



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 800 kV OIP CONDENSER BUSHING

NAME & ADDRESS OF THE SUPPLIER :

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

Spec No. : BCE/PS/800/37, Rev00 Date : 21-12-2019			
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 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	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	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	

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	

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. 000-T-E-A-002-R00 attached at Annexure-I.	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 warrantee period, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
3.0	Technical Parameters		
3.1	Rated Voltage	800 kV	Vendor to specify
3.2	Rated Current (Min.)	2500 A	Vendor to specify
3.3	Lightning impulse withstand voltage	2100 kVp	Vendor to specify
3.4	Switching impulse withstand voltage	1550 kVp	Vendor to specify
3.5	One minute power frequency withstand voltage	970 kVrms	Vendor to specify
3.6	Minimum total creepage distances	24800 mm (31 mm/kV)	Vendor to specify
3.7	Tan delta of bushings	≤ 0.004	Vendor to specify

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	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 confirm	
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. Offer will be liable for rejection in case of non submission of required documents within stipulated time.		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 confirm	

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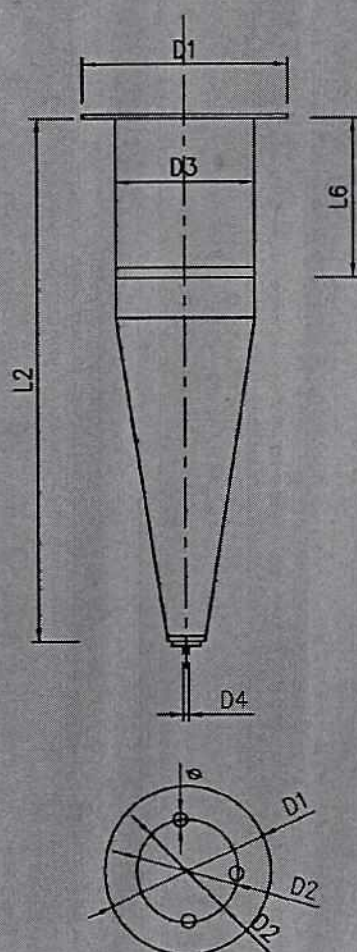
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
4.4	Offers of suppliers banned by POWERGRID as on bid opening date shall not be considered and shall be rejected.	Vendor to confirm	
5.0	DOCUMENTATION : Following documents in English language should be submitted along with the bid for our evaluation.	Vendor to Confirm	
5.1	OGA Drawing	Vendor to submit	
5.2	Type test reports	Vendor to submit	
5.3	Instruction manual	Vendor to submit	
5.4	Quality Plan	Vendor to submit	
6.0	GUARANTEE :		
6.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer/TPIA at supplier's works.	Vendor to confirm	


Prepared By:
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AGM (BCE & CIE)


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

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VOLTAGE RATING KV	800	420	145	52
TYPE	OIP	OIP	RIP	RIP
BIL (kV)	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	DRG NO
BY	BY	BY	STD.DIMN.FOR CONDENSER BUSHINGS FOR 765 KV TRANSFORMERS& REACTORS (LOWER PORTION)	000-T-E-A-002-R00
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BHARAT HEAVY ELECTRICAL LIMITED, POOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 420 kV OIP CONDENSER BUSHING

NAME & 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/420/38, Rev00
Date : 21-12-2019

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. 2.2,2.2.1 & 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	

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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Spec No. : BCE/PS/420/38, Rev00 Date : 21-12-2019				
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	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		

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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	

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 warrantee period, the supplier shall arrange to replace the defective bushing by new one.	Vendor to Confirm	
3.0	Technical Parameters		
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	
3.8	Max partial discharge level at Um	Vendor to specify	
3.9	Test tap voltage withstand level	Vendor to specify	
3.10	Corona Extinction Voltage	Vendor to Confirm	
3.11	Maximum Oil end length excluding shield (mm)	Vendor to Confirm	
3.12	Terminal dia. (mm)	Vendor to Confirm	

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	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 confirm	
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. Offer will be liable for rejection in case of non submission of required documents within stipulated time.		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 confirm	
4.4	Offers of suppliers banned by POWERGRID as on bid opening date shall not be considered and shall be rejected.		Vendor to confirm	
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	Type test reports		Vendor to submit	

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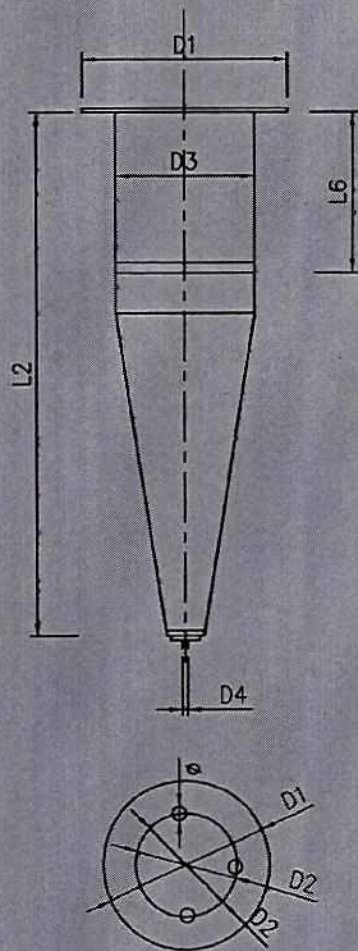
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Spec No. : BCE/PS/420/38, Rev00 Date : 21-12-2019			
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
5.3	Instruction manual	Vendor to submit	
5.4	Quality Plan	Vendor to submit	
6.0	GUARANTEE :		
6.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	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 By:
Mahendra Kurre
AGM (BCE & CIE)


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



VOLTAGE RATING KV	800	420	145	52
TYPE	OIP	OIP	RIP	RIP
BIL (kV)	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 ϵ)	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
(ϕ 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 245 kV OIP CONDENSER BUSHING

NAME & ADDRESS OF THE SUPPLIER :

SCOPE: SUPPLY OF 245 kV, 2000A, CTL - 300mm OIP CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/245/35, Rev00 Date : 16-11-2019			
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 245 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	In case valid type test report as mentioned under Sr. Nos. 2.2 & 2.2.1 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	

Engineer
(29)

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	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	




S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
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	
2.6	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to confirm	

[Signature]

22

Spec No. : BCE/PS/245/35, Rev00
Date : 16-11-2019

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
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. 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	
2.16	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	

Engm. (2)

mlf

Spec No. : BCE/PS/245/35, Rev00
Date : 16-11-2019

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.17	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	
2.18	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	
3.0	Technical Parameters		
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	
3.8	Max partial discharge level at Um	Vendor to specify	
3.9	Test tap voltage withstand level	Vendor to specify	
3.10	Maximum Oil end length	Vendor to Confirm	
3.11	Terminal dia. (mm)	Vendor to Confirm	
3.12	Bottom porcelain max. dia. (mm)	Vendor to Confirm	
3.13	Flange, PCD	Vendor to Confirm	

[Signature]

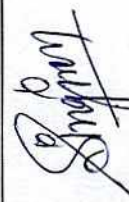
[Signature] 20

S.NO.	DESCRIPTION OF BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED BY	REMARKS
3.14	CT space min.	300 mm ✓	Vendor to Confirm	
3.15	Type of Lead	Bottom connected	Vendor to Confirm	
3.16	Half connector & fixing hardware for transformer lead	Matching with the bushing bottom connector	Vendor to Confirm & Supply	
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 confirm	
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. Offer will be liable for rejection in case of non submission of required documents within stipulated time.		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 confirm	
4.4	Offers of suppliers banned by POWERGRID as on bid opening date shall not be considered and shall be rejected.		Vendor to confirm	

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Spec No. : BCE/PS/245/35, Rev00
Date : 16-11-2019

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	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	Type test reports	Vendor to submit	
5.3	Instruction manual	Vendor to submit	
5.4	Quality Plan	Vendor to submit	
6.0	GUARANTEE :		
6.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer/TPIA at supplier's works.	Vendor to confirm	


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


Checked By:
Mahendra Kurre
AGM (BCE & CIE)


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

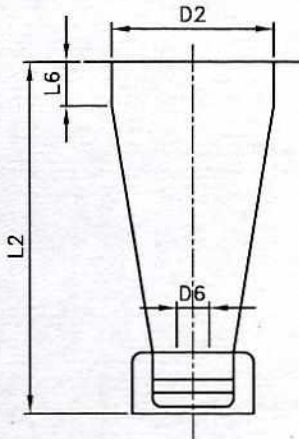
18

FIRST ANGLE PROJECTION

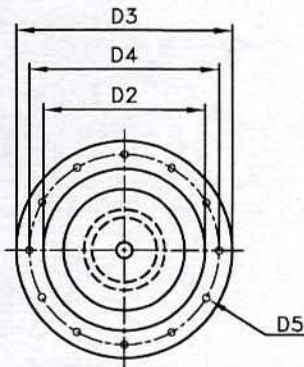
(ALL DIMENSIONS ARE IN mm)



REV.	DATE	ALTERED	REV.	DATE	ALTERED	ADDITIONAL INFORMATION
		CHECKED			CHECKED	
		APPROVED			APPROVED	
						STATUS OF DRAWING M
						DISTRIBUTION OF PRINTS BCE BCM TRX QAX 1 4 1 1



DESCRIPTION				
VOLTAGE RATING KV	420	245	145	52
CURRENT RATING (A) (MIN.)	1600	2000	1250	3150
L2 ± 5 (FOR DIFF. VALUES OF L6)	1640	1230	600	475
L6 (CT LENGTH)	600	300	100	100
D2	340	230	165	165
D3 ± 2	720	450	335	335
D4 ± 1	660	400	290	290
D5xN	24x12	20x12	15x12	15x12
D6 (MIN.)	60	60	60	60



- NOTES:- 1. ALL DIMENSION ARE IN M.M.
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED
AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED.

000-T-E-A-001-R02
REF. DRG. NO.

SIGN. & DATE

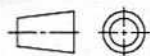


BHARAT HEAVY ELECTRICALS LTD.
BHOPAL

	NAME	SIGN	DATE	NO. OF VAR.
DRN	PRADEEP		21.11.19	
CKD	BRM/SEK		21.11.19	
APPD	M.KURRE		21.11.19	

INVENTORY NO.

DEPT BCE
CODE 421



SCALE
NTS

WEIGHT (K.G.)
--

REF. TO ASSY. DRG.
--

ITEM NO.
--

NO. OF ITEM
--

TITLE
STD. DIMN. FOR OIP CONDENSER
BUSHINGS (LOWER PORTION)

DRAWING NO.
BCE-4-1481

REV.
00

SHT. NO. 01

NO. OF SHT. 01

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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 145 kV OIP CONDENSER BUSHING

NAME & ADDRESS OF THE SUPPLIER :

SCOPE: SUPPLY OF 145 kV, 1250A, CTL - 100mm OIP CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/145/36, Rev00 Date : 16-11-2019			
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 245 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	In case valid type test report as mentioned under Sr. Nos. 2.2 & 2.2.1 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	

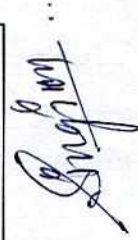
Signature

18

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	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	

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
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	
2.6	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to confirm	

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
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. 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	
2.16	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	



S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.17	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	
2.18	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	
3.0	Technical Parameters		
3.1	Rated Voltage	145 kV ✓	Vendor to specify
3.2	Rated Current (Min.)	1250 A ✓	Vendor to specify
3.3	Lightning impulse withstand voltage	650 kVp ✓	Vendor to specify
3.4	One minute power frequency withstand voltage	305 kVrms ✓	Vendor to specify
3.5	Minimum total creepage distances	4495 mm (31 mm/kV)	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	Maximum Oil end length excluding shield (mm)	600mm ✓	Vendor to Confirm
3.10	Terminal dia. (mm)	60mm (preferable) ✓	Vendor to Confirm
3.11	Bottom porcelain max. dia. (mm)	165 mm ✓	Vendor to Confirm
3.12	Flange, PCD	12 holes, dia. 15 mm equally spaced on PCD 290 mm ✓	Vendor to Confirm
3.13	CT space min.	100 mm ✓	Vendor to Confirm

S.NO.	DESCRIPTION OF BHEL REQUIREMENT		SPECIFIED / TO BE CONFIRMED BY	REMARKS
3.14	Type of Lead	Draw Rod/Lead upto Flange level	Vendor to Confirm	
3.15	Half connector & fixing hardware for transformer lead	Matching with the bushing bottom connector	Vendor to Confirm & Supply	
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 confirm	
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. Offer will be liable for rejection in case of non submission of required documents within stipulated time.		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 confirm	
4.4	Offers of suppliers banned by POWERGRID as on bid opening date shall not be considered and shall be rejected.		Vendor to confirm	

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	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	Type test reports	Vendor to submit	
5.3	Instruction manual	Vendor to submit	
5.4	Quality Plan	Vendor to submit	
6.0	GUARANTEE :		
6.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer/TPIA at supplier's works.	Vendor to confirm	

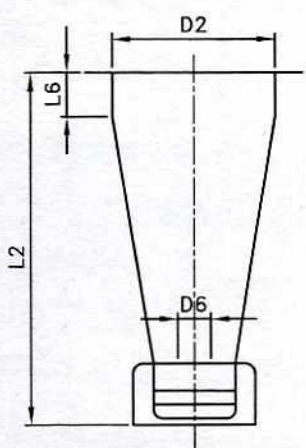
Prepared By:Singiren.E.Kandulna
Dy. Mgr (BCE)Checked By:Mahendra Kurre
AGM (BCE & CIE)Approved By:Assem Dhamija
AGM (BCE, CIE & TRX)

FIRST ANGLE PROJECTION

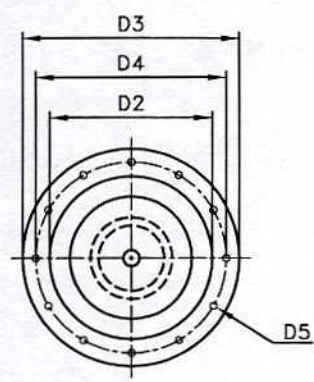
(ALL DIMENSIONS ARE IN mm)

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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

REV.	DATE	ALTERED	REV.	DATE	ALTERED	ADDITIONAL INFORMATION				
		CHECKED			CHECKED					
		APPROVED			APPROVED					
						STATUS OF DRAWING M				
						DISTRIBUTION BCE BCM TRX QAX OF PRINTS 1 4 1 1				



DESCRIPTION				
VOLTAGE RATING KV	420	245	145	52
CURRENT RATING (A) (MIN.)	1600	2000	1250	3150
L2 ±5(FOR DIFF.VALUES OF L6)	1640	1230	600	475
L6 (CT LENGTH)	600	300	100	100
D2	340	230	165	165
D3 ±2	720	450	335	335
D4 ±1	660	400	290	290
D5xN	24x12	20x12	15x12	15x12
D6 (MIN.)	60	60	60	60



- NOTES:- 1. ALL DIMENSION ARE IN M.M.
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED
AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED.

000-T-E-A-001-R02
REF. DRG. NO.

SIGN. & DATE



BHARAT HEAVY ELECTRICALS LTD.
BHOPAL

	NAME	SIGN	DATE	NO.OF VAR.
DRN	PRADEEP		21.11.19	
CKD	BRM/SEK		21.11.19	
APPD	M.KURRE		21.11.19	

INVENTORY NO.

DEPT	BCE		SCALE	WEIGHT (K.G.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
CODE	421		NTS	--	--	--	--
TITLE STD. DIMN. FOR OIP CONDENSER BUSHINGS (LOWER PORTION)					DRAWING NO. BCE-4-1481		REV. 00
					SHT. NO. 01		NO. OF SHT. 01



BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 52 kV OIP CONDENSER BUSHING

NAME & ADDRESS OF THE SUPPLIER :

SCOPE: SUPPLY OF 52 kV, 3150A, CTL - 100mm OIP CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW :

Spec No. : BCE/PS/52/34, Rev00 Date : 16-11-2019		
S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY
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 245 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	In case valid type test report as mentioned under Sr. Nos. 2.2 & 2.2.1 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

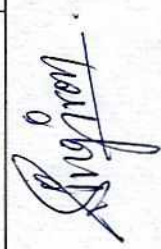
Signature

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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	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	

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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	
2.6	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to confirm	

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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. 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	
2.16	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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S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.17	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	
2.18	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	
3.0	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	One minute power frequency withstand voltage	105 kVrms	Vendor to specify
3.5	Minimum total creepage distances	1300 mm (25 mm/kV)	Vendor to specify
3.6	Tan delta of bushings	≤ 0.004	Vendor to specify
3.7	Max partial discharge level at U_m	< 10 pC	Vendor to specify
3.8	Test tap voltage withstand level	2 kVrms	Vendor to specify
3.90	Maximum Oil end length excluding shield (mm)	475mm	Vendor to Confirm
3.10	Terminal dia. (mm)	60mm (preferable)	Vendor to Confirm
3.11	Bottom porcelain max. dia. (mm)	115 mm	Vendor to Confirm
3.12	Flange, PCD	12 holes, dia. 15 mm equally spaced on PCD 290 mm	Vendor to Confirm
3.13	CT space min.	100 mm	Vendor to Confirm



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3.14	Type of Lead	Bottom connected	Vendor to Confirm	
3.15	Half connector & fixing hardware for transformer lead	Matching with the bushing bottom connector	Vendor to Confirm & Supply	
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 confirm	
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. Offer will be liable for rejection in case of non submission of required documents within stipulated time.		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 confirm	
4.4	Offers of suppliers banned by POWERGRID as on bid opening date shall not be considered and shall be rejected.		Vendor to confirm	

Signature

S.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	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	Type test reports	Vendor to submit	
5.3	Instruction manual	Vendor to submit	
5.4	Quality Plan	Vendor to submit	
6.0	GUARANTEE :		
6.1	12 months from the date of commissioning of the transformer and 18 months from the date of supply, whichever is later.	Vendor to Confirm	
7.0	ROUTINE TEST INSPECTION:	Vendor to confirm	
7.1	Routine tests to be conducted on all bushings as per IEC 60137:2017. The routine tests may be witnessed by BHEL/customer/TPIA at supplier's works.	Vendor to confirm	

Prepared By:
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Dy. Mgr (BCE)

Checked By:
Mahendra Kurre
AGM (BCE & CIE)

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

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

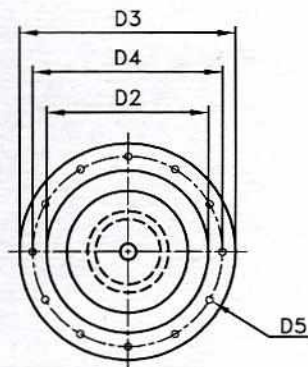
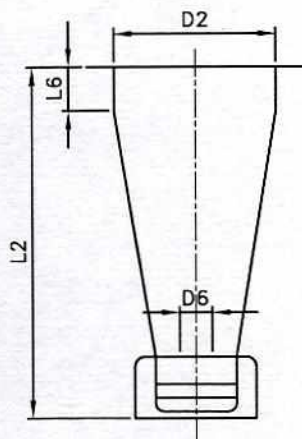
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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

000-T-E-A-001-R02
REF. DRG. NO.

SIGN. & DATE

INVENTORY NO.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	ADDITIONAL INFORMATION
		CHECKED			CHECKED	
		APPROVED			APPROVED	
						STATUS OF DRAWING M
						DISTRIBUTION OF PRINTS BCE BCM TRX QAX 1 4 1 1



DESCRIPTION				
VOLTAGE RATING KV	420	245	145	52
CURRENT RATING (A) (MIN.)	1600	2000	1250	3150
L2 ± 5 (FOR DIFF. VALUES OF L6)	1640	1230	600	475
L6 (CT LENGTH)	600	300	100	100
D2	340	230	165	165
D3 ± 2	720	450	335	335
D4 ± 1	660	400	290	290
D5xN	24x12	20x12	15x12	15x12
D6 (MIN.)	60	60	60	60

- NOTES:- 1. ALL DIMENSION ARE IN M.M.
2. NO POSITIVE TOL. WHERE MAX. DIMENSION SPECIFIED
AND NO NEG. TOL. WHERE MIN. DIMENSION IS SPECIFIED.



BHARAT HEAVY ELECTRICALS LTD.
BHOPAL

	NAME	SIGN	DATE	NO. OF VAR.
DRN	PRADEEP		21.11.19	
CKD	BRM/SEK		21.11.19	
APPD	M.KURRE		21.11.19	

DEPT	BCE		SCALE	WEIGHT (K.G.)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
CODE	421		NTS	--	--	--	--
TITLE STD. DIMN. FOR OIP CONDENSER BUSHINGS (LOWER PORTION)					DRAWING NO. BCE-4-1481		REV. 00
					SHT. NO. 01		NO. OF SHT. 01