

BHARAT HEAVY ELECTRICAL LIMITED, BHOPAL

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF 420 kV Oil-SF6 CONDENSER BUSHING

NAME & ADDRESS OF THE SUPPLIER:

SCOPE: SUPPLY OF 420 kV, 1250A OIL-SF6 CONDENSER BUSHINGS COMPLYING WITH THE SPECIFICATIONS AS BELOW:

2.2.2	2.2.1	2.2	2.1	2.1	2.0		1.1	1.0	S.NO.	
Type Tests reports should include the following tests also, (i)Seismic Test (ii)Snap Back Test	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.	Valid type test reports as per IEC:60137 (2017) for similar 420 kV Oil-SF6 RIP bushings, conducted within last 7(seven) years prior to the date of bid opening shall be submitted alongwith the bid.	The busihng shall be suitable for connection with GIS SF6/ Oil Interface as per IEC 62271-211.	The electrical and mechanical characteristics of bushings shall be in accordance with latest revisions of IEC: 60137:2017 & IEC 62271-211.	SPECIFICATION:	420KV Oil-SF6 RIP (Resin Impregnated Paper) condenser type bushing.	Item:	WORKPIECE MATERIAL	DESCRIPTION OF BHEL REQUIREMENT	
Vendor to confirm	Vendor to confirm	Vendor to confirm and submit the test reports alongwith the bid	Vendor to confirm	Vendor to confirm		Vendor to confirm			SPECIFIED / TO BE CONFIRMED BY	Spec No. : BCE
									REMARKS	Spec No.: BCE/PS/420/50, Rev00 Date: 13-01-2023



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S NO	DESCRIPTION OF RHEL REQUIREMENT	SPECIFIED / TO BE	Date: 13-01-2023
272	In case valid type test report as mentioned under Sr. Nos. 2.2.2.2.1 & 2.2.2.2	Vender 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.	Vendor to confirm	
2.3	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	
2.4	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	
2.5	End fittings shall be free from cracks, seams, shrinks, air holes and rough edges.	Vendor to confirm	
2.6	End fittings should be effectively, sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents.	Vendor to confirm	
2.7	All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.	Vendor to confirm	-
2.8	Clamps and fittings shall be of hot dip galvanised/stainless steel.	Vendor to confirm	
2.9	Spare Bushing shall be specially packed suitable for long storage with non-returnable.	Vendor to confirm	
2.10	Bushings of identical current and voltage ratings must be interchangeable.	Vendor to confirm	
2.11	Supplier to submit their Quality Plan for review by BHEL.	Vendor to confirm	
2.12	Bottom stress shield insulated with 5mm pressboard is preferrable. It shall be duly packed in moisture proof condition and supplied alongwith bushing.	Vendor to confirm	



	Vendor to Confirm	Tan delta value of RIP condenser bushing at site shall be 0.005 (max) in temperature range of 20 deg C to 90 deg C. The measured tan delta value at site of in-service bushing should not exceed by 0.001 w.r.t factory results (measured at approx. similar temperature conditions) during warranty period.	2.17
		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	Tan delta measurement at variable frequency (in the range of 20 Hz to 350 Hz) shall be carried out on each condenser type bushing (RIP) at manufacturing	2.16
A 20	Vendor to Confirm	Detail method for storage of bushing including accessories shall be brought out in the instruction manual.	2.15
		dry air pressure and a suitable pressure monitoring device shall be fitted on the metal housing during storage to avoid direct contact with moisture with epoxy. Alternatively, oil filled metal housing / tank with suitable arrangement for taking care oil expansion due to temperature variations shall also be acceptable. Tank shall have necessary provision for oil filling, level gauge etc. Manufacturer shall submit drawing/ documents of packing for approval during detail engineering.	
	Vendor to Confirm	Both bushing oil end & SF6 end shall be fitted with metal housing with positive	2.14
	Vendor to Confirm	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.	2.13
REMARKS	SPECIFIED / TO BE CONFIRMED BY	DESCRIPTION OF BHEL REQUIREMENT	s.No.
Spec No. : BCE/PS/420/50, Rev00 Date : 13-01-2023	Spec No.: BCE/		



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2.18 If the bushing does not fulfill the criteria under Cl. No. 2.17 mentioned above, the supplier shall arrange to replace the defective bushing by a new one ,within the warrantee period. 3.0 Technical Parameters 3.1 Rated Voltage 3.2 Rated Current (Min.) 3.3 Lightning impulse withstand voltage 3.4 Switching impulse withstand voltage 3.5 Tan delta of bushings 3.6 Tan delta of bushings 3.7 Nax partial discharge level at Um 3.8 Text tap voltage withstand level 3.9 SF6 end Terminal details 3.10 Oil end side max. bushing dia. (mm) 3.11 Oil end side max. bushing denails - Transformer 3.12 CT space min. 3.13 CT space min. 3.14 CT space min. 3.15 CT space min. 3.16 CT space min. 3.17 One minute power frequency 4.20 kV 4.20 kV					Date . 13-01-2023
If the bushing does not fulfill the criteria under Cl. No. 2.17 mentioned above, the supplier shall arrange to replace the defective bushing by a new one ,within the warrantee period. Technical Parameters Rated Voltage Rated Current (Min.) Lightning impulse withstand voltage Rated Current (Min.) Rated Voltage Rated Current (Min.) Rated Voltage Rated Current (Min.) Rated Voltage 1050 kV 420 kV Rated Current (Min.) 200 kV Rated Current (Min.) Rated Current (Min.) Lightning impulse withstand level 200 mm Sp6 side and oil side PCD areas) Cil end side max. bushing dia. (mm) Flange Fixing details - Sp6 side On PCD 640 mm Flange Fixing details - Transformer 12 holes, dia. 23 mm equally spaced on PCD 450 mm CT space min. 300 mm	S.NO.	DESCRIPTION OF BI	IEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
Technical Parameters Rated Voltage 420 kV Rated Current (Min.) 1250 A Lightning impulse withstand voltage 1250 kVp Switching impulse withstand voltage 1050 kVp One minute power frequency withstand voltage 695 kVrms withstand voltage < 0.005	2.18	If the bushing does not fulfill the criteria the supplier shall arrange to replace the the warrantee period.	under Cl. No. 2.17 mentioned above, lefective bushing by a new one ,within	Vendor to Confirm	
Rated Voltage Rated Current (Min.) Rated Current (Min.) Rated Current (Min.) Lightning impulse withstand voltage Switching impulse withstand voltage One minute power frequency withstand voltage Tan delta of bushings Max partial discharge level at Um Test tap voltage withstand level SF6 end Terminal details SF6 end Terminal details As per drg. at Annexure-I Height of mounting flange (between SF6 side and oil side PCD areas) Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side Oil end Side max. bushing dia. (mm) Flange Fixing details - Transformer side CT space min. A20 mm PCD 450 mm 12 holes, dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.0	Technical Parameters			
Rated Current (Min.) Lightning impulse withstand voltage Switching impulse withstand voltage One minute power frequency withstand voltage Tan delta of bushings Max partial discharge level at Um Test tap voltage withstand level SF6 end Terminal details SF6 end Terminal details Oil End Terminal details Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side on PCD 450 mm CT space min. 12 holes, dia. 23 mm equally spaced on PCD 450 mm CT space min. 12 holes, dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.1	Rated Voltage	420 kV	Vendor to Confirm	
Lightning impulse withstand voltage Switching impulse withstand voltage One minute power frequency withstand voltage Tan delta of bushings Max partial discharge level at Um Test tap voltage withstand level SF6 end Terminal details SF6 side and oil side PCD areas) Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side side CT space min. 12 holes, dia. 23 mm equally spaced on PCD 450 mm CT space min. 12 holes, dia. 23 mm FCD 450 mm SF0 side and oil side max. bushing dia. (mm) CT space min.	3.2	Rated Current (Min.)	1250 A	Vendor to Confirm	
Switching impulse withstand voltage One minute power frequency withstand voltage Tan delta of bushings Tan delta of bushings C=0.005 Max partial discharge level at Um Test tap voltage withstand level SF6 end Terminal details Coil End Terminal details Coil end side max. bushing dia. (mm) Flange Fixing details - SF6 side Flange Fixing details - Transformer side Cor space min. 1050 kVp 695 kVrms C=0.005 As per drg. at Annexure-I As per drg. at Annexure-I Plat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. 16 holes, dia. 20 mm equally spaced on PCD 640 mm Flange Fixing details - Transformer Side CT space min. 12 holes, dia. 23 mm equally spaced on PCD 450 mm ST6 side ST6 side side side side side on PCD 450 mm The side side side side side side side sid	3.3	Lightning impulse withstand voltage	1425 kVp	Vendor to Confirm	
One minute power frequency withstand voltage Tan delta of bushings Ten delta of bushings Max partial discharge level at Um Test tap voltage withstand level SF6 end Terminal details SF6 end Terminal details As per drg. at Annexure-I Height of mounting flange (between SF6 side and oil side PCD areas) Oil End Terminal details Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side on PCD 640 mm Flange Fixing details - Transformer side CT space min. 695 kVrms <	3.4	Switching impulse withstand voltage	1050 kVp	Vendor to Confirm	
Tan delta of bushings <= 0.005 Max partial discharge level at Um Test tap voltage withstand level 2 kVrms SF6 end Terminal details Height of mounting flange (between SF6 side and oil side PCD areas) Oil End Terminal details Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side on PCD 640 mm CT space min. <p>CT space min.</p>	3.5	One minute power frequency withstand voltage	695 kVrms	Vendor to Confirm	
Max partial discharge level at Um Test tap voltage withstand level SF6 end Terminal details Height of mounting flange (between SF6 side and oil side PCD areas) Oil End Terminal details Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side flange Fixing details - Transformer side CT space min. CT space min. As per drg. at Annexure-1 As per drg. at Annexure-1 Plat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. 16 holes,dia. 20 mm equally spaced on PCD 640 mm 12 holes,dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.6	Tan delta of bushings	<= 0.005	Vendor to Confirm	
Test tap voltage withstand level SF6 end Terminal details Height of mounting flange (between SF6 side and oil side PCD areas) Oil End Terminal details Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side Flange Fixing details - Transformer side CT space min. As per drg. at Annexure-I As per drg. at Annexure-I Plange drg. at Annexure-I Flat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. 16 holes,dia. 20 mm equally spaced on PCD 640 mm 12 holes,dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.7	Max partial discharge level at Um	< 10 pC	Vendor to Confirm	
SF6 end Terminal details Height of mounting flange (between SF6 side and oil side PCD areas) Oil End Terminal details Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side side CT space min. As per drg. at Annexure-I 200 mm Flat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. 298 mm 16 holes,dia. 20 mm equally spaced on PCD 640 mm 12 holes,dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.8	Test tap voltage withstand level	2 kVrms	Vendor to Confirm	
Height of mounting flange (between SF6 side and oil side PCD areas) Oil End Terminal details Oil end side max: bushing dia. (mm) Flange Fixing details - SF6 side Flange Fixing details - Transformer side CT space min. 200 mm Flat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. 16 holes,dia. 20 mm equally spaced on PCD 640 mm 12 holes,dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.9	SF6 end Terminal details	As per drg. at Annexure-I	Vendor to Confirm	
Oil End Terminal details Flat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side Flange Fixing details - Transformer side CT space min. Flat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch. 16 holes,dia. 20 mm equally spaced on PCD 640 mm 12 holes,dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.10	Height of mounting flange (between SF6 side and oil side PCD areas)		Vendor to Confirm	
Oil end side max. bushing dia. (mm) Flange Fixing details - SF6 side Flange Fixing details - Transformer Flange Fixing details - Transformer side CT space min. 298 mm 16 holes,dia. 20 mm equally spaced on PCD 640 mm 12 holes,dia. 23 mm equally spaced on PCD 450 mm 300 mm	3.11	Oil End Terminal details	Flat rectangular shaped with 2 nos. 14mm dia holes at 40mm pitch.	Vendor to Confirm	
Flange Fixing details - SF6 side 16 holes,dia. 20 mm equally spaced on PCD 640 mm Flange Fixing details - Transformer 12 holes,dia. 23 mm equally spaced on PCD 450 mm CT space min. 300 mm	3.12	Oil end side max. bushing dia. (mm)	298 mm	Vendor to Confirm	
Flange Fixing details - Transformer side 12 holes,dia. 23 mm equally spaced on PCD 450 mm CT space min. 300 mm	3.13	Flange Fixing details - SF6 side	16 holes,dia. 20 mm equally spaced on PCD 640 mm	Vendor to Confirm	
CT space min. 300 mm	3.14	ge Fixing details	12 holes,dia. 23 mm equally spaced on PCD 450 mm	Vendor to Confirm	
	3.15	CT space min.	300 mm	Vendor to Confirm	

	Spec No.: BCE/PS/420/50, Rev00
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	BCE
Date: 13-01-2023	/PS/
e : 1	420,
3-0	50,
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23	V00

s.NO.	DESCRIPTION OF BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
3.16 T.	Type of Lead Bottom connected	Vendor to Confirm	
4.0 D	DOCUMENTATION:	Vendor to Confirm	
Di E	Following documents in English language should be submitted along with the bid for our evaluation.		
4.1 0	OGA Drawing	Vendor to submit	
4.2 T	Type test reports	Vendor to submit	
4.3 In	Instruction manual	Vendor to submit	
4.4 Q	Quality Plan	Vendor to submit	
5.0 G	GUARANTEE:		
5.1 12 fr	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 R	ROUTINE TEST INSPECTION:	Vendor to confirm	
6.1 R	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	2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2

Prepared By Singiren.E.Kandulna

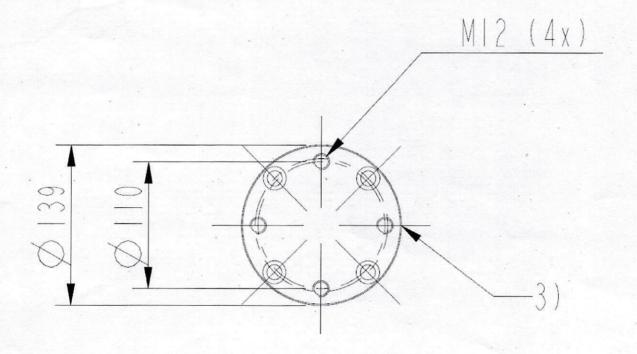
Mgr (CIE)

Checked By:
Kulamani Naik
SDGM (BCE & CIE)

Approved By:
Mahendra Kurre
AGM (BCE & CIE)

ANNEXURE-I

SF6 SIDE BUSHING TERMINAL DETAILS



Singin's