

**RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD.**

**2 X 660 MW SURATGARH STPS, STAGE-V, UNIT # 7&8**

***VOLUME – II***

***TECHNICAL SPECIFICATION FOR  
GENERATOR CIRCUIT BREAKER***

***BHEL DOCUMENT NO. : PE-TS-392-510-E001, REV-0***



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
NOIDA, UTTARPRADESH, INDIA – 201301**



**TECHNICAL SPECIFICATION FOR  
GENERATOR CIRCUIT BREAKER**

**2X660 MW SURATGARH STPS, UNIT#7&8**

**SPECIFICATION NO. PE-TS-392-510-E001**

**VOLUME II B**

**SECTION**

**REVISION 0 DATE: 07.08.2013**

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**TOTAL NO. OF SHEETS =47 (INCLUDING COVER/ SEPARATOR SHEETS)**

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT  
THERE ARE NO TECHNICAL DEVIATIONS.**

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**BIDDER'S STAMP & SIGNATURE  
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS)**



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**INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS**

1. In line with clause no. 6.0 of Section-C, Volume-II-B of the specification, two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
  - a. Unpriced BOQ-Cum-Price Schedule with 'QUOTED' word against each item with bidder's signature and company stamp.
  - b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.
  - c. A copy of previous sheet ("List of Contents"), with bidder's signature and company stamp.
  - d. Other document as listed in clause no. 6.0 of Sec-C, Vol-II-B.
2. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
3. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
4. Any changes made by the bidder in the price schedule with respect to the GCB description/ quantities, notes etc. from those given in BOQ-Cum-Price Schedule of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

\_\_\_\_\_  
**BIDDER'S STAMP & SIGNATURE**



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**PREAMBLE**

**1.0**      The Tender document contains three Volumes. The Bidder shall meet the requirements of all three Volumes.

**1.1**                      **VOLUME: I      CONDITIONS OF CONTRACT**

This consists of four parts as below:

**Volume-IA:**      This Part contains instructions to Bidders for making Bids to BHEL.

**Volume-IB:**      This Part contains General Commercial Conditions of the Tender & includes provision that Vendor shall be responsible for the Quality of item supplied by their Sub-Vendors.

**Volume-IC:**      This Part contains Special Conditions of Contract.

**Volume-ID:**      This Part contains Commercial Conditions for Erection & Commissioning Site Work as applicable.

**1.2**                      **VOLUME: II      TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume-II, which comprises of :

**Volume-IIA:      General Technical Conditions.**

**Volume-IIB:      Technical Specification.**

Volume –IIB      is sub-divided in to following Sections.

**Section-A:**      This Section outlines the Scope of enquiry.

**Section-B:**      This Section provides Project information.

**Section-C:**      This Section indicates Specific Requirements.

**Data Sheet A (Specified Data)**

**Attachment-I**

**Attachment-II**

**Attachment-III**

**Attachment-IV**

**Section-D:**      This Section comprises the following:

**Technical Specification/Requirements**

**Data Sheet C (Data / Documents to be furnished after the award of Contract).**

**1.3**                      **VOLUME: III      TECHNICAL SCHEDULES**

This Volume contains the following:

**Data Sheet – B (To be duly filled by Bidder and furnished with the Technical Bid.)**

**Note: The requirements mentioned in Section-C / Data Sheet A of Volume-IIB shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-D**



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**SEC-A**

**SCOPE OF ENQUIRY**

- 1.0 This specification covers design, manufacture, assembly, inspection & testing at manufacturer's works, proper packing, delivery to site and supervision of E&C of Generator Circuit Breaker as mentioned in different sections of this specification, complete with all accessories for efficient and trouble-free operation of 2X660 MW SURATGARH STPS UNIT # 7 & 8.
- 2.0 It is not the intent to specify completely herein all details of the design and manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 3.0 The general terms and conditions, instruction to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.
- 4.0 The Bidder shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Bidders shall confirm total compliance to the specification without any deviations from the technical/ quality assurance requirements stipulated..
- 6.0 The documents shall be in English language and MKS system of units.



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**SECTION: B**

**PROJECT INFORMATION**

SPEC.NO. TCE.5750A-H-500-001	<b>TATA CONSULTING ENGINEERS LIMITED</b>	VOLUME II SECTION – B
	<b>RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 &amp; 8 at Suratgarh, Rajasthan</b> GENERAL PROJECT INFORMATION	SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001  Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	<b>Climatic conditions</b>	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

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SPEC.NO. TCE.5750A-H-500-001	<b>TATA CONSULTING ENGINEERS LIMITED</b>	VOLUME II SECTION – B
	<b>RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 &amp; 8 at Suratgarh, Rajasthan</b> GENERAL PROJECT INFORMATION	SHEET 2 OF 3

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
	a) For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b) For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c) For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d) For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e) DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f) AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g) Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

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SPEC. NO. TCE.5750A-H-500-001	<b>TATA CONSULTING ENGINEERS LIMITED</b>		VOLUME II SECTION - B
	<b>RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 &amp; 8 at Suratgarh, Rajasthan</b> GENERAL PROJECT INFORMATION		SHEET 3 OF 3

	supply (For all instrumentation and control system equipment and solenoid valves)
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g) Lighting fixtures and space heaters    240 V, 1 phase, 2 wire, 50Hz, solidly earthed system

h) Construction supply    415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.

i) The above voltages may vary as follows :

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

AC supply	Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
DC supply	Combined voltage & frequency variation 10% Voltage variation $+10\%$ , $-15\%$

j) For instrument and control system of steam generator and steam turbine generator.    230 V  $\pm 5\%$  AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0    All the electrical equipment shall be designed for 50° C reference ambient temperature.

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**SECTION - C**

	<b>TATA CONSULTING ENGINEERS LIMITED</b>	SEC-C
	<b>RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 &amp; 8, at Suratgarh, Rajasthan</b> GCB	SHEET 1 OF 6
<p><b>1.0 <u>SPECIFIC REQUIREMENTS</u></b></p> <p>1.1 Generator circuit breakers shall be provided in single phase enclosure, all fully assembled for all three phases on a common frame with operating mechanisms, supervisory and control equipment.</p> <p>1.2 The current interrupting capacity of the generator circuit breaker shall be decided as follows:</p> <p>a) Symmetrical AC interrupting capacity and DC component interrupting capacity rating of the generator circuit breaker shall be computed from higher of the following:</p> <p>(i) The short circuit current contribution from generator</p> <p style="text-align: center;">OR</p> <p>(ii) The short circuit current contribution from 400kV system through generator transformer (400 kV system fault level 50kA) PLUS (+) Contribution of 21 kV auxiliary system through Unit transformers and Station Transformer.</p> <p>The interrupting duties mentioned above shall be calculated on the basis of breaker contact separation time of not more than 60ms from the instant of inception of fault.</p> <p>The short circuit current contribution from higher of two cases mentioned shall be considered as 160kA.</p> <p>b) <b>Momentary current rating:</b></p> <p>It shall be as per equation 7.3.5.3.6 of IEEE C37.013-1997.</p> <p>1.3 GCB shall comprise of the following:</p> <p>a) SF6 Circuit Breaker</p> <p>b) Motor operated series disconnecter on generator transformer side</p> <p>c) Motor operated earthing switches on either side of circuit breaker</p> <p>d) Manual short circuiting facility between circuit breaker and series disconnecter along with grounding link</p> <p>e) Low voltage control panel for housing various protection &amp; control equipment</p> <p><del>f) Flexible connectors with stress restricting rings/devices for connecting to the isolated phase busduct</del></p> <p>g) Supporting structures</p> <p>h) Surge capacitor on both generator and generator transformer side</p> <p>i) Surge arrester on the generator transformer side</p> <p>1.4 All equipment shall be suitable for satisfactory operation for the site conditions and power supply variations as mentioned in Project Information.</p> <p>1.5 The Generator Circuit Breaker (GCB) shall be installed indoor/<del>outdoor. If located outdoor then it shall be suitably protected against rain and provided with canopy.</del> GCB shall be connected to Isolated Phase Bus duct (IPBD) on</p>		
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	<b>TATA CONSULTING ENGINEERS LIMITED</b>	SEC-C
	<b>RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 &amp; 8, at Suratgarh, Rajasthan</b> GCB	SHEET 2 OF 6
<p>both sides (Generator side and Generator Transformer side). Suitable provisions shall be made for connection with IPBD through flexible connections.</p> <p>1.6 Support structure shall be designed to withstand the dynamic as well as static load of the GCB.</p> <p>1.7 The support structure shall have grated platform around the GCB for erection and maintenance of GCB. <del>Suitable stairs shall be provided for access to the platform. A monorail shall be provided above the GCB for handling the GCB components during maintenance. Sun protection roof shall be provided for the GCB above the monorail.</del> All exposed structures shall be hot dip galvanized. The acceptable value of the coating of zinc on the structural steel members shall be 900 gm/m<sup>2</sup>.</p> <p>1.8 The GCB shall be SF6 filled , metal enclosed and free standing type. The GCB enclosure shall be non magnetic aluminium alloy and isolated phase type with degree of protection IP-54. The phase distance shall suit the isolated phase busduct spacing. Inspection windows shall be provided in the phase enclosure near to the disconnecter and earthing switches to allow visual inspection of the position of each of them. A reliable mechanically operated position indicator shall be provided for indication of circuit breaker position.</p> <p>1.9 The earthing switches shall be rated for the full fault current for 3 second with no current making or continuous carrying capacity. A reliable mechanically operated position indicator shall be provided for indication of circuit breaker position, disconnecter position &amp; earth switch position also.</p> <p>1.10 Suitable mechanical interlocks between GCB, earthing switches and short circuiting connection shall be provided for safety against any inadvertent operations.</p> <p>1.11 Local control panel shall be provided near GCB to facilitate Local On/Off control. It shall also house Local/Remote selector switches, operation counter for circuit breaker, mimic diagram &amp; status indication, alarm and annunciation of the breaker and its accessories. Necessary contacts shall be provided for remote operation, indication and annunciation. The control panel shall be provided with MCB, thermostat controlled anti-condensation heaters rated for 1-Phase, 230V AC, 50Hz. Each panel shall also be provided with door switch operated fluorescent lamp and power socket outlet. The control panel shall have IP-54/ <del>IP-55</del> (indoor/<del>outdoor</del>) degree of protection.</p> <p>1.12 Duplicate electrically independent shunt trip release coils suitable for operation with control voltage up to 70% of rated voltage of coils along with status monitoring shall be provided.</p> <p>1.13 Suitable SF6 gas monitors shall be provided for monitoring the gas density. Gas density monitoring shall be possible both locally and at remote. Necessary interlocks shall be arranged to prevent breaker operation on fall of SF6 gas density.</p> <p>1.14 In case of hydraulic operating mechanism, the stored energy shall be suitable for two close-open operations. The breaker shall have 2x100% hydraulic pumps.</p> <p>In case of motorized spring charged operating mechanism, stored energy shall be suitable for open-close-open operations. But in both cases rated duty cycle shall comply CO-30min-CO.</p>		
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	<b>TATA CONSULTING ENGINEERS LIMITED</b>	SEC-C
	<b>RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 &amp; 8, at Suratgarh, Rajasthan</b> GCB	SHEET 3 OF 6
<p>1.15 The minimum number of auxiliary potential free contacts required to be wired up to the terminal strip for Purchaser's use shall be :</p> <ul style="list-style-type: none"> <li>- 12NC + 12NO for Circuit Breaker</li> <li>- 8NC + 8NO for Disconnector</li> <li>- 8NC + 8NO for each Earthing Switch</li> </ul> <p>1.16 The electrical characteristics and performance of the GCBs and their associated components shall be as per Data Sheet. GCB shall conform to IEEE Std. C37.013</p> <p><del>1.17 Contact wear monitor shall be offered as an optional item.</del></p> <p><b>2.0 <u>TESTING AND INSPECTION</u></b></p> <p><b>2.1 Type Tests</b></p> <p>Certified copies of reports of type tests carried out on similar type and rating of the equipment within last five years from the date of submission of Bid shall be furnished to the Purchaser for review and approval. In case the type test reports are not found to be meeting the specification requirements, the Vendor shall conduct all such tests under this contract free of cost to the Purchaser and submit the reports for approval.</p> <p><b>2.2 Routine Tests</b></p> <p>2.2.1 All acceptance and routine tests as prescribed in the relevant IEC and ANSI/IEEE standards shall be carried out on all the equipment/components of the GCB. These tests shall be performed on all units. Charges for these shall be deemed to be included in the equipment price.</p> <p>2.2.2 In order to permit the Purchaser or his designated representative to be present for inspection and tests, the Vendor shall give a minimum of 30 days advance notice of his intention to carry out tests on equipment/material being made available for inspection. In the case of tests of long duration, the actual date of commencement shall be mutually agreed between the Vendor and Purchaser.</p> <p><b>3.0 <u>ERECTION AND INSTALLATION</u></b></p> <p>3.1 Vendor shall supply all the instruction manuals necessary to perform erection, testing &amp; commissioning, operation and maintenance activities. The Vendor's personnel shall be available to supervise the site erection, testing and commissioning activities.</p> <p>3.2 The instructions shall include full details and procedure for installation of the equipment and all necessary adjustments during service and operation, together with parts lists to enable spare part or replacements to be ordered.</p> <p><b>4.0 <u>TRAINING OF PERSONNEL</u></b></p> <p>Bidder shall quote price, for training Purchaser's personnel to enable <i>Purchaser's personnel to operate, troubleshoot and maintain the offered equipment/components</i>. The general guidelines for the training requirement, description of type of training required and the duration of training shall be indicated by the Bidder to fulfil the above objective.</p>		
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	<b>TATA CONSULTING ENGINEERS LIMITED</b>	SEC-C
	<b>RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 &amp; 8, at Suratgarh, Rajasthan</b> GCB	SHEET 4 OF 6

**5.0    STORAGE AT SITE**

5.1    Vendor shall indicate the specific requirements, if any for proper storage of the equipment supplied at site.

5.2    In general, while shipping the equipment to site, Vendor shall ensure that each assembly or component shall be skidded, crated, boxed or otherwise suitably protected against damage or loss during shipment and to facilitate site storage. All openings shall be effectively sealed with temporary closures to prevent entry of dust, dirt, moisture and other foreign matter.

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**6.0 DOCUMENTS REQUIRED ALONG WITH TECHNICAL OFFER**

Bidder shall submit following documents along with technical offer:

- a] Filled in Data Sheet -B.
- b] Technical leaflet/ catalogue.
- c] Correction curves/ tables to arrive at current rating of GCB and series isolator at various ambient temperatures.
- d] General Arrangement drawing of GCB showing various dimensions, space required for operation and maintenance, weight etc.
- e] Summary of Type tests certificates indicating key test results, clause & standard reference, date and place of testing (As per IEEE)
- f] Write up on operating mechanism of GCB.
- g] Schedule of deviations
- h] Schedule of BOQ-Cum-Price Schedule (Unpriced)
- i] Schedule of start-up and commissioning spares (Unpriced)
- j] Schedule of special tools and tackles (Unpriced)
- k] Reference list.





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**7.0 DOCUMENTS REQUIRED AFTER THE AWARD OF LOI**

7.1 Bidder shall submit following documents after the award of LOI for approval and distribution:

- a] Filled in data sheet – C(Combination of Datasheet-A and Datasheet-B) .
- b] Detailed general arrangement drawing of GCB showing various dimensions, space required for operation and maintenance, weights etc. (GA drawing to be complete for GCB and auxiliaries.)
- c] Foundation arrangement drawing showing loading, forces at various points etc.
- d] General arrangement drawing of local control panel.
- e] Logic for closing/tripping of GCB, isolator and earth-switch.
- f] Electrical control scheme of local control panel.
- g] Drawings for operating mechanism.
- h] P & I Diagram.
- i] Complete Type tests certificates (as per IEEE)
- j] Manufacturing Quality Plan.
- k] Field quality plan for equipment storage, handling, erection, testing and commissioning at site, recommended by vendor.
- l] O & M Manual.
- m] Routine test certificates.
- n] Design calculations for support structure
- o] Detailed calculations for short circuit capability for system side/ generator side fault contribution.

7.2 All drawings, documents shall be in English.

7.3 The vendor after LOI shall submit drawings/documents in requisite number of copies as indicated in ATTACHMENT-III ("DOCUMENTS / DRAWINGS DISTRIBUTION SCHEDULE").



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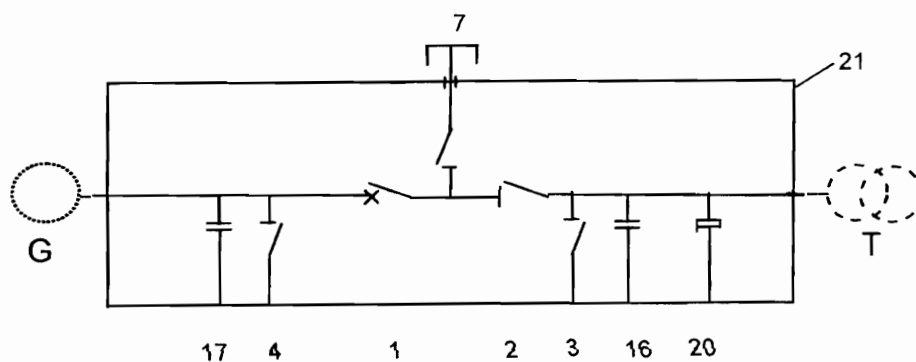
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**ATTACHMENT – I**



- 1     Circuit-breaker  
2     Disconnector  
3, 4   Earthing switches  
20    Surge Arrester

- 7     Short-circuiting/braking switch  
16, 17   Surge capacitors  
21    System enclosure

**REF. SINGLE LINE CONFIGURATION  
OF GENERATOR CIRCUIT BREAKER**



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**ATTACHMENT – II**

SL. NO.	DESCRIPTION	UNIT	VALUE
1	RATED POWER	MVA	777
2	RATED FREQUENCY	Hz	50
3	RATED VOLTAGE	KV	21
4	MINIMUM / MAXIMUM GENERATION VOLTAGE	%	+/-5
5	RATED POWER FACTOR		0.85
6	REACTANCE VALUE (SATURATED):		
	SYNCHRONOUS REACTANCE, DIRECT AXIS	pu	1.916
	TRANSIENT REACTANCE, DIRECT AXIS	pu	0.302
	SUB TRANSIENT REACTANCE, DIRECT AXIS	pu	0.202
	SYNCHRONOUS REACTANCE, QUADRATURE AXIS	pu	2.31(Unsaturated)
	TRANSIENT REACTANCE, QUADRATURE AXIS	pu	0.86 (Unsaturated)
	SUB TRANSIENT REACTANCE, QUADRATURE AXIS	pu	0.222
	ZERO SEQUENCE REACTANCE	pu	0.106(Unsaturated)
7	TIME CONSTANTS (SHORT CIRCUIT TIME CONSTANTS):		
	TRANSIENT TIME CONSTANT, DIRECT AXIS	s	0.855
	SUB TRANSIENT TIME CONSTANT, DIRECT AXIS	s	0.0278
	TRANSIENT TIME CONSTANT, QUADRATURE AXIS	s	0.762
	SUB TRANSIENT TIME CONSTANT, QUADRATURE AXIS	s	0.08
	ARMATURE TIME CONSTANT	s	0.326
8	SPEED	rpm	3000



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**ATTACHMENT – III**

No. of prints to be submitted by vendor after award of contract shall be as under:

S. NO.	DESCRIPTION	No. hard /soft copies	No. of CD-ROMs	REMARKS
1	Docs. /drgs. for approval (First submission)	PDF File + 2 Hard copies	NIL	
2	Drgs. / docs. for approval (Second & subsequent submission till approval)	PDF File + 2 Hard copies	NIL	
3	Final approval drgs. / docs. for Distribution after CAT-1.	PDF File + 5 Hard Copies	NIL	
4	As Built drgs./doc.	6 Hard Copies	4 CD-ROMS	
5	Operation, Erection & Maintenance manual for approval	PDF File + 2 Hard Copies	NIL	
6	Approved Operation & Maintenance Manual for distribution	PDF File + 6 Hard Copies	4 CD-ROMS	
7	Type Test Certificates/ Reports for approval	PDF+ 2 hard Copies	NIL	
8	Type Test Certificates/ Reports for distribution	6 hard Copies	6 CD-ROMS	



# **TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER**

**2X660 MW SURATGARH STPS, UNIT#7&8**

**SPECIFICATION NO. PE-TS-392-510-E001**

**VOLUME II B**

**SECTION C**

**REVISION 0**

**DATE: 07.08.2013**

**SHEET**

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## **DATA SHEET-A**

SL.NO.	PARAMETER	UNIT	VALUE/REQUIREMENTS
1.01	QUANTITY OF GCB	Nos.	2
1.02	CONFIGURATION OF EARTH SWITCH, SERIES DISCONNECTOR, SURGE CAPACITOR, SURGE ARRESTOR & MANUAL SHORT CIRCUITING CONNECTION		AS PER ATTACHMENT - I
1.03	DEGREE OF PROTECTION OF GCB ENCLOSURE AND LOCAL CONTROL PANEL		IP54
1.04	INTERFACE WITH IPBD		ENCLOSURE THROUGH FLANGES AND BUSBAR THROUGH FLEXIBLE CONNECTIONS
1.05	CONTINUOUS CURRENT AT 50 °C	A	<b>23613</b>
1.06	RATED VOLATGE	kV	TO SUIT GENERATOR TERMINAL VOLTAGE
1.07	MAX. RATED VOLTAGE	kV	24
1.08	RATED FREQUENCY	Hz	50
1.09	AUXILIARY VOLTAGE		220V DC, 415V 3-PH, 3-WIRE AC 50Hz
1.10	NO. OF POLES	NOS.	3
1.11	RATED SHORT TIME WITHSTANDS CURRENT	kA	160 [FOR 3 SEC.]
1.12	INTERRUPTING CAPACITY AT RATED VOLTAGE AND OPERATING DUTY		
1.13	A) SYMMETRICAL	kA(RMS)	160
1.14	B) ASYMMETRICAL	kA(PEAK)	AS PER IEEE
1.15	INTERRUPTING TIME (TRIPPING COMMAND TILL ARC EXTINCTION)	ms	NOT MORE THAN 60 MILLISECOND
1.16	OPENING TIME (TRIPPING COMMAND TILL CONTACT SEPARATION)	ms	40 MILLISECOND
1.17	TRANSIENT RECOVERY VOLTAGE (FOR GENERATOR SOURCE FAULTS)		2.2 kV/MICRO SEC
1.18	TRANSIENT RECOVERY VOLTAGE (FOR SYSTEM SOURCE FAULTS)		5.5 kV/MICRO SEC
1.19	OPERATING MECHANISM FOR GCB		HYDRAULIC/SPRING OPERATED
1.20	RATED DUTY CYCLE		CO-30 MIN-CO
1.21	ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE TO EARTH & ACROSS CIRCUIT BREAKER/ SWITCH CONTACTS	kV(RMS)	60
1.22	LIGHTNING IMPULSE WITHSTAND VOLTAGE TO EARTH & ACROSS CIRCUIT BREAKER/SWITCH CONTACTS	kV(PEAK)	125
1.23	ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE FOR AUXILIARY AND CONTROL CIRCUITS	kV(RMS)	2
1.24	MAX. AMBIENT TEMP.	°C	50



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SL.NO.	PARAMETER	UNIT	VALUE/REQUIREMENTS
1.25	MAX. TEMP. OF BUSBAR CONNECTIONS CONSIDERING SILVER PLATED JOINTS	°C	105
1.26	MAX. TEMP. OF ENCLOSURE CONNECTIONS	°C	80
1.27	RATED SHORT TIME WITHSTANDS CAPABILITY FOR CIRCUIT BREAKER, DISCONNECTOR AND EARTH SWITCH		FOR 3 SEC.
1.28	OPERATING MECHANISM FOR DISCONNECTOR AND EARTH SWITCH		ELECTRICAL MOTOR OPERATED
1.29	TYPE OF SURGE ARRESTOR		METAL OXIDE GAPLESS
2.01	<b>GENERATOR DETAILS</b>		
A.	RATED VOLTAGE	kV	21
B.	VOLTAGE VARIATION	±%	5
C.	PEAK MW RATING AT 50 DEG C AMBIENT	MW	660
D.	RATED POWER FACTOR		0.85
E.	FREQUENCY	Hz	50
F.	GENERATOR REACTANCES AND TIME CONSTANTS		AS PER ATTACHMENT - II
G.	GENERATOR NEUTRAL EARTHING		HIGH RESISTANCE (THROUGH TRANSFORMER LOADED WITH RESISTANCE ON SECONDARY)
H.	GEN. STATOR WINDING BASIC INSULATION LEVEL	KV(PEAK)	89
3.01	<b>GENERATOR BUSDUCT DETAILS</b>		
A.	TYPE		ISOLATED PHASE BUS-DUCT
B.	MAXIMUM CONTINUOUS CURRENT AT 50 °C	A	26000
C.	ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE	KV(RMS)	60
D.	IMPULSE WITHSTAND VOLTAGE	KV(PEAK)	125
E.	OVERALL DIAMETER OF ENCLOSURE (INSIDE)	MM	1700 (TENTATIVE)
F.	THICKNESS OF ENCLOSURE	MM	9
G.	PHASE-PHASE SPACING	MM	2100 (TENTATIVE)
H.	ENCLOSURE MATERIAL		AL. ALLOY
I.	CONDUCTOR MATERIAL		AL. ALLOY
J.	CONDUCTOR PROFILE		ROUND
K.	COOLING		NATURAL
L.	PRESSURIZATION SYSTEM PROVIDED	YES/NO	YES (HOT AIR BLOWING EQUIPMENT ALSO FOR IR MAINTENANCE IS PROVIDED)



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SL.NO.	PARAMETER	UNIT	VALUE/REQUIREMENTS
M.	PRESSURE OF AIR INSIDE THE ENCLOSURE	Pa	500-2500
N.	MAXIMUM TEMPERATURE OF CONDUCTOR AT 50°C	°C	90
O.	MAXIMUM TEMPERATURE OF ENCLOSURE AT 50°C	°C	70
P.	MAXIMUM TEMPERATURE OF SILVER PLATED CONDUCTOR JOINTS AT 50°C	°C	105
4.01	<b>TYPE TESTS</b>		
A.	VALIDITY PERIOD OF TYPE TEST REPORTS		5 YEARS FROM THE DATE OF SUBMISSION OF BID
B.	TYPE TESTS TO BE CONDUCTED FOR THIS CONTRACT, DESPITE AVAILABILITY OF VALID & ACCEPTABLE TEST CERTIFICATES	YES/ NO	NO
C.	IF YES, LIST OF TYPE TESTS TO BE CONDUCTED		NA
5.01	<b>MANDATORY SPARES</b>		
A.	MANDATORY SPARES TO BE QUOTED FOR THIS CONTRACT	YES/ NO	YES
B.	IF YES, LIST OF MANDATORY SPARES		AS PER BOQ-CUM-PRICE SCHEDULE

	<b>TATA CONSULTING ENGINEERS LIMITED</b>		
	<b>RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 &amp; 8, at Suratgarh, Rajasthan</b>		SHEET 1 OF 4
	<b>DATA SHEET-B</b> <b>GCB</b>		
ENQUIRY/SPECIFICATION NO.:			BIDDER:
1.0	<b>COOLING METHOD</b>	NATURAL FORCED	
1.1	IF FORCE COOLED. 100 % REDUNDANT EQUIPMENT PROVIDED FOR COOLING	YES NO NOT APPLICABLE	
1.2	EMERGENCY CURRENT RATING AND DURATION ON LOSS OF COOLING		
1.3	POWER CONSUMPTION OF COOLING SYSTEM AT SPECIFIED AMBIENT CONDITION TO MAINTAIN RATED GCB CURRENT	Kw	
2.0	<b>SUNSHIELD TO BE PROVIDED</b>	YES NO	
3.0	<b>TRANSIENT RECOVERY VOLTAGE RATINGS</b>		
3.1	OUT-OF-PHASE CURRENT SWITCHING CAPABILITY		
3.2	FIRST POLE TO CLEAR FACTOR		
4.0	ARC EXTINGUISHING METHOD		
5.0	<b>INTERRUPTION MEDIUM</b>		
5.1	<b>SF6 GAS (FOR SF6 BREAKERS)</b>		
5.1.1	NORMAL PRESSURE		
5.1.2	LEAKAGE RATE		
		SIGNATURE OF BIDDER & DATE	
		<div style="border: 1px solid black; width: 100px; height: 40px; margin: 0 auto;"></div>	
		<div style="border: 1px solid black; padding: 2px; display: inline-block;"> ISSUE R1 </div>	



	<b>TATA CONSULTING ENGINEERS LIMITED</b>		
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	<b>DATA SHEET-B</b> <b>GCB</b>		
ENQUIRY/SPECIFICATION NO.:			BIDDER:
5.2	<b>COMPRESSED AIR (FOR AIR BLAST CIRCUIT BREAKER )</b>		
5.2.1	TYPE OF COMRESSED AIR ARRANGEMENT	INDIVIDUAL COMPRESSOR STATION CENTRAL COMPRESSOR PLANT	
5.2.2	100 % REDUNDANT COMPRESSOR	YES NO	
5.2.3	100 % REDUNDANT PIPING ARRANGEMENT (IN CASE OF CENTRALISED COMPRESSOR SYSTEM)	YES NO	
5.2.4	COMPRESSOR MOTOR RATING		
5.2.5	NORMAL PRESSURE		
5.2.6	LEAKAGE RATE		
6.0	<b>OPERATING MECHANISM</b>		
6.1	OPERATING METHOD FOR TRIPPING	PNEUMATIC / HYDRAULIC / SPRING	
6.2	OPERATING METHOD FOR CLOSING	PNEUMATIC / SPRING / HYDRAULIC	
6.3	RATED OPERATING PRESSURE		
		SIGNATURE OF BIDDER & DATE	
		ISSUE R1	

	<b>TATA CONSULTING ENGINEERS LIMITED</b>		
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	<b>DATA SHEET-B</b> <b>GCB</b>		
ENQUIRY/SPECIFICATION NO.:			BIDDER:
6.4	MOTOR POWER SUPPLY RATING		
7.0	<b>CIRCUIT BREAKER</b>		
7.1	SIMULTANESITY OF POLES	Ms	
8.0	(CLOSING OR OPENING) <b>SERVICE CAPABILITY</b>		
8.1	SHORT CIRCUIT BREAKING		
8.2	RATED CURRENT BREAKING		
8.3	OFF-LOAD BREAKING		
9.0	<b>DISCONNECTING SWITCH DATA</b>		
9.1	OPERATING MECHANISM		
9.2	TYPE		
9.3	MOTOR POWER		
9.4	OPERATING TIME	(SEC)	
9.5	MECHANICAL LIFE		
10.0	EARTHING SWITCH DATA		
		SIGNATURE OF BIDDER & DATE	
		<div style="border: 1px solid black; padding: 2px; display: inline-block;"> ISSUE R1 </div>	

	<b>TATA CONSULTING ENGINEERS LIMITED</b>		
	<b>RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 &amp; 8, at Suratgarh, Rajasthan</b>		SHEET 4 OF 4
	DATA SHEET-B GCB		
ENQUIRY/SPECIFICATION NO.:			BIDDER:
10.1	OPERATING MECHANISM		
10.2	TYPE		
10.3	MOTOR POWER		
10.4	OPERATING TIME	(SEC)	
10.5	MECHINICAL LIFE		
11.0	<b>SURGE ARRESTOR DATA</b>		
11.1	VOLTAGE CLASS		
11.2	TYPE		
11.3	RATING		
11.4	LOCATION		
12.1	<b>CAPACITOR DATA</b>		
12.2	LOCATION		
12.3	RATING		
13	<b>OPTIONAL ITEMS</b>	BIDDER TO LIST ITEMS AND FURNISH THE SALIENT FEATURES	
			SIGNATURE OF BIDDER & DATE
			<div style="border: 1px solid black; padding: 2px; display: inline-block;"> ISSUE R1 </div>

**2X660 MW SURATGARH STPS**  
**BOQ-CUM-PRICE SCHEDULE OF GENERATOR CIRCUIT BREAKER**

SL. NO.	ITEM CODE	ITEM DESCRIPTION	UNIT	QTY.	UNIT PRICE	TOTAL PRICE	REMARKS
1.0	510-11003-A	GENERATOR CIRCUIT BREAKER INCLUDING ISOLATOR, SERIES CONNECTOR, EARTH-SWITCH, MANUAL SHORT CIRCUITING FACILITY WITH GROUNDING LINK, SURGE CAPACITOR, SURGE ARRESTOR AND CONTROL PANEL	SET	2			
2.0	510-11007-A	START-UP AND COMMISSIONING SPARES	SET	1			BIDDER TO FURNISH THE LIST
3.0	510-11008-A	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING	SET	2			REFER NOTE-1
4.0	510-11011-A	SPECIAL TOOLS AND TACKLES	SET	1			BIDDER TO FURNISH THE LIST
5.0	510-11000-B	MANDATORY SPARES	SET	1			REFER ANNEXURE-1 FOR DETAILED LIST
6.0	510-11012-A	TRAINING OF ENGINEERS a) BASIC COST (IRRESPECTIVE OF ENGINEERS) b) ADDITIONAL VARIABLE COST PER ENGINEER	SET	1			FOR OPERATION, TROUBLESHOOT AND MAINTENANCE

**NOTES**

1 FOR SUPERVISION OF ERECTION, TESTING AND COMMISSIONING, PRICE FOR 4(FOUR) MANDAYS AND 1(ONE) VISIT SHALL BE QUOTED FOR EACH GCB. THE PRICES SHALL BE INCLUSIVE OF CHARGES OF AIRFARE, BOARDING/LODGING, VISA, MEDICAL, INSURANCE ETC.

2 WHEREEVER SET IS INDICATED ABOVE, IT MEANS THE TOTAL PARTS/ACCESSORIES REQUIRED TO REPLACE THE PARTICULAR ITEM FOR A GIVEN EQUIPMENT.

**2X660 MW SURATGARH STPS (GCB)  
MANDATORY SPARES LIST (ANNEXURE-1)**

SL. NO.	ITEM CODE	ITEM DESCRIPTION	UNIT	QTY.	UNIT PRICE	TOTAL PRICE	REMARKS
<b>5.0</b>	<b>510-11000-B</b>	<b>MANDATORY SPARES</b>					
1		BREAKER AUX.SWITCHES(4 NO+4 NC)	NOS.	1			
2		CLOSING COILS	SETS	4			
3		TRIPPING COILS	SETS	4			
4		SPRING CHARGING MOTORS	NOS.	2			
5		GASKETS	NOS.	5			
6		BUS BAR SUPPORT INSULATORS	NOS.	3			
7		AUX.SWITCH ASSEMBLY, LIMIT POSITION SWITCHES, LOCAL/REMOTE SELECTOR SWITCH, BREAKER CONTROL SWITCHES & OTHER SWITCHES	NOS.	5			
8		OPERATING MECHANISM RODS	NOS.	2			
9		AUXILIARY RELAYS	NOS.	2			
10		PANEL SPACE HEATERS	NOS.	2			
11		AC SWITCHES	NOS.	1			
12		DC SWITCHES	NOS.	1			
13		LV FUSE LINKS	NOS.	3			
14		PRESSURE GAUGE & SWITCHES	NOS.	1			
15		TRANSDUCERS OF EACH TYPE	NOS.	1			
16		INDICATING LAMP OF EACH TYPE	NOS.	1			
17		GAS FILLING EQUIPMENT	NOS.	1			
18		VACCUUM PULLING EQUIPMENT	NOS.	1			
19		150 KG SF6 GAS CYLINDER WITH GAS FILLED	NOS.	1			
20		CONTACTORS OF EACH TYPE	NOS.	2			

NOTES

1 WHEREEVER SET IS INDICATED ABOVE, IT MEANS THE TOTAL PARTS/ACCESSORIES REQUIRED TO REPLACE THE PARTICULAR ITEM FOR A GIVEN EQUIPMENT.



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**1.00.00 SCOPE**

1.01.00 The scope shall include planning, design, engineering, manufacturing, assembly, testing, inspection, packing, supply, transportation of equipment related to Generator Circuit Breaker and associated equipment and services:

- Generator circuit breaker [as per quantity indicated in Data Sheet –A/BOQ-Cum-Price Schedule].
- Start-up and commissioning spares.
- Mandatory spares, as specified.
- Recommended spares for three (3) years of plant operation and maintenance.
- Special tools and tackles.
- Supervision of erection, testing & commissioning.
- Training of engineers.

1.02.00 Terminal points:

- Bus bar of GCB.
- Enclosure of GCB.
- Cable glands and lugs in Local Control Panel.
- Earthing terminals of GCB Local Control Panel.



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**2.00.00 GENERATOR CIRCUIT BREAKER**

- 2.01.00 The generator circuit breaker (GCB) shall be of the metal enclosed type suitable for direct connection to phase isolated generator bus duct in a manner designed to preserve the phase isolated principle. The breaker shall have continuous and short time current ratings as those indicated for Generator Bus Duct in the Data Sheet - A.
- 2.02.00 The interrupters of the circuit breaker shall be SF6 type. The rated duty cycle shall be CO - 30 minutes - CO.
- 2.03.00 The circuit breaker shall be operated with a hydraulic operating mechanism. All the three poles of the circuit breaker shall be gang operated. The circuit breaker shall have antipumping feature.
- 2.04.00 Protection shall be provided to take care of possible failure of the hydraulic system that drives the breaker. Upon failure of the hydraulic system in the open position, the breaker shall remain locked in open position and shall not tend to close. Similarly, upon failure of the hydraulic system in the closed position, the breaker shall remain locked in closed position.
- 2.05.00 Each three-phase circuit breaker shall have a hydraulic system complete with all associated pipework etc. The total stored energy in the operating system offered shall be sufficient for 2CO operations.
- 2.06.00 The number of motor driven hydraulic pumps shall be included by bidder as per bidder's standard and proven practice, ensuring utmost reliability of the operating system. Bidder in the bid shall declare the number of motor driven hydraulic pumps included.
- 2.07.00 Each circuit breaker shall be provided with a shunt opening release. Such release shall have duplicate actuating coils. These coils shall be capable of opening the circuit breaker at any load or short circuit with the voltage at coil terminals reduced to 56 % of the rated operating voltage of the coil.
- The trip coils are to be rated for DC auxiliary voltage specified in Data-Sheet-A and the minimum operating voltage of the trip coils shall be 56% of rated DC voltage. Both the trip coils shall be monitored.
- Necessary terminals shall be provided for connection of trip coil supervision relays provided in Generator Relay Panels.
- 2.08.00 SF6 gas monitor(s) shall be provided for each circuit breaker by bidder as per bidder's standard and proven practice, ensuring utmost reliability of the equipment and failsafe monitoring of SF6 gas, covering all phases and associated pipework. Bidder in the bid shall declare the number of SF6 gas monitor(s) included.
- Interlock shall be provided to prevent breaker from opening when the SF6 gas density falls to a level, which is inadequate to complete a successful opening operation of the breaker at its rated capacity.
- 2.09.00 Each phase of the circuit breaker shall be enclosed in a non-magnetic (Aluminium alloy) enclosure. The degree of protection of the enclosure shall be such that the air leakage rate shall not exceed 5% of the total enclosure volume per hour. The enclosure shall



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be minimum flux type so as to prevent heating of nearby metallic structures.

2.10.00 Support insulators shall be interchangeable and of high creepage distance, high mechanical and dielectric strength as required by the circuit breaker. Insulators shall be so mounted as to provide easy access for cleaning and removal.

2.11.00 The design and testing of the generator circuit breaker shall be in line with IEEE C37.013 latest version.

2.12.00 The arrangement shall include earth switch as per Data Sheet - A. The design and testing of the earth switch shall be in line with IEC129.

2.13.00 The arrangement shall include a series isolator as per Data Sheet - A. The design and testing of the isolator shall be in line with IEC129.

2.14.00 Single phase Voltage Transformers (VT) and Lightning Arresters (LA) shall be included on each phase of GCB assembly as per the technical particulars & quantities specified in Data Sheet - A of this specification. VT primary leads shall be provided with suitable HT fuses and the neutral formation of VT primary windings shall be grounded as stipulated in Data Sheet - A. VT secondary leads shall be brought to terminal blocks & in GCB LCP after providing suitable fuses/ MCBs and the neutral formation of secondary leads shall be grounded.

2.15.00 Following interlocks and locking facilities shall be provided:

a) It shall be possible to key-lock the series isolator in 'open' position blocking both electrical and hand closing of the isolator.

b) Key interlock shall be provided to prevent unauthorized operation of GCB.

c) Interlock shall also be provided between GCB and isolator.

d) Interlock shall also be provided between earth-switch and isolator.

2.16.00 GCB, isolator and earthing switch shall have separate operating mechanism. The operating mechanism for isolator and earth switch shall be motor operated.

Hand operation of the operating mechanism shall also be possible for GCB, isolator and earthing switch.

2.17.00 Each three-phase circuit breaker shall have a local control panel, for control of the auxiliaries. It shall have all the necessary indication for gas (SF6) pressure, temperature etc. as per the standard practice of the manufacturer.

Local control panel shall also contain, stay put type local/remote selector switch, spring return to neutral control switch for GCB, isolator & earth switch, electrically operated position indicator for GCB, isolator & earth switch etc.

2.18.00 Mimic diagram shall be provided on local control panel (LCP). Electrically operated semaphore indicators shall be used for indicating status of GCB, isolator and earth



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switch. Semaphore indicators shall form part of the mimic diagram. In case of failure of auxiliary DC supply, indicating bar of semaphore indicators shall take 45° position.

2.19.00 Requirement of potential free auxiliary contacts for purchaser's use is indicated below:

GCB : 12NO + 12NC  
Each Isolator : 4NO + 4NC  
Each Earth Switch : 4NO + 4NC

These contacts shall be wired to the terminal blocks of LCP for external use.

2.20.00 Two nos. incoming DC supply feeders will be made available by purchaser for GCB. Necessary arrangement shall be provided in GCB LCP for receiving these two feeders. Independent MCBs and voltage supervision relays shall be provided in GCB LCP for each DC supply.

2.21.00 a) It shall be possible to know abnormal or fault or lockout conditions from GCB local control panel. Visual annunciation shall be provided for this purpose alongwith 'lamp reset' and 'lamp test' push buttons on GCB LCP.

b) Separate sets of contacts for annunciation of various abnormal conditions of GCB in CCR shall be provided.

c) Two sets of contacts of GCB lockout conditions (when GCB is 'closed') shall be provided for interlocking in generator protection scheme. This is in addition to the requirements of GCB abnormal condition contacts given in b) above.

d) Potential-free contacts shall be provided on GCB LCP for indication in CCR for following conditions:

- i) GCB selected for remote control
- ii) GCB ready for 'close'

e) Potential-free contacts shall also be provided on GCB LCP for 'DC failure at GCB'.

2.22.00 Operation counter for GCB shall be provided in Local Control Panel.

2.23.00 Gland plate of local control panel shall be of adequate size for terminating external cables using glands. No. of external cables shall be finalized after the award of LOI.

2.24.00 Spare terminals shall be provided in local control panel. Number of spare terminals shall not be less than 10%.

2.25.00 All interconnecting cables between various equipment in the scope of the bidder shall be included by bidder in his scope.

2.26.00 GCB normal current rating, short time withstand current rating, peak withstand current rating, insulation levels, etc. shall not be less than those given for generator busduct given in Data Sheet-A.

2.27.00 Generator Circuit Breaker shall be suitable for busduct fault levels given in Data Sheet - A. Bidder must also establish that the model quoted is suitable for asymmetrical and symmetrical short circuit current contribution from generator side to a 3-phase and 2-



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phase fault. Generator reactances and time constants are given in Data Sheet -A to enable bidder to compute generator side fault current and establish GCB suitability. Bidder must take a negative tolerance of 15% on generator reactances and an over-voltage factor of 1.05 for calculating the fault currents. Also, both no-load and full-load conditions of generator shall be considered.

Bidder must also include the computations/ verification checks for the above in the bid. In the absence of this, the bid will be treated as incomplete and liable to be rejected.

2.28.00 Cable glands, cable lugs and foundation bolts shall be supplied alongwith GCB.

The required quantity of glands and lugs for terminating purchaser's external cables shall be finalized during contract engineering and there shall be no price implication on this account.

2.29.00 Bidder to ensure that the equipment offered has been in successful operation after commissioning at two different power plants for at least two years as on date of this enquiry.



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**3.00.00 COLOUR OF PAINT**

The colour of paint shall be intimated to the vendor after the award of LOI and there shall be no commercial implication on this account.



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**4.00.00 TESTS****4.01.00 ROUTINE TESTS**

The equipment shall be completely assembled, wired, adjusted and routine tested at manufacturer's works as per applicable standards.

**4.02.00 TYPE TESTS**

All equipment offered should be of type-tested design. Offered model of GCB should have been type tested as per latest version of standard ANSI/IEEE C37.013. Series isolator and earth switch should have been type tested as per latest version of standard IEC-129.

Type tests should have been conducted within last five years as on date indicated in Data Sheet -A.

Any specific requirement of conducting type tests against this enquiry is included in Data Sheet – A.

**4.03.00 SITE TESTS**


Each generator circuit breaker shall be subjected to the following tests after it is totally assembled at site in its final location.

- i/ Leakage tests alongwith generator busduct
- ii/ Gauge tests
- iii/ Stored energy system tests
- iv/ Electrical resistance of current path tests
- v/ Clearance and mechanical adjustment check tests
- vi/ Timing tests
- vii/ Low frequency withstand voltage tests

**4.04.00 WITNESSING OF TESTS**

All tests shall be performed in presence of purchaser's representatives.

The vendor shall give at least 45 days advance notice for routine tests and type tests (if required as per cl. 4.02.00).

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## 5.00.00 QUALITY PLAN

- a. The manufacturer shall draw a detailed Quality Plan for approval covering testing on all major component like, enclosures, castings, forgings, insulators, springs, contacts, nozzles, cylinders (SF6), manometers, pressure switches, density meters, valves, pipes and fittings, pumps, coils (for tripping and closing), heaters, relays, filters, base frame, support structures, SF6 gas, terminals, etc. The tests shall include all applicable tests like, material, chemical and other tests as per relevant material and international standard. The critical casting and forgings and weld joints shall also be subject to UT/RT and dye penetration examination to ensure freedom from defects. All pressurized vessels/enclosures shall be pressure and leak tested at 1.5 times the design pressure or twice the operating pressure.
- b. The assembled generator circuit breaker shall be tested in accordance with relevant IEC/Test procedure, etc. The manufacturer shall draw up a detailed test procedure for routine and type test for BHEL/ultimate customer review and approval. The tests to be carried out shall include following but not limited to same:

### 1. ROUTINE TESTS ON GCB

- a. Check completeness of breaker and associated control system.
- b. Millivolt drop test
- c. Mechanical operation test as per IEC
- d. Determination of leak rate of SF6 & moisture condensation determination (dampness rate)
- e. Determination of breaker operating times including speed (under various conditions of driving mechanism and various pressure and voltage conditions).
- f. PF high voltage tests on breakers as per IEC56 Clause 20 Part-IV (with poles closed and open conditions).
- g. Functional and performance test of all control circuits, trip and alarms circuits with breaker connected.
- h. Drive mechanism
  - i/ Performance tests
  - ii/ Functional tests
  - iii/ Resistance of trip coils
  - iv/ Check performance of safety valves
  - v/ Operation of pressure switches and setting ranges.
  - vi/ Check motor current consumption and also the ratings.
- i/ Check performance of gang operated switches and the auxiliary contact terminals as per schematic arrangement.



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2. ROUTINE TESTS ON ISOLATOR AND EARTH-SWITCH

Routine tests on isolator and earth-switch shall be conducted as per IEC 129.



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**6.00.00 SPARES**

- 6.01.00 Start-up and commissioning spares are those which may be required during the start-up and commissioning of the equipment.
- 6.02.00 Mandatory spares shall be quoted as applicable as per Data Sheet-A.
- 6.03.00 The bidder shall include and provide a list of recommended spares for 3 years of normal operation of the plant.
- 6.04.00 Various schedules of spares to be submitted alongwith the bid shall indicate description of spare parts alongwith type designation, quantity, unit price, total price etc.



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## **7.00.00 SPECIAL TOOLS & TACKLES**

- 7.01.00 Bidder shall offer one set of unused special tools and tackles which are required for erection, assembly, disassembly, adjustment and maintenance of GCB.
- 7.02.00 These tools and tackles shall be separately packed and sent to site prior to erection of GCB.
- 7.03.00 List of special tools and tackles, alongwith quantity shall be furnished as a part of technical offer.



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### 8.00.00 SUPERVISION OF ERECTION, TESTING AND COMMISSIONING

Bidder shall quote for supervision of erection, testing and commissioning of each GCB. Details shall be furnished in the technical offer.

Required instruments for site testing of GCB shall be arranged by the vendor, in case the same are not available at site. These instruments shall be brought by the vendor and shall be taken back after completion of commissioning.



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**9.00.00 TRAINING OF ENGINEERS**

Bidder shall provide training for a maximum of six (6) engineers from BHEL/ultimate customer at works, training centre etc. The training shall also include application, layout, design, construction, operating principle, operating mechanism, local control panel, operation, maintenance, site inspection, erection, site testing, spares etc. of GCB.

9.01.00 The language of instructions shall be English. All training material to be supplied to engineers shall be in English.

9.02.00 The training programme shall be finalised after the award of LOI.



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#### 10.00.00 DOCUMENTS REQUIRED ALONG WITH TECHNICAL OFFER

Bidder shall submit following documents alongwith technical offer:

- a] Filled in Data Sheet -B.
- b] Technical leaflet/ catalogue.
- c] Correction curves/ tables to arrive at current rating of GCB and series isolator at various ambient temperatures.
- d] Verification checks for short circuit capability for generator side fault contribution (refer clause 2.27.00 of this specification).
- e] General Arrangement drawing of GCB showing various dimensions, space required for operation and maintenance, weight etc.
- f] Summary of Type tests certificates indicating key test results, clause & standard reference, date and place of testing.
- g] Write up on operating mechanism of GCB.
- h] Schedule of deviations.
- i] Schedule of start-up and commissioning spares. (Unpriced)
- j] Schedule of Mandatory spares. (Unpriced)
- k] Schedule of recommended spares for 3 years of plant operation. (Unpriced)
- l] Schedule of special tools and tackles. (Unpriced)
- m] Reference list.

REFER SEC-C FOR DOCUMENT



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**11.00.00 DOCUMENTS REQUIRED AFTER THE AWARD OF LOI**

Bidder shall submit following documents after the award of LOI for approval and distribution:

- a] Filled in data sheet.
- b] Detailed general arrangement drawing of GCB showing various dimensions, space required for operation and maintenance, weights etc. (GA drawing to be complete for GCB and auxiliaries.)
- c] Foundation arrangement drawing showing loading, forces at various points etc.
- d] General arrangement drawing of local control panel.
- e] Logic for closing/tripping of GCB, isolator and earth-switch.
- f] Electrical control scheme of local control panel.
- g] Drawings for operating mechanism.
- h] P & I Diagram.
- i] Type tests certificates.
- j] Manufacturing Quality Plan.
- k] Field quality plan for equipment storage, handling, erection, testing and commissioning at site, recommended by vendor.
- l] O & M Manual.
- m] Routine test certificates.

11.01.00 All drawings, documents shall be in English.

11.02.00 The vendor after LOI shall submit drawings/documents in requisite number of copies as indicated in ATTACHMENT-V ("DOCUMENTS / DRAWINGS DISTRIBUTION SCHEDULE").

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**12.00.00 O & M MANUAL**

The vendor shall submit after the award of LOI, draft O & M manual for approval. Final O & M manuals shall be properly bound.

12.01.00 The instruction manual shall contain full details and drawings of all the equipment furnished, the storage procedures, erection and testing procedures, operation and maintenance procedure of the equipment.

12.02.00 The operating and maintenance instructions of the equipment shall be in sufficient details to enable the Owner to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step-by-step procedure for all operations likely to be carried out during the life of the plant/ equipment including erection, testing, commissioning, operation, maintenance, dismantling, repair and assembly. Each manual shall also include a complete set of approved drawings together with performance/ rating curves of the equipment and test certificate wherever applicable.

12.03.00 The instruction manuals shall also include the spare part catalogue for all the equipment.

12.04.00 A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets, drawings and list of parts with procedure for ordering spares. Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out daily, weekly, monthly and at longer intervals to ensure trouble free operation. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down. A collection of manufacturer's standard leaflets will not be accepted as a compliance of this clause. The manual shall be specifically compiled for the concerned project.



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**13.00.00 TECHNICAL DEVIATIONS**

Bidder shall clearly indicate deviations in the offer. Only the deviations which are specifically mentioned in the offer in the prescribed Deviation Schedule shall be considered, otherwise it shall be presumed that offer is fully in conformance to the specification.