



## BHARAT HEAVY ELECTRICALS LIMITED BHOPAL

VENDOR QUALIFICATION REQUIREMENT FOR  
800KV AND 420KV OIP BUSHING

Date: 29.01.2021

## TECHNICAL:

Sl. No.	Description	Vendor's remarks (Y/N)
1	<p>The vendor should be either manufacturer of OIP bushings as per BHEL Enquiry <u>OR</u> their authorized representative.</p> <p>Authorized representative to submit authorization letter from the manufacturer as a documentary proof.</p>	
2	<p>The manufacturer should have supplied at least 5 nos. of OIP bushings in each KV rating (or higher KV rating in BHEL enquiry) in the last five years from the tender opening date.</p> <p>Vendor to submit the un-priced copy of purchase order alongwith unpriced copy of it's of Invoice/ dispatch documents/test reports.</p>	

Prepared by: Sukhvir Singh  
Sr. Engineer (CIE)

Approved by: Mahendra Kurre  
AGM (CIE, BCE)



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

## SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 800 kV OIP CONDENSER BUSHING

## NAME &amp; ADDRESS OF THE SUPPLIER :

SCOPE: SUPPLY OF 800 kV, 2500A, CTL - 600mm OIP CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

S.NO.		DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
1.0	WORKPIECE MATERIAL			
1.1	Item :			
		Oil Impregnated Paper (OIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :			
2.1		The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137:2017.	Vendor to confirm	
2.2		Valid type test reports as per IEC:60137 (2017) for 800 kV OIP bushings , conducted <u>within last 10(ten) years prior to the date of bid opening</u> shall be submitted alongwith the bid.	Vendor to confirm and submit the test reports alongwith the bid	
2.2.1		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	
2.2.2		Type Tests reports should include the following tests also, (i) Seismic Test (ii) Snap back Test / Free Oscillation test	Vendor to confirm	
2.2.3		In case valid type test report as mentioned under Sr. Nos. 2.2.2.2.1 & 2.2.2 above is not available, then vendor has to conduct type test in presence of BHEL / Customer representative before delivery of first lot , at no extra cost. All arrangements including airfare, lodging & boarding, local conveyance shall be arranged by the vendor.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3	The porcelain bushings must be shipped in crates to prevent them from breaking. The bushings can be packed in a slanted position on their own support so that the bushing insulation is always covered with oil. Each bushing must be lying on a solid base and protected by adequate filling material to avoid free-movement during transportation. If the manufacturer deems it necessary, the bushings can be strapped with nylon belts to block them in place.	Vendor to confirm	
2.3.1	Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137. Hollow column insulator shall be manufactured and tested in accordance with IEC-62155 / IS:5621. The insulators shall also conform to IEC 60815 as applicable.	Vendor to confirm	
2.3.2	Insulators shall be manufactured and conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & 2544, 5621 & IEC-62155, as applicable.	Vendor to confirm	
2.3.3	Bushings insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.	Vendor to confirm	
2.3.4	The bushing shall be of porcelain and have adequate current capacity to use the equipment to its maximum overload capacity.	Vendor to confirm	
2.3.5	All the porcelain shall have adequate physical properties and glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.	Vendor to confirm	
2.3.6	Insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.	Vendor to confirm	
2.3.7	Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service.	Vendor to confirm	
2.3.8	The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture.	Vendor to confirm	



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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3.9	All portions of the assembled porcelain enclosures and support insulators other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.	Vendor to confirm	
2.3.10	All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.	Vendor to confirm	
2.3.11	Bottom stress shield with bolted fixing arrangement is preferable.	Vendor to confirm	
2.3.12	Bottom stress shield insulated with 5mm pressboard is preferable. It shall be duly packed in moisture proof condition and supplied alongwith bushing.	Vendor to confirm	
2.4	The bidder may also offer composite silicon rubber insulator, conforming to IEC- 61462.	Vendor to confirm	
2.4.1	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	
2.4.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to confirm	
2.4.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to confirm	
2.4.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to confirm	
2.4.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to confirm	
2.4.6	It shall be extruded or directly moulded on the core.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.4.7	The interface between the housing and the core must be uniform and without voids.	Vendor to confirm	
2.4.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to confirm	
2.4.9	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	
2.4.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to confirm	
2.4.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815 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	
2.4.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to confirm	
2.4.13	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	
2.4.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to confirm	
2.4.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.4.16	The composite insulator shall be capable of high pressure washing.	Vendor to confirm	
2.5	When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action.	Vendor to confirm	
2.6	No radio interference shall be caused by the bushings when operating at the normal rated voltage. All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to confirm	
2.7	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to confirm	
2.8	End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to confirm	
2.9	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to confirm	
2.10	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to confirm	
2.11	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to confirm	
2.12	Bushings of identical current and voltage ratings must be interchangeable.	Vendor to confirm	
2.13	All dimensions to match as per drg. no. <u>000-T-E-A-002-R00</u> attached at <u>Annexure-I</u> .	Vendor to confirm	
2.14	Supplier to submit their Quality Plan for review by BHEL.	Vendor to confirm	
2.15	Corona Shield to be provided at 800KV Bushing terminal (Air End) to minimise corona.	Vendor to confirm	



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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.16	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	
2.17	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.18	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	
2.19	Tan delta value of OIP 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	
2.20	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	
3.0	<b>Technical Parameters</b>		
3.1	Rated Voltage	Vendor to specify	
3.2	Rated Current (Min.)	Vendor to specify	
3.3	Lightning impulse withstand voltage	Vendor to specify	
3.4	Switching impulse withstand voltage	Vendor to specify	
3.5	One minute power frequency withstand voltage	Vendor to specify	
3.6	Minimum total creepage distances	Vendor to specify	
3.7	Tan delta of bushings	Vendor to specify	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED BY	REMARKS
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	Corona Extinction Voltage	508 kV rms	Vendor to Confirm	
3.11	Maximum Oil end length excluding shield (mm)	1955mm	Vendor to Confirm	
3.12	Terminal dia. (mm)	60mm (preferable)	Vendor to Confirm	
3.13	Bottom porcelain max. dia. (mm)	528 mm	Vendor to Confirm	
3.14	Flange, PCD	12 holes, dia. 32 mm equally spaced on PCD 711 mm	Vendor to Confirm	
3.15	CT space min.	600 mm	Vendor to Confirm	
3.16	Type of Lead	Bottom connected	Vendor to Confirm	
3.17	Half connector & fixing hardware for transformer lead	Matching with the bushing bottom connector	Vendor to Confirm & Supply	
4.0	<b>DOCUMENTATION :</b> Following documents in English language should be submitted along with the bid for our evaluation.		Vendor to Confirm	
4.1	OGA Drawing		Vendor to submit	
4.2	Type test reports		Vendor to submit	
4.3	Instruction manual		Vendor to submit	
4.4	Quality Plan		Vendor to submit	
5.0	<b>GUARANTEE :</b>			
5.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.		Vendor to Confirm	



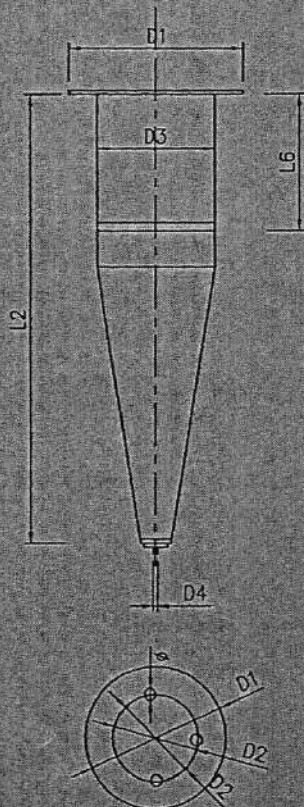
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
6.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
6.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer at supplier's works.	Vendor to confirm	

Prepared By:  
Singiren.E. Kandulna  
Mgr (BCE)

Checked & Approved By:  
Mahendra Kurre  
AGM (BCE & CIE)

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VOLTAGE RATING KV	800	420	145	52
TYPE	OIP	OIP	RIP	RIP
BIL (kV <sub>p</sub> )	2550	1425	650	250
CREEPAGE(MM)(MIN.)	20000	10500	3625	1300
CURRENT RATING(A)(Min.)	2500	2500	1250	3150
L2+5 (FOR DIFF.VALUES OF L)	1955	1335	1100	685
L6 (MIN.)	600	600	500	300
( D1+2 )	780	480	400	350
( D2+1 )	711	430	350	300
D3 ( Max.)	528	330	220	224
( Ø X N )	32x12	20x8	24x6	20x6
D4 ( Min.)	48	48	34	48
TAN DELTA(Max.) (AT AMBIENT TEMPERATURE)	0.004	0.004	0.004	0.004

## NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMN.SPECIFIED NO NEG. TOL. WHERE MIN.DIM. SPECIFIED
3. APPLICABLE FOR 765KV CLASS TRANSFORMER/REACTOR ONLY

PREPARED BY	CHECKED BY	APPROVED BY	TITLE STD.DIMN.FOR CONDENSER BUSHINGS FOR 765 KV TRANSFORMERS& REACTORS (LOWER PORTION)	DRG NO 000-T-E-A-002-R00
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>		



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

## SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 420 KV OIP CONDENSER BUSHING

NAME &amp; ADDRESS OF THE SUPPLIER :

SCOPE: SUPPLY OF 420 KV, 2500A, CTL - 600MM OIP CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/420/26, Rev00 Date : 24-09-2019			
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : Oil Impregnated Paper (OIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137:2017.	Vendor to confirm	
2.2	Valid type test reports as per IEC:60137 (2017) for 420 KV OIP bushings , conducted <u>within last 10(ten) years prior to the date of bid opening</u> shall be submitted alongwith the bid.	Vendor to confirm and submit the test reports alongwith the bid	
2.2.1	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	
2.2.2	Type Tests reports should include the following tests also, (i) Seismic Test (ii) Snap back Test / Free Oscillation test	Vendor to confirm	
2.2.3	In case valid type test report as mentioned under Sr. Nos. 2.2.2.1 & 2.2.2 above is not available, then vendor has to conduct type test in presence of BHEL / Customer representative before delivery of first lot , at no extra cost. All arrangements including airfare, lodging & boarding, local conveyance shall be arranged by the vendor.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3	The porcelain bushings must be shipped in crates to prevent them from breaking. The bushings can be packed in a slanted position on their own support so that the bushing insulation is always covered with oil. Each bushing must be lying on a solid base and protected by adequate filling material to avoid free-movement during transportation. If the manufacturer deems it necessary, the bushings can be strapped with nylon belts to block them in place.	Vendor to confirm	
2.3.1	Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137. Hollow column insulator shall be manufactured and tested in accordance with IEC-62155 / IS:5621. The insulators shall also conform to IEC 60815 as applicable.	Vendor to confirm	
2.3.2	Insulators shall be manufactured and conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & 2544, 5621 & IEC-62155, as applicable.	Vendor to confirm	
2.3.3	Bushings insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.	Vendor to confirm	
2.3.4	The bushing shall be of porcelain and have adequate current capacity to use the equipment to its maximum overload capacity.	Vendor to confirm	
2.3.5	All the porcelain shall have adequate physical properties and glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.	Vendor to confirm	
2.3.6	Insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3.7	Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service.	Vendor to confirm	
2.3.8	The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture.	Vendor to confirm	
2.3.9	All portions of the assembled porcelain enclosures and support insulators other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.	Vendor to confirm	
2.3.10	All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.	Vendor to confirm	
2.4	The bidder may also offer composite silicon rubber insulator, conforming to IEC- 61462.	Vendor to confirm	
2.4.1	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	
2.4.2	The design of the composite insulators shall be tested and verified according to IEC 61462 (Type & Routine test).	Vendor to confirm	
2.4.3	Polymer / composite insulator shall be seamless sheath of a silicone rubber compound.	Vendor to confirm	
2.4.4	The housing & weather sheds should have silicon content of minimum 30% by weight.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.4.5	It should protect the bushing against environmental influences, external pollution and humidity.	Vendor to confirm	
2.4.6	It shall be extruded or directly moulded on the core.	Vendor to confirm	
2.4.7	The interface between the housing and the core must be uniform and without voids.	Vendor to confirm	
2.4.8	The strength of the bond shall be greater than the tearing strength of the polymer.	Vendor to confirm	
2.4.9	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	
2.4.10	The technique being followed with detailed procedure and sampling shall be finalized during finalization of MQP.	Vendor to confirm	
2.4.11	The weather sheds of the insulators shall be of alternate shed profile as per IEC 60815 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	
2.4.12	The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure.	Vendor to confirm	
2.4.13	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	
2.4.14	The track resistance of housing and shed material shall be class 1A4.5 according to IEC 60587.	Vendor to confirm	
2.4.15	The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer.	Vendor to confirm	
2.4.16	The composite insulator shall be capable of high pressure washing.	Vendor to confirm	



Spec No. : BCE/PS/420/26, Rev00 Date : 24-09-2019			
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.5	When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action.	Vendor to confirm	
2.6	No radio interference shall be caused by the bushings when operating at the normal rated voltage. All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to confirm	
2.7	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to confirm	
2.8	End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to confirm	
2.9	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to confirm	
2.10	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to confirm	
2.11	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to confirm	
2.12	Bushings of identical current and voltage ratings must be interchangeable.	Vendor to confirm	
2.13	All dimensions to match as per drg. no. <u>000-T-E-A-002-R00</u> attached at <u>Annexure-I</u> .	Vendor to confirm	
2.14	Supplier to submit their Quality Plan for review by BHEL.	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	

Spec No. : BCE/PS/420/26, Rev00  
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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.16	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	
2.17	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	
2.18	Tan delta value of OIP 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	
2.19	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	
3.0	<b>Technical Parameters</b>		
3.1	Rated Voltage	420 kV	Vendor to specify
3.2	Rated Current (Min.)	2500 A	Vendor to specify
3.3	Lightning impulse withstand voltage	1425 kVp	Vendor to specify
3.4	Switching impulse withstand voltage	1050 kVp	Vendor to specify
3.5	One minute power frequency withstand voltage	695 kVrms	Vendor to specify
3.6	Minimum total creepage distances	13020 mm (31 mm/kV)	Vendor to specify
3.7	Tan delta of bushings	$\leq 0.004$	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	Corona Extinction Voltage	320 kV rms	Vendor to Confirm
3.11	Maximum Oil end length excluding shield (mm)	1335mm	Vendor to Confirm
3.12	Terminal dia. (mm)	60mm (preferable)	Vendor to Confirm

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED BY	REMARKS
3.13	Bottom porcelain max. dia. (mm)	330 mm	Vendor to Confirm	
3.14	Flange, PCD	8 holes, dia. 20 mm equally spaced on PCD 430 mm	Vendor to Confirm	
3.15	CT space min.	600 mm	Vendor to Confirm	
3.16	Type of Lead	Bottom connected	Vendor to Confirm	
3.17	Half connector for transformer lead (Alongwith fixing hardware)	Matching with the bushing bottom connector	Vendor to Confirm & Supply	
4.0	<b>DOCUMENTATION :</b> Following documents in English language should be submitted along with the bid for our evaluation.		Vendor to Confirm	
4.1	OGA Drawing		Vendor to submit	
4.2	Type test reports		Vendor to submit	
4.3	Instruction manual		Vendor to submit	
4.4	Quality Plan		Vendor to submit	
5.0	<b>GUARANTEE :</b>			
5.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.		Vendor to Confirm	
6.0	<b>ROUTINE TEST INSPECTION:</b>		Vendor to confirm	
6.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer at supplier's works.		Vendor to confirm	

Prepared By:  
Singiren.E.Kandulna

Dy. Mgr (BCE)

Checked & Approved By:  
Mahendra Kurre

AGM (BCE &amp; CIE)





BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

## SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 420 kV OIP CONDENSER BUSHING

NAME & ADDRESS OF THE SUPPLIER :		Spec No. : BCE/PS/420/37, Rev00 Date : 23-11-2019	
SCOPE: SUPPLY OF 420 kV, 2000A, CTL - 600MM OIP CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :			
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
1.0	WORKPIECE MATERIAL		
1.1	Item : Oil Impregnated Paper (OIP) Condenser Bushing	Vendor to note	
2.0	SPECIFICATION :		
2.1	The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137:2017.	Vendor to confirm	
2.2	Valid type test reports as per IEC:60137 (2017) for 420 kV OIP bushings , conducted <u>within last 10(ten) years prior to the date of bid opening</u> shall be submitted alongwith the bid.	Vendor to confirm and submit the test reports alongwith the bid	
2.2.1	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	
2.2.2	Type Tests reports may be submitted for following tests if available: (i) Seismic Test (ii) Snap back Test / Free Oscillation test	Vendor to confirm	
2.2.3	In case valid type test report as mentioned under Sr. Nos. 2.2.2.1 & 2.2.2 above is not available, then vendor has to conduct type test in presence of BHEL / Customer representative before delivery of first lot , at no extra cost. All arrangements including airfare, lodging & boarding, local conveyance shall be arranged by the vendor.	Vendor to confirm	

(b)

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3	The porcelain bushings must be shipped in crates to prevent them from breaking. The bushings can be packed in a slanted position on their own support so that the bushing insulation is always covered with oil. Each bushing must be lying on a solid base and protected by adequate filling material to avoid free-movement during transportation. If the manufacturer deems it necessary, the bushings can be strapped with nylon belts to block them in place.	Vendor to confirm	
2.3.1	Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137. Hollow column insulator shall be manufactured and tested in accordance with IEC-62155 / IS:5621. The insulators shall also conform to IEC 60815 as applicable.	Vendor to confirm	
2.3.2	Insulators shall be manufactured and conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & 2544, 5621 & IEC-62155, as applicable.	Vendor to confirm	
2.3.3	Bushings insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.	Vendor to confirm	
2.3.4	The bushing shall be of porcelain and have adequate current capacity to use the equipment to its maximum overload capacity.	Vendor to confirm	
2.3.5	All the porcelain shall have adequate physical properties and glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.	Vendor to confirm	
2.3.6	Insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.	Vendor to confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3.7	Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service.	Vendor to confirm	
2.3.8	The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture.	Vendor to confirm	
2.3.9	All portions of the assembled porcelain enclosures and support insulators other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.	Vendor to confirm	
2.3.10	All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.	Vendor to confirm	
2.4	When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action.	Vendor to confirm	
2.5	No radio interference shall be caused by the bushings when operating at the normal rated voltage. All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona.	Vendor to confirm	





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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.6	End fittings shall be free from cracks, seams, shrink, air holes and rough edges.	Vendor to confirm	
2.7	End fittings should be effectively sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to confirm	
2.8	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to confirm	
2.9	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to confirm	
2.10	Spare Bushing shall be specially packed suitable for long storage with non- returnable.	Vendor to confirm	
2.11	Bushings of identical current and voltage ratings must be interchangeable.	Vendor to confirm	
2.12	All dimensions to match as per drg. no. attached at <u>Annexure-I</u> .	Vendor to confirm	
2.13	Supplier to submit their Quality Plan for review by BHEL.	Vendor to confirm	
2.14	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	
2.15	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	Vendor to Confirm	

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED BY
3.0	Technical Parameters		REMARKS
3.1	Rated Voltage	420 kV	Vendor to specify
3.2	Rated Current (Min.)	2000 A	Vendor to specify
3.3	Lightning impulse withstand voltage	1425 kVp	Vendor to specify
3.4	Switching impulse withstand voltage	1050 kVp	Vendor to specify
3.5	One minute power frequency withstand voltage	695 kVrms	Vendor to specify
3.6	Minimum total creepage distances	13020 mm (31 mm/kV)	Vendor to specify
3.7	Tan delta of bushings	$\leq 0.004$	Vendor to specify
3.8	Max partial discharge level at Um	$\leq 10$ pC	Vendor to specify
3.9	Test tap voltage withstand level	2 kVrms	Vendor to specify
3.10	Minimum Air end length	4200mm	Vendor to Confirm
3.11	Terminal dia. (mm)	60mm (preferable)	Vendor to Confirm
3.12	Bottom porcelain max. dia. (mm)	340 mm	Vendor to Confirm
3.13	Flange, PCD	12 holes, dia. 24 mm equally spaced on PCD 660 mm	Vendor to Confirm
3.14	CT space min.	600 mm	Vendor to Confirm
3.15	Type of Lead	Draw rod with lead connection at bushing flange level.	Vendor to Confirm
3.16	Half connector for transformer lead (Alongwith fixing hardware)	Matching with the bushing bottom connector	Vendor to Confirm & Supply

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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
4.0	<b>DOCUMENTATION :</b> Following documents in English language should be submitted along with the bid for our evaluation.	Vendor to Confirm	
4.1	OGA Drawing	Vendor to submit	
4.2	Type test reports	Vendor to submit	
4.3	Instruction manual	Vendor to submit	
4.4	Quality Plan	Vendor to submit	
5.0	<b>GUARANTEE :</b>		
5.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
6.0	<b>ROUTINE TEST INSPECTION:</b>	Vendor to confirm	
6.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer at supplier's works.	Vendor to confirm	

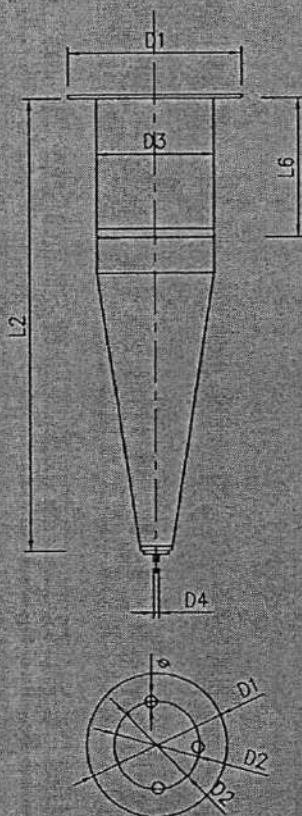
Prepared By:  
Singiren.E.Kandulna

Mgr (BCE)

Checked & Approved By:  
Mahendra Kurre

AGM (BCE & CIE)





VOLTAGE RATING KV	800	420	145	52
TYPE	OIP	OIP	RIP	RIP
BIL (kV <sub>p</sub> )	2550	1425	650	250
CREEPAGE(MM)(MIN.)	20000	10500	3625	1300
CURRENT RATING(A)(Min.)	2500	2500	1250	3150
L2+5 (FOR DIFF.VALUES OF L)	1955	1335	1100	685
L6 (MIN.)	600	600	500	300
( D1+2 )	780	480	400	350
( D2+1 )	711	430	350	300
D3 ( Max.)	528	330	220	224
( Ø X N )	32x12	20x8	24x6	20x6
D4 ( Min.)	48	48	34	48
TAN DELTA(Max.) (AT AMBIENT TEMPERATURE)	0.004	0.004	0.004	0.004

## NOTE:

1. ALL DIMENSIONS ARE IN MM
2. NO POSITIVE TOL. WHERE MAX. DIMN.SPECIFIED NO NEG. TOL. WHERE MIN.DIM. SPECIFIED
3. APPLICABLE FOR 765KV CLASS TRANSFORMER/REACTOR ONLY

PREPARED BY	CHECKED BY	APPROVED BY	TITLE STD.DIMN.FOR CONDENSER BUSHINGS FOR 765 KV TRANSFORMERS& REACTORS (LOWER PORTION)	DRG NO 000-T-E-A-002-R00
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>		