our evaluation		Vendor to Confirm	
5.1	OGA Drawing		Vendor to submit	
5.2	Guaranteed Technical Particulars		Vendor to submit	
5.3	Manufacturing Quality Plan		Vendor to submit	
5.4	Type test reports		Vendor to submit	
5.5	Catalogues, O&M Manuals		Vendor to submit	
6.0	GUARANTEE:			

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Signature

Date: 24.09.2018

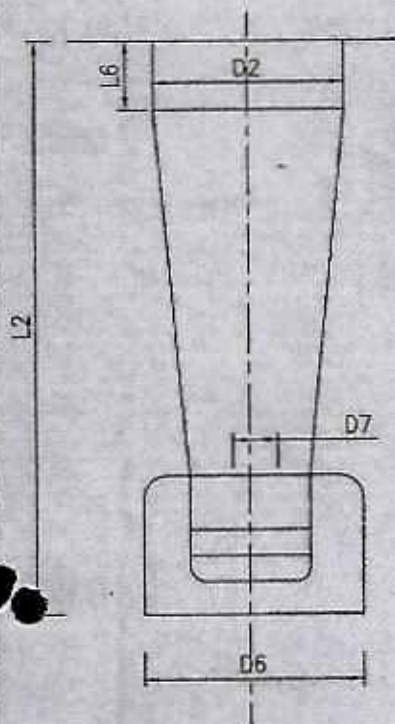
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.	Vendor to confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests may be witnessed by BHEL/ POWERGRID representatives at supplier's works.	Vendor to confirm	
7.2	Air-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL/ POWERGRID.	Vendor to note	
7.3	Competent, English speaking experts shall be arranged by the vendor during inspection.	Vendor to confirm	

Prepared By: Singiren. E. Kandulna
Dy. Mgr (CIE)

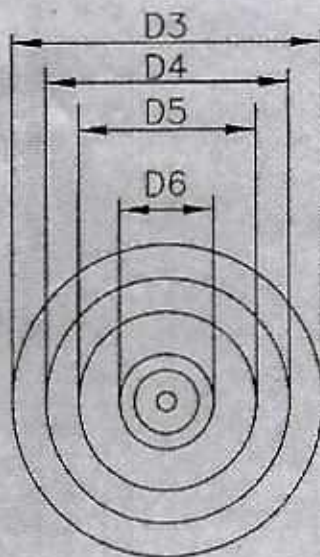
Checked By: Mahendra Kurre
AGM (BCE & CIE)

Approved By: Aseem Dhamija
AGM (BCE, CIE & TRX)

ANNEXURE-I TO SPEC NO - BCE/PS/245/28, REV 00



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (KV)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2±5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600 [#] /800	695
L6 (MIN.)	400	300	100 [#] /300	300	100
D2 (Max.)	350	270	165	115	165
D3±2	720	450	335	225	335
D4±1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	—	38	—



NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

Engin

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 245 KV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER :		NAME & ADDRESS OF THE INDIAN AGENT :	
SCOPE: SUPPLY OF 245 KV, 1250 A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/245/33 Rev 00	
		Date: 24.09.2018	
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1.0	WORKPIECE MATERIAL		
1.1	Item : 245 KV, 1250A, CTL-300 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 42530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting and oil end dimensions of bushing shall be as per drawing no 000-T-E-A-001-R02. (Refer Annexure-I)	Vendor to confirm and submit the drawing along with the bid	

9/10/2018
35

Date: 24.09.2018

DESCRIPTION FOR BHEL REQUIREMENT			
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/ POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		
2.7.1	The hollow silicone composite Insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm	
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm	
2.7.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm	
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm	
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm	
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm	
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm	
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm	
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm	
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm	
2.7.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to Confirm	
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm	



Date: 24.09.2018

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm	
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanized/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	In case of RIP bushing with polymer housing, Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	

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Date: 24.09.2018

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm	
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warranty period w.r.t. pre-commissioning values, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
2.22	Valid type test report for all type tests as per IEC : 60137 for 245KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted along with the bid.	Vendor to Confirm	
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm	
2.24	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm	
3	Technical Parameters		
3.1	Rated Voltage	245 kV	Vendor to specify
3.2	Rated Current (Min.)	1250 A	Vendor to specify
3.3	Lightning impulse withstand voltage	1050 kVp	Vendor to specify
3.4	Switching Impulse Withstand Voltage	850 kVp	
3.5	One minute power frequency withstand voltage	505 kVrms	Vendor to specify
3.6	Minimum total creepage distances	6125 mm	Vendor to specify



Date: 24.09.2018

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED	REMARKS
3.7	Tan delta of bushings	< 0.004	Vendor to specify	
3.8	Max partial discharge level at Um	< 10 pC	Vendor to specify	
3.9	Test tap voltage withstand level	2 kVrms	Vendor to specify	
3.10	CT space min.	300 mm	Vendor to specify	
3.11	Maximum Oil End Length (with shield)	1130mm	Vendor to specify	
3.12	Maximum Flange diameter	450mm	Vendor to specify	
3.13	Mounting Flange Hole PCD	400mm	Vendor to specify	
3.14	Mounting Flange PCD Hole dia & qty	20mm x 12 nos.	Vendor to specify	
3.15	Maximum oil end diameter	270mm	Vendor to specify	
3.16	Type of Lead	Bottom Palm type	Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:		Vendor to confirm	
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.		Vendor to note	
4.2	The other technically qualified vendors , who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.		Vendor to confirm	
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.		Vendor to note	
5.0	DOCUMENTATION : Following documents In English language should be submitted along with the bid for our evaluation		Vendor to Confirm	
5.1	OGA Drawing		Vendor to submit	
5.2	Guaranteed Technical Particulars		Vendor to submit	
5.3	Manufacturing Quality Plan		Vendor to submit	
5.4	Type test reports		Vendor to submit	
5.5	Catalogues, O&M Manuals		Vendor to submit	
6.0	GUARANTEE :			

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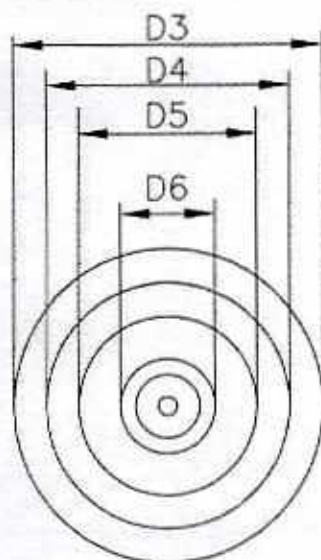
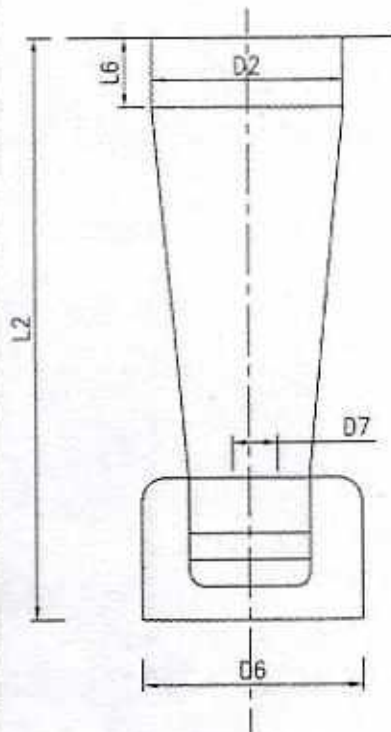
Date: 24.09.2018

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests may be witnessed by BHEL/ POWERGRID representatives at supplier's works.	Vendor to confirm	
7.2	Air-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL/ POWERGRID.	Vendor to note	
7.3	Competent, English speaking experts shall be arranged by the vendor during inspection.	Vendor to Confirm	

Prepared By: Singiren.E.Kandulna
Dy. Mgr (CIE)

Checked By: Mahendra Kurte
AGM (BCE & CIE)

Approved By: Assem Dhamija
AGM (BCE, CIE & TRX)



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (kV _p)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2±5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600/800	695
L6 (MIN.)	400	300	100/300	300	100
D2 (Max.)	350	270	165	115	165
D3±2	720	450	335	225	335
D4±1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	-	38	-

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02



BIHAR HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 145 kV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER :			
SCOPE: SUPPLY OF 145 KV, 1250A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/145/30 Rev 00	
		Date:24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : 145 KV, 1250A, CTL-300 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 42530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting and oil end dimensions of bushing shall be as per drawing no 000-T-E-A-001-R02. (Refer Annexure - I)	Vendor to confirm and submit the drawing alongwith the bid	
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/ POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		

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SCOPE: SUPPLY OF 145 KV, 1250A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/145/30 Rev 00		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7.1	The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm	
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm	
2.7.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm	
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm	
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm	
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm	
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm	
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm	
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm	
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm	
2.7.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to Confirm	
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm	
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm	
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm	

SCOPE: SUPPLY OF 145 KV, 1250A, CTL-300MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/145/30 Rev 00

Date: 24.09.2019

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	REMARKS	
		SPECIFIED / TO BE CONFIRMED	
2.7.16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non-returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	

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SCOPE: SUPPLY OF 145 KV, 1250A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE

SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/145/30 Rev 00

Date:24.09.2019

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm	
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warrantee period, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
2.22	Valid type test report for all type tests as per IEC : 60137 for 145KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted alongwith the bid.	Vendor to Confirm	
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm	
2.24	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm	
3	Technical Parameters		
3.1	Rated Voltage	Vendor to specify	145 kV
3.2	Rated Current (Min.)	Vendor to specify	1250 A
3.3	Lightning impulse withstand voltage	Vendor to specify	650 kVp
3.4	Switching Impulse Withstand Voltage		N/A
3.5	One minute power frequency withstand voltage	Vendor to specify	305 kVrms
3.6	Minimum total creepage distances	Vendor to specify	3625 mm
3.7	Tan delta of bushings	Vendor to specify	< 0.004
3.8	Max partial discharge level at Um	Vendor to specify	< 10 pC
3.9	Test tap voltage withstand level	Vendor to specify	2 kVrms
3.10	CT space min.	Vendor to specify	220 mm
3.11	Maximum Oil End Length (with shield)	Vendor to specify	800mm

SCOPE: SUPPLY OF 145 KV, 1250A, CTL-3000MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/145/30 Rev 00

Date: 24.09.2019

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED	REMARKS
3.12	Maximum Flange diameter	335mm	Vendor to specify	
3.13	Mounting Flange Hole PCD	290mm	Vendor to specify	
3.14	Mounting Flange PCD Hole dia & qty	15mm x 12 nos.	Vendor to specify	
3.15	Maximum oil end diameter	165mm	Vendor to specify	
3.16	Type of Lead	Bottom Palm type	Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:		Vendor to confirm	
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.		Vendor to note	
4.2	The other technically qualified vendors , who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.		Vendor to confirm	
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.		Vendor to note	
5.0	DOCUMENTATION : Following documents in English language should be submitted along with the bid for our evaluation		Vendor to Confirm	
5.1	OGA Drawing		Vendor to submit	
5.2	Guaranteed Technical Particulars		Vendor to submit	
5.3	Manufacturing Quality Plan		Vendor to submit	
5.4	Type test reports		Vendor to submit	
5.5	Catalogues, O&M Manuals		Vendor to submit	
6.0	GUARANTEE :			
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.		Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:		Vendor to confirm	

SCOPE: SUPPLY OF 145 KV, 1250A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE

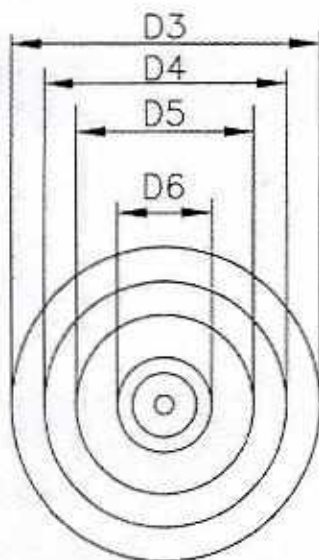
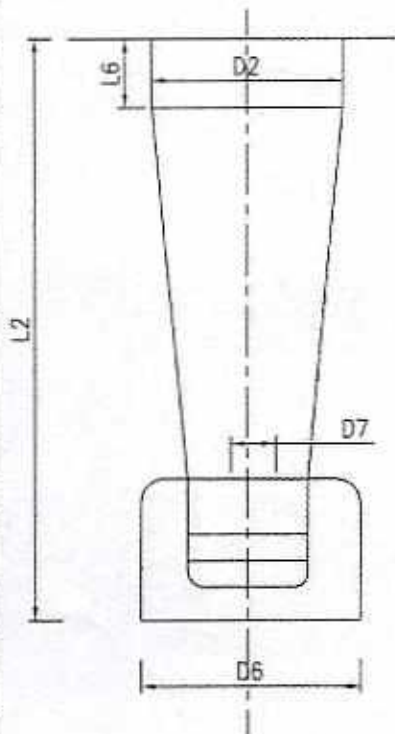
SPECIFICATIONS AS BELOW :

SR.NO.		DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED		REMARKS	
7.1		Routine tests may be witnessed by BHEL/ POWERGRID representatives at supplier's works.		Vendor to confirm			
7.2		Air-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL/ POWERGRID.		Vendor to note			
7.3		Competent, English speaking experts shall be arranged by the vendor during inspection.		Vendor to Confirm			

Prepared By: Singireni E. Kandulna
Dy. Mgr (CIE)

Checked By: Mahendra Kurre
AGM (BCE & CIE)

Approved By: Assem Dhamija
AGM (BCE, CIE & TRX)



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (KV)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2±5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600 [#] /800	695
L6 (MIN.)	400	300	100 [#] /300	300	100
D2 (Max.)	350	270	165	115	165
D3±2	720	450	335	225	335
D4±1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	-	38	-

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 145 KV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER :		NAME & ADDRESS OF THE INDIAN AGENT :	
SCOPE: SUPPLY OF 145 KV, 1250A, CTL-500 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/145/29 Rev 00	
		Date: 24.09.2018	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : 145 KV, 1250A, CTL-500 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 42530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting & oil end dimensions of bushing shall be as per drawing no 000-T-E-A-002-R00. (Refer Annexure -1)	Vendor to confirm and submit the drawing alongwith the bid	

Signature

Spec No. : BCE/PS/145/29 Rev 00			Date: 24.09.2018
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		
2.7.1	The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm	
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm	
2.7.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm	
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm	
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm	
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm	
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm	
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm	
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm	
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm	
2.7.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to Confirm	
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm	
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm	

Signature

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		Vendor to Confirm	
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrink, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	In case of RIP bushing with polymer housing. Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	

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2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm	
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warranty period w.r.t. pre-commissioning values, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
2.22	Valid type test report for all type tests as per IEC : 60137 for 145KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted along with the bid.	Vendor to Confirm	
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm	
2.24	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm	
3	Technical Parameters		
3.1	Rated Voltage	Vendor to specify	145 kV
3.2	Rated Current (Min.)	Vendor to specify	1250 A
3.3	Lightning impulse withstand voltage	Vendor to specify	650 kVp
3.4	Switching Impulse Withstand Voltage		N/A
3.5	One minute power frequency withstand voltage	Vendor to specify	305 kVrms
3.6	Minimum total creepage distances	Vendor to specify	3625 mm
3.7	Tan delta of bushings	Vendor to specify	< 0.004
3.8	Max partial discharge level at Um	Vendor to specify	< 10 pC
3.9	Test tap voltage withstand level	Vendor to specify	2 kVrms
3.10	CT space min.	Vendor to specify	±500 mm

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3.11	Maximum Oil End Length (without shield)	1100mm	Vendor to specify	
3.12	Maximum Flange diameter	400mm	Vendor to specify	
3.13	Mounting Flange Hole PCD	350mm	Vendor to specify	
3.14	Mounting Flange PCD Hole dia & qty	24mm x 6 nos.	Vendor to specify	
3.15	Maximum oil end diameter	220mm	Vendor to specify	
3.16	Type of Lead	Bottom Palm type	Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:			
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.			
4.2	The other technically qualified vendors, who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.			
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.			
5.0	DOCUMENTATION:			
	Following documents in English language should be submitted along with the bid for our evaluation			
5.1	OGA Drawing		Vendor to Confirm	
5.2	Guaranteed Technical Particulars		Vendor to submit	
5.3	Manufacturing Quality Plan		Vendor to submit	
5.4	Type test reports		Vendor to submit	
5.5	Catalogues, O&M Manuals		Vendor to submit	
6.0	GUARANTEE:			
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.			
7.0	ROUTINE TEST INSPECTION:			
7.1	Routine tests may be witnessed by BHEL/ POWERGRID representatives at supplier's works.			

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7.2	Alr-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL/ POWERGRID.	Vendor to note	
7.3	Competent, English speaking experts shall be arranged by the vendor during inspection.	Vendor to Confirm	



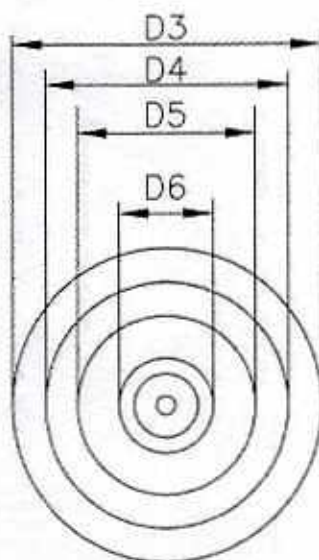
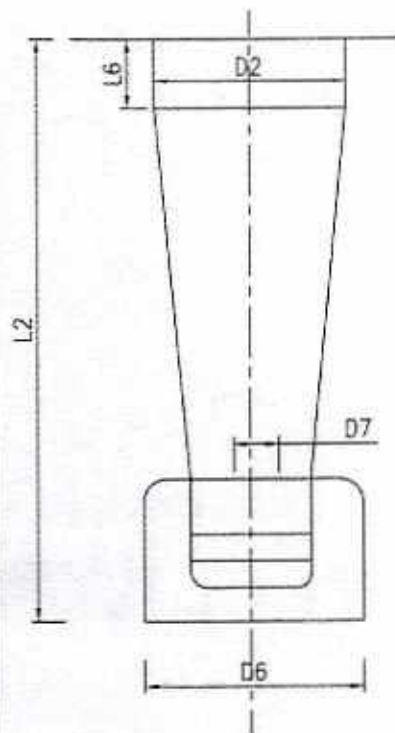
Prepared By: Singireni.E.Kandulna
Dy. Mgr (CIE)



Checked By: Mahendra Kurre
AGM (BCE & CIE)



Approved By: Aseem Dhamija
AGM (BCE, CIE & TRX)



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (KV)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2 ± 5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600/800	695
L6 (MIN.)	400	300	100/300	300	100
D2 (Max.)	350	270	165	115	165
D3 ± 2	720	450	335	225	335
D4 ± 1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	-	38	-

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 52 KV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER :			
SCOPE: SUPPLY OF 52 KV, 3150A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/52/31 Rev 00	
		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : 52 KV, 3150A, CTL-300 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 42530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting & oil end dimensions of bushing shall be as per drawing no 000-T-E-A-002-R00. (Refer Annexure -I)	Vendor to confirm and submit the drawing along with the bid	
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/ POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/31 Rev 00		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7.1	The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm	
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm	
2.7.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm	
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm	
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm	
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm	
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm	
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm	
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm	
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm	
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm	
2.7.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to Confirm	
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm	
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm	
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm	

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-300 (M), RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/31 Rev 00		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7,16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/31 Rev 00

Date: 24.09.2019

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	REMARKS	
		SPECIFIED / TO BE CONFIRMED	
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm	
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warranty period, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
2.22	Valid type test report for all type tests as per IEC : 60137 for 52 KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted alongwith the bid.	Vendor to Confirm	
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm	
2.24	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm	
3	Technical Parameters		
3.1	Rated Voltage	52 kV	Vendor to specify
3.2	Rated Current (Min.)	3150 A	Vendor to specify
3.3	Lightning impulse withstand voltage	250 kV/p	Vendor to specify
3.4	Switching Impulse Withstand Voltage	N/A	
3.5	One minute power frequency withstand voltage	105 kVrms	Vendor to specify
3.6	Minimum total creepage distances	1300 mm	Vendor to specify
3.7	Tan delta of bushings	< 0.004	Vendor to specify
3.8	Max partial discharge level at Um	< 10 pC	Vendor to specify
3.9	Test tap voltage withstand level	2 kVrms	Vendor to specify
3.10	CT space min.	300 mm	Vendor to specify
3.11	Maximum Oil End Length (with shield)	685mm	Vendor to specify
3.12	Maximum Flange diameter	350mm	Vendor to specify

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-300 mm, RESIN IMPREGNATED PAPER (RIP) CONDUCTOR BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/S2/31 Rev 00

Date: 24.09.2019

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED	REMARKS
3.13	Mounting Flange Hole PCD	300mm	Vendor to specify	
3.14	Mounting Flange PCD Hole dia & qty	20mm x 6 nos.	Vendor to specify	
3.15	Maximum oil end diameter	224mm	Vendor to specify	
3.16	Type of Lead	Bottom Palm type	Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:		Vendor to confirm	
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.		Vendor to note	
4.2	The other technically qualified vendors , who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.		Vendor to confirm	
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.		Vendor to note	
5.0	DOCUMENTATION : Following documents in English language should be submitted along with the bid for our evaluation		Vendor to Confirm	
5.1	OGA Drawing		Vendor to submit	
5.2	Guaranteed Technical Particulars		Vendor to submit	
5.3	Manufacturing Quality Plan		Vendor to submit	
5.4	Type test reports		Vendor to submit	
5.5	Catalogues, O&M Manuals		Vendor to submit	
6.0	GUARANTEE :			
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.		Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:		Vendor to confirm	

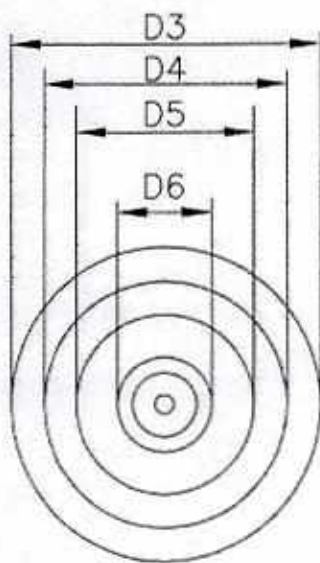
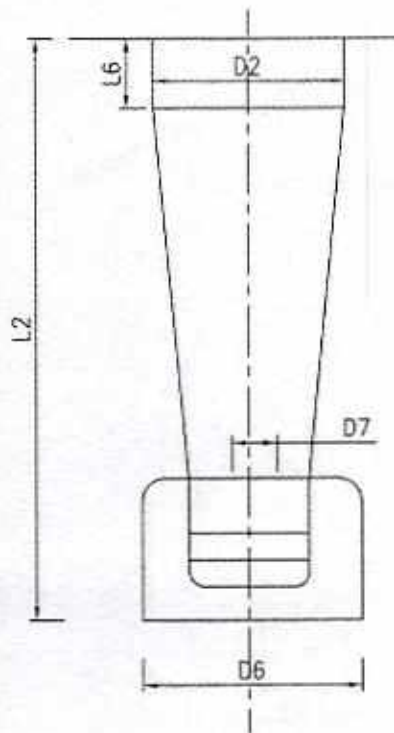
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SCOPE: SUPPLY OF 52 KV, 3150A, CTL-300 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/52/31 Rev 00	
		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
7.1	Routine tests may be witnessed by BHEL/ POWERGRID representatives at supplier's works.	Vendor to confirm	
7.2	Air-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL/ POWERGRID.	Vendor to note	
7.3	Competent, English speaking experts shall be arranged by the vendor during inspection.	Vendor to Confirm	


 Prepared By: Singireni E. Kandulna
 Dy. Mgr (CIE)


 Checked By: Maheendra Kurra
 AGM (BCE & CIE)

Approved By: Aseem Dhamija
 AGM (BCE, CIE & TRX)



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (KV _p)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2±5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600/800	695
L6 (MIN.)	400	300	100/300	300	100
D2 (Max.)	350	270	165	115	165
D3±2	720	450	335	225	335
D4±1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	—	38	—

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 52 KV RIP BUSHINGS

NAME & ADDRESS OF THE SUPPLIER :			
SCOPE: SUPPLY OF 52 KV, 3150A, CTL-100 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
		Spec No. : BCE/PS/52/32 Rev 00	
		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : 52 KV, 3150A, CTL-100 MM Resin Impregnated Paper (RIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	Bushings shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout and movement along with the spare Transformer/ Reactor with bushing erected and provided with proper support from one foundation to another foundation within the substation area.	Vendor to Confirm	
2.2	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137/DIN 42530. All details of the bushing shall be submitted for approval and design review during contract stage.	Vendor to Confirm	
2.3	The bushing shall be provided with tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.	Vendor to Confirm	
2.4	Where current transformers are provided, the bushings shall be removable without disturbing the current transformers.	Vendor to Confirm	
2.5	Bushings of identical rating shall be interchangeable to optimise the requirement of spares. Mounting and oil end dimensions of bushing shall be as per drawing no 000-T-E-A-001-R02. (Refer Annexure - I)	Vendor to confirm and submit the drawing along with the bid	
2.6	These bushings are for POWERGRID contracts and shall be manufactured meeting their requirements. Drawings, Quality and test schedules etc shall be got approved by BHEL/ POWERGRID before commencement of manufacturing.	Vendor to Confirm	
2.7	Polymer / Composite Insulator		

Signature

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-100 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/32 Rev 00		
Date: 24.09.2019		
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED
2.7.1	The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.	Vendor to Confirm
2.7.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to Confirm
2.7.3	Polymer / composite Insulator shall be seamless sheath of a silicone rubber compound.	Vendor to Confirm
2.7.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to Confirm
2.7.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to Confirm
2.7.6	It shall be extruded or directly moulded on the core.	Vendor to Confirm
2.7.7	The interface between the housing and the core must be uniform and without voids.	Vendor to Confirm
2.7.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to Confirm
2.7.9	The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.	Vendor to Confirm
2.7.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to Confirm
2.7.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815-3. The weather sheds shall be vulcanized to the sheath (extrusion process) or moulded as part of the sheath (injection moulding process) and free from imperfections.	Vendor to Confirm
2.7.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to Confirm
2.7.13	Any seams / burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing.	Vendor to Confirm
2.7.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to Confirm
2.7.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to Confirm

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-100 MM², RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/32 Rev 00		Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
2.7.16	The composite insulator shall be capable of high pressure washing.	Vendor to Confirm	
2.8	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to Confirm	
2.9	End fittings should be effectively sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to Confirm	
2.10	All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to Confirm	
2.11	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to Confirm	
2.12	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to Confirm	
2.13	No arcing horns shall be provided on the bushings.	Vendor to Confirm	
2.14	Spare Bushing shall be specially packed suitable for long storage with non-returnable.	Vendor to Confirm	
2.15	Bushing shall be specially packed to avoid any damage during transit and suitable for long storage, with non-returnable packing wooden boxes with hinged type cover. Without any gap between wooden planks. Packing Box opening cover with nails/screws type packing arrangement shall not be acceptable.	Vendor to Confirm	
2.16	Bushing oil end portion shall be fitted with metal housing with positive dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy.	Vendor to Confirm	
2.17	Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	Vendor to Confirm	
2.18	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.19	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing at manufacturing works as routine test before despatch and the result shall be compared at site during commissioning to verify the healthiness of the bushing.	Vendor to Confirm	

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-100 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/32 Rev 00			Date: 24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS	
2.20	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site should not increase by 0.001 w.r.t factory results (without any temperature correction) during warranty period.	Vendor to Confirm		
2.21	If the bushing Tan delta goes beyond 0.005 or increase is more than 0.001 within the warranty period, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm		
2.22	Valid type test report for all type tests as per IEC : 60137 for 52 KV of similar design conducted not earlier than 10 years from the bid opening date, shall be submitted along with the bid.	Vendor to Confirm		
2.23	The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by client / third party.	Vendor to Confirm		
2.24	In absence of valid type test report, the offer is liable to be rejected.	Vendor to Confirm		
3	Technical Parameters			
3.1	Rated Voltage	52 kV	Vendor to specify	
3.2	Rated Current (Min.)	3150 A	Vendor to specify	
3.3	Lightning Impulse withstand voltage	250 kVp	Vendor to specify	
3.4	Switching Impulse Withstand Voltage	N/A		
3.5	One minute power frequency withstand voltage	105 kVrms	Vendor to specify	
3.6	Minimum total creepage distances	1300 mm	Vendor to specify	
3.7	Tan delta of bushings	< 0.004	Vendor to specify	
3.8	Max partial discharge level at Um	< 10 pC	Vendor to specify	
3.9	Test tap voltage withstand level	2 kVrms	Vendor to specify	
3.10	CT space min.	100 mm	Vendor to specify	
3.11	Maximum Oil End Length (with shield)	475mm	Vendor to specify	

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-100 MM² RESIN IMPREGNATED PAPER (RIP) CONDUCTOR BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/32 Rev 00

Date: 24.09.2019

SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED	REMARKS
3.12	Maximum Flange diameter	335mm	Vendor to specify	
3.13	Mounting Flange Hole PCD	290mm	Vendor to specify	
3.14	Mounting Flange PCD Hole dia & qty	15mm x 12 nos.	Vendor to specify	
3.15	Maximum oil end diameter	165mm	Vendor to specify	
3.16	Type of Lead	Bottom Palm type	Vendor to confirm	
4.0	VENDOR APPROVAL BY CUSTOMER:		Vendor to confirm	
4.1	The vendors approved by customer (POWERGRID INDIA) shall only be considered. Vendor to submit the OGA drawings/ Type test approval/ any other documents indicating the approval of POWERGRID, India alongwith the bid, in proof of above.		Vendor to note	
4.2	The other technically qualified vendors , who are not registered by POWERGRID, shall have to submit the required documents within 15 days from the intimation.		Vendor to confirm	
4.3	The decision of POWERGRID in approval of the vendor shall be final. The final approved vendors of POWERGRID shall only be considered.		Vendor to note	
5.0	DOCUMENTATION : Following documents in English language should be submitted along with the bid for our evaluation		Vendor to Confirm	
5.1	OGA Drawing		Vendor to submit	
5.2	Guaranteed Technical Particulars		Vendor to submit	
5.3	Manufacturing Quality Plan		Vendor to submit	
5.4	Type test reports		Vendor to submit	
5.5	Catalogues, O&M Manuals		Vendor to submit	
6.0	GUARANTEE :			
6.1	12 months from the date of commissioning of the system and 18 months from the date of supply, whichever is later.		Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:		Vendor to confirm	

SCOPE: SUPPLY OF 52 KV, 3150A, CTL-100 MM, RESIN IMPREGNATED PAPER (RIP) CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

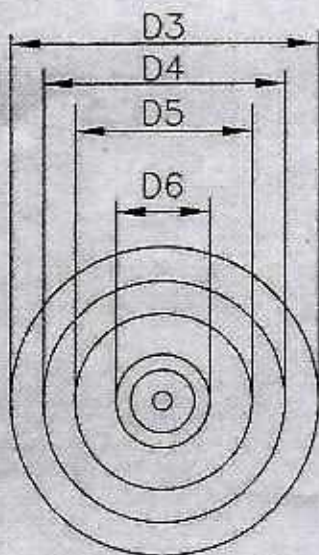
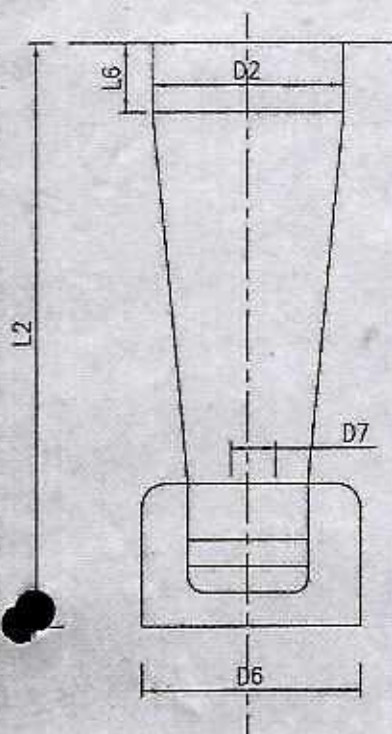
Spec No. : BCE/PS/52/32 Rev 00		Date:24.09.2019	
SR.NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED	REMARKS
7.1	Routine tests may be witnessed by BHEL/ POWERGRID representatives at supplier's works.	Vendor to confirm	
7.2	Air-fare, boarding & lodging for the BHEL / POWERGRID representatives shall be borne by BHEL/ POWERGRID.	Vendor to note	
7.3	Competent, English speaking experts shall be arranged by the vendor during inspection.	Vendor to Confirm	

Prepared By:  Singh
Dy. Mgr (CIE)

Checked By:  Mahendra Kurre
AGM (BCE & CIE)

Approved By:  Aseem Dhamija
AGM (BCE, CIE & TRX)

ANNEXURE-I TO SPEC NO - BCE/PS/52/52, REV 00.



VOLTAGE RATING KV	420	245	145	72.5	52
BIL (kV)	1425	1050	650	325	250
CREEPAGE (MM) (Min.)	10500	6125	3625	1810	1300
CURRENT RATING (A) (Min.)	800	1250	1250	2000	800
L2±5 (FOR DIFF. VALUES OF L6)	1640	1130	1230	600 [#] /800	695
L6 (MIN.)	400	300	100 [#] /300	300	100
D2 (Max.)	350	270	165	115	165
D3±2	720	450	335	225	335
D4±1	660	400	290	185	290
D5xN	24x12	20x12	15x12	15x6	15x12
D6 (MAX)	350	270	165	115	115
D7 (Min)	60	48	-	38	-

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED

APPLICABLE FOR SHUNT REACTOR

Singh

PREPARED BY	CHECKED BY	APPROVED BY	TITLE	DRG NO
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	STD. DIMN. FOR RIP CONDENSER BUSHINGS (LOWER PORTION)	000-T-E-A-001-R02