

ANDHRA PRADESH POWER GEN. CO. LTD.
1 x 600 MW STAGE IV RAYALSEEMA EXTN.


VOLUME IIB

**TECHNICAL SPECIFICATION
FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.: PE-TS-371-510-E001 (REV. 02)



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UTTAR PRADESH, INDIA

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	
		Rev. : 02	
		Page : 1 of 1	

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 comprises the following:

Specific Technical Requirements:

Data Sheet A (Specified Data)

Attachment-I

Attachment-II

Attachment-III

Price Schedule

Technical Deviation Schedule


Section-D: This Section comprises the following:

Technical Specification/Requirements:

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


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

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.

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	A
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	


SECTION – A

SCOPE OF ENQUIRY

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	A
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	
		Page : 1 of 1	

SECTION- 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 1 x 600 MW thermal power plant proposed at Rayalseema.
- 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 For every shipment made, a shipping list containing item reference [item number and description as per specification Bill of material or package drawing] and quantity of the same [in nos./ weight] shall be provided by vendor at the time of dispatch of material.
- 6.0 Deviation if any should be brought out very clearly on deviation sheet enclosed with the specification only. Otherwise it will be presumed that the bidder's offer is in line with what has been stated/ asked for in this specification.
- 7.0 The documents shall be in English language and MKS system of units.

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	B
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	

SECTION – B

PROJECT INFORMATION

PROJECT DATA

1.00 SITE DESCRIPTION

The site for Rayalaseema Thermal Power Project is located at V.V. Reddy Nagar, near Kalamalla Village, which is 9 KM North of Chilamakur Village on Kadapa (Cuddapah) – Tadipatri road. Chilamakur is 43 KM from Kadapa (Cuddapah). Post, Telegraph, and Telephone facilities are available at V.V. Reddy Nagar. Medical facilities are available at Proddatur, which is 13km from the project.

1.01 Site of Project : Proddatur Taluk; Kadapa (Cuddapah) district, Andhra Pradesh, India

1.02 Approach to site :

a) Nearest Town : Proddatur (13 KM from site)

b) Nearest Railway Station : Muddanur Railway Station: South Central Railway (10 KM from site)

c) Nearest Airport : Renigunta (150 KM from site).

1.03 Access Roads : Metal road off Chilamakur village on Kadapa – Tadipatri Road.

All equipment and construction materials to be transported to site by road or by Broad gauge railway siding into the plant area.

1.04 Site Elevation : 172M-190M above MSL

1.05 Climate : Tropical – Hot – Humid

1.06 Seismic Data : Zone II as per IS:1893-2002

2.00 METEOROLOGICAL DATA [from nearby meteorological station Kadapa]

2.01 Ambient Temperature (Dry Bulb)

a) Daily maximum (Mean) : 40.3⁰C

b) Daily minimum (Mean) : 19.1⁰C



- c) Design ambient temp. for continuous rating of motors : 50.0° C

2.02 Relative Humidity

- a) Maximum during monsoon (June to October) : 49 to 74 percent
- b) Humidity during summer (March to June) : 35 to 60 percent
- c) Humidity during winter (November to March) : 55 to 70 percent

2.03 Rainfall

- a) Maximum per annum : 1273.6 mm
- b) Average per annum : 742.8 mm
- c) Tropical monsoon : June to October

2.04 Wind Velocity & Pressure (As per IS: 875-1987)

- a) Basic Wind Speed : 39 M/Sec. at 10 M above mean retarding surface
- b) Terrain classification : Category –III


3.00 AUXILIARY SUPPLIES

- 3.01 Auxiliary Power Supplies : Auxiliary electrical equipment shall be suitable for operation on the following supply system :
- (a) For motors 1500 kW & above : 11000V, 3 phase, 3 wire, 50 Hz medium resistance earthed AC
- (b) 175 kW & upto 1500 Kw : 3300V, 3 phase, 3 wire, 50 Hz medium resistance earthed AC (upto 1500 KW)
- (c) For motor rated 175 kW and below : 415, 3 phase, 3 wire solidly earthed AC
- (d) For motor control center : 415V, 3 phase, 3 wire solidly earthed AC

- (e) DC motor starters, DC solenoids, DC alarm, control and protections : 220 V DC, 2 wire, unearthed DC
- (f) AC control & protective devices : 110 V resistance. The single-phase 110V AC supply shall be derived by Contractor by providing 415V/110V 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 supply from UPS system for I&C (including indicator recorders) and UCMS only
- (h) Space heaters (for motors rated 30 KW and above) : 240V, 1 phase, 2 wire, 50 Hz AC system with effectively earthed neutral. The power supply shall be derived by CONTRACTOR by providing 415V / 240V transformer of adequate rating with MCCB / MCB on primary / secondary sides.
- (i) Solid state controls (including solenoid valves) : 24V DC, 2 wire (24 V DC derived from UPS supply)
- (j) Lighting fixtures; and space heaters in panels : 240V, 1 phase, 2 wire, 50 Hz system
- (k) 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.

- i) AC supply : Voltage variation $\pm 10\%$
Frequency variation $\pm 5\%$
Combined voltage & frequency variation $\pm 10\%$
- ii) DC supply : Voltage variation + 10%, - 20%

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	C
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	

SECTION – C

SPECIFIC TECHNICAL REQUIREMENTS

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 02	
		Page : 1 of 4	

1.0 **GENERAL**

- 1.1 The Generator circuit breaker (GCB) offered shall be complete in all respects. Any material and component not specifically stated in this specification and which is necessary for trouble free operation of the GCB and accessories specified in this specification shall be deemed to be included unless specifically excluded.
- 1.2 Design and manufacture shall be such that GCB / accessories of same type and rating are inter-changeable.
- 1.3 The GCB shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous operation.


2.0 **CODES AND STANDARDS:**

- 2.1 The equipment covered by this specification shall be designed, constructed and tested in accordance with the latest revisions of applicable IEC / IEEE/ANSI publications:


Standard	Title
IEC 62271-100	HV AC Circuit Breakers
IEC 376, 376A, 376B	Specification and acceptance of new Sulphur Hexafluoride.
IEEE C37.013	IEEE Standard for AC High Voltage Generator Circuit Breakers Rated on Symmetrical Current Basis.
IEC 694	Common clauses for high voltage switchgear and control gear standards.
IEC 298	AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV.
IEC 144	Degree of protection of metal enclosed control gear and switchgear.
IEC 358	Coupling Capacitors and Capacitor Dividers.
IEC 129	Alternating Current Disconnectors (Isolators) and Earthing Switches

3.0 **Generator Circuit Breaker System**

- 3.1 Support structure shall be designed to withstand the dynamic as well as static load of the GCB. Design calculations of support structure shall be furnished for BHEL/ customer's approval.
- 3.2 The short time and momentary current rating of the Generator circuit breaker shall be as per Data sheet-A.
- 3.3 The basic switchgear module shall include the following minimum equipment but shall not be limited to the same:

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 1	
		Page : 2 of 4	

- a) Circuit breaker with disconnecter for series isolation.
 - b) Grounding switches fitted both sides of unit and to all three phases.
 - c) Protective capacitors fitted to both sides of the unit and to all three phases.
- 3.4 The GCB shall be of SF6, metal enclosed, indoor and free standing type. It shall be provided with three pole gang operation and antipumping feature. The Generator circuit breaker shall use SF6 gas both as its arc-extinguishing medium as well as for internal insulation. It shall be designed with separate contact systems for the current breaking and current carrying functions. Semaphore position indicators shall be provided for local indication of the position of the circuit breaker.
- 3.5 The GCB enclosure shall be non magnetic aluminium alloy, minimum flux, isolated phase type with degree of protection IP-52.
- 3.6 Insulators shall be of high strength, fine glazed porcelain or epoxy resin type.
- 3.7 SF6 gas monitor shall be provided. Necessary interlocks are to be arranged to prevent breaker operation on fall of SF6 gas density.
- 3.8 A series disconnecter shall be fitted on the outgoing side of the circuit breaker and within the same enclosure. The disconnecter shall have adequate clearances across the main contact to withstand specified voltage impulse levels on loss of SF6 pressure.
- 3.9 Grounding switches shall be provided on both sides of the switchgear unit. The connections and the switches shall be rated for full fault current. The ground connections shall be made via the switchgear enclosure to the housings of the isolated phase busbars and then to their grounding connection.
- 3.10 Locking bars or effective mechanical arrangement shall be provided to lock main and auxiliary contact in the open position to prevent inadvertent closing either in main breaker or on disconnecting switch.
- 3.11 Duplicate shunt opening release coils suitable for operation with voltage upto 56% of rated voltage of coils along with status monitoring shall be provided.
- 3.12 The GCB shall have hydraulic/ spring operating mechanism. In case of hydraulic mechanism, the stored energy shall be suitable for two close open operations & the breaker shall have 2 x100% hydraulic pumps with provision for alternate arrangements for emergency operation. In case of motorized charged spring operating mechanism, the stored energy shall be suitable for O-C-O operation.
- 3.13 The GCB shall be suitable for synchronizing duty and capable of withstanding out of phase voltage across open contacts. The breaker shall also be capable of switching on to a fault and out of phase switching.
- 3.14 Paint shade shall be RAL 7032.
- 3.15 Mechanical interlock shall also be provided with electrical interlocks for circuit breaker, isolators & earth switches.

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 1	
		Page : 3 of 4	

3.16 Surge capacitor should be as low as possible from the point of view of generator neutral grounding system

3.17 GCB shall have closing coil and tripping coil supervision relays.

4.0 Tests

4.1 All routine tests as per latest version of applicable standard shall be conducted on each of the generator circuit breaker.


4.2 The offered GCB shall be of type tested design. Valid test reports for the complete type tests shall be submitted for each type & rating of equipment.

In case valid type test report is not available the same shall be done without any commercial/ delivery implication to BHEL.

5.0 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 (For all test indicated at clause no. 4.2)
- f] Write up on operating mechanism of GCB.
- h] Schedule of deviations.
- i] Schedule of prices(Unpriced)
- j] Schedule of start-up and commissioning spares. (Unpriced)
- k] Schedule of special tools and tackles. (Unpriced)
- l] Reference list.

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 1	
		Page : 4 of 4	

6.0 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] Complete Type tests certificates (For all test indicated at clause no. 4.2).
- 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.
- p] List of recommended spares for 3 years of plant operation


	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 02	
		Page : 1 of 3	

DATA SHEET –A


SL.NO.	PARAMETER	UNIT	VALUE
1.00	Generator		
1.01	Rated voltage	kV	24
1.02	Voltage variation	±%	5
1.03	Output current at 50°C ambient temperature	A	19407
1.04	Rated power factor		0.85 (lag)
1.05	Frequency	Hz	50 (±5%)
2.00	<u>Generator Bus Duct details [GCB to comply to these requirements]</u>		
2.01	Type		Isolated phase busduct
2.02	Maximum continuous current at 50°C ambient temperatures	A	22000
2.03	One minute power frequency withstand voltage	kV(RMS)	60
2.04	Impulse withstand voltage	kV(Peak)	125
2.05	Overall diameter of enclosure (Inside)		
	a) For Steam Turbine Generator	mm	1600 (Tentative)
2.06	Thickness of enclosure		
	a) For Steam Turbine Generator	mm	8 (Tentative)
2.07	Phase-phase spacing		
	a) For Steam Turbine Generator	mm	2000 (Tentative)
2.08	Enclosure material		Al. alloy
2.09	Conductor material		Al. alloy
2.10	Conductor profile		Round
2.11	Cooling		Natural
2.12	Pressurization System provided	Yes/No	No, HOT AIR BLOWING is provided
2.13	Pressure of air inside the enclosure	mm of water col.mn	N.A.
2.14	Maximum temperature of enclosure at 50°C	°C	80

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 02	
		PAGE 2 of 3	

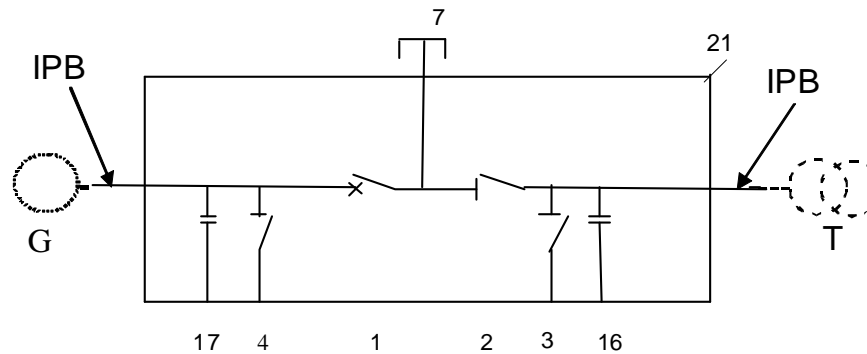
2.15	Maximum temperature of silver plated conductor joints at 50°C	°C	105
3.00	Generator Circuit Breaker details		
3.01	Maximum continuous current at 50°C ambient	A	22000
3.02	Rated voltage	kV	24
3.03	No. of poles	Nos.	3
3.04	Rated short time withstands current [1 sec.]	kA	140
3.05	Interrupting capacity (symmetrical) at rated voltage and operating duty	kArms	140
3.06	One minute power frequency withstand voltage	kV(RMS)	60
3.07	Impulse withstand voltage	kV(Peak)	125
3.08	Location of GCB	Indoor / Outdoor	Indoor
3.09	Quantity of GCB	Nos.	1
3.10	Quantity of Earth Switch per GCB	Nos.	2
3.11	Quantity of Series Isolator per GCB	Nos.	1
3.12	Configuration of Earth Switch, Series Isolator & Short circuiting connection with switch		As per Attachment - I
4.00	Generator Neutral Earthing		High Resistance (Through Transformer loaded with Resistance on secondary)
5.00	Gen. Stator Winding Basic Insulation Level	KVpeak	89
6.00	<u>Voltage Transformers (on each GCB)</u>		NOT APPLICABLE
6.01	Quantity		
6.02	Voltage Ratio		
6.03	Accuracy Class		
6.04	Burden per phase	VA	
6.05	Neutral of VT primary windings to be grounded?	Yes/No	
7.00	<u>Lightning Arresters (on each GCB)</u>		NOT APPLICABLE
7.01	Quantity		
7.02	Rated Voltage	kV	

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	C
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	
		PAGE 3 of 3	

7.03	Nominal Discharge current	kA	
7.04	Type		
8.00	Type Tests		
8.01	Validity period of type test reports		
8.02	Type tests to be conducted for this contract, despite availability of valid & acceptable test certificates	Yes/ No	No
8.03	If yes, list of type tests to be conducted	NA	
9.00	<u>Auxiliary supplies</u>		
9.01	DC	V	220
9.02	AC [Any single phase power for lighting and heating circuits to be derived by vendor from this supply]	Phase, Wire, Hz	415V, 3 phase, 3 wire effectively earthed (control transformer to be provided for deriving 240V, 1 phase, 2 wire, 50 Hz with one Point earthed).

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 02	
		Page : 1 of 1	

ATTACHMENT – I



1	Circuit-breaker	7	Manual Short-circuiting connection
2	Disconnecter	16, 17	Surge capacitors
3, 4	Earthing switches	21	System enclosure

SINGLE LINE CONFIGURATION OF GENERATOR CIRCUIT BREAKER FOR STEAM TURBINE GENERATOR

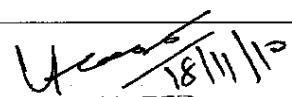
ANNEXURE-II


DISTRIBUTION SCHEDULE

P.O.NO.TMO 873/CPP/111/RTTP-IV/F.BTG/D.No.322/2010, DATED:18.11.2010

S.No.	Description	MD/ Hyd	APGENCO								Consultant			Equipment Vendor	Remarks
			Director (Projecs)	CE/ Civil/ Thermal Hyd.	CE (TPC-II) Hyd	CE O&M/ RTTP	SE (Civil) RTTP	SE (E&M-I) RTTP	SE (E&M-II) RTTP	EE RTTP Stage -III	Head Office	HYD	RTTP Site		
A.	Vendor Drawings														
1.	Preliminary	-	1	1	2	1	1	2	2	-	10	1	-	S	
2.	Return preliminary with comments	-	1	1	2	1	1	1	1	-	S+2	-	-	1	
3.	Final and any revision thereof	1	1	1	3+1T	1	1	3+1T	3+1T	-	2+1T	1	1	S	
B.	Progress Report Monthly														
1.	Equipment vendor	1	1	1	2	1	1	1	1	1	1	1	1	S	
C.	Instruction Manuals/ Data Books/As built drawings														
1.	Equipment manufacturer	-	-	-	2	1	-	1	1	4	2	1	1	S	
D.	Correspondence														
	1. Technical	1	1	-	1	1	-	1	1	1	1	1	1	S	
	2. General & Commercial	1	1	-	1	1	-	1	-	-	-	-	-	S	
	S : Source														
	T : Transparency and soft copy on CD														

Supply P.O. TMO 873 DT: 18.11.2010
ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED
VIDYUT SOUDHA :: HYDERABAD-500 082.



CHIEF ENGINEER
 Thermal Projects Constrn.
 APGENCO, Vidyut Soudha,
 HYDERABAD - 500 082. Page 49 of 49

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	C
		Rev. : 02	
		Page : 1 of 1	

ATTACHMENT – III

GENERATOR DATA (STEAM TURBINE GENERATOR)

SL. NO.	DESCRIPTION	UNIT	VALUE
1	Generator MVA	MVA	705.9
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	1.74
	Transient Reactance, Direct Axis	pu	0.24
	Sub transient Reactance, Direct Axis	pu	0.17
	Synchronous Reactance, Quadrature Axis(unsat)	pu	1.93
	Transient Reactance, Quadrature Axis	pu	0.65
	Sub transient Reactance, Quadrature Axis	pu	0.19
	Negative Sequence Reactance	pu	0.18
	Zero Sequence Reactance	pu	0.09
7	Time Constants (Short Circuit Time Constants):		
	Transient Time Constant, Direct Axis (T_d)	s	0.78
	Sub transient Time Constant, Direct Axis (T_d'')	s	0.03
	Armature Time Constant (T_a)	s	0.30
8	Speed	rpm	3000


	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	C
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	
		Page : 1 of 1	

DEVIATION SCHEDULE

SL. NO.	CLAUSE NO.	DEVIATION	REASONS FOR DEVIATION

It is certified that the offer is fully in conformance to the specification requirements except for the deviations which are specifically brought out in the above prescribed Deviation Schedule.

Signature & seal of Bidder's authorized representative

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	C
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	
		Page : 1 of 1	


PRICE SCHEDULE

SL.NO	ITEM CODE	ITEM	QTY.	REMARKS	UNIT PRICE	TOTAL PRICE
1	510-11003-A	Generator Circuit Breaker (natural cooled/ forced cooled) including all associated series isolators, earth-switches, surge capacitors & manual short circuiting connection link	1 No			
2	510-11007-A	Start-up and Commissioning Spares (Bidder to furnish the list)	1 No			
3	510-11011-A	Special Tools and Tackles (Bidder to furnish the list)	1 Set			
4	510-11008-A	Supervision of Erection, Testing and Commissioning(Refer Note 1)	1 Set			
5	510-11012-A	Training of Engineers: (Optional) a) Basic cost [irrespective of no. of engineers] b) Additional variable cost per engineer	1 Set			

Note 1: For Supervision of Erection, Testing and Commissioning, price for 4 mandays & 1 visit shall be quoted for each GCB. The price shall be all inclusive of charges for airfare, boarding/ lodging, visa, medical, insurance etc.

Note 2: Wherever set is indicated above, it means the total parts/ accessories required to replace the particular item for a given equipment.

Note 3: Bidders to note that prices for all items including optional items as above shall be used for price evaluation purpose.

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	D
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	

SECTION – D

GENERAL TECHNICAL REQUIREMENTS



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 1 OF 18

CONTENTS

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.00.00	SCOPE	2
2.00.00	GENERATOR CIRCUIT BREAKER	3
3.00.00	COLOUR OF PAINT	7
4.00.00	TESTS	8
5.00.00	QUALITY PLAN	9
6.00.00	SPARES	11
7.00.00	SPECIAL TOOLS & TACKLES	12
8.00.00	SUPERVISION OF ERECTION, TESTING & COMMISSIONING	13
9.00.00	TRAINING OF ENGINEERS	14
10.00.00	DOCUMENTS REQUIRED ALONGWITH TECHNICAL OFFER	15
11.00.00	DOCUMENTS REQUIRED AFTER THE AWARD OF LOI	16
12.00.00	O & M MANUAL	17
13.00.00	TECHNICAL DEVIATIONS	18



TITLE :

**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 2 OF 18

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].
- 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.



TITLE : TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	SPECIFICATION NO. PE-SS-999-510-E001
	VOLUME NO. : II-B
	SECTION : D
	REV NO. : 00 DATE : 15.02.2006
	SHEET : 3 OF 18

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



TITLE : TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	SPECIFICATION NO. PE-SS-999-510-E001
	VOLUME NO. : II-B
	SECTION : D
	REV NO. : 00 DATE : 15.02.2006
	SHEET : 4 OF 18

rate shall not exceed 5% of the total enclosure volume per hour. The enclosure shall 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



TITLE : TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	SPECIFICATION NO. PE-SS-999-510-E001
	VOLUME NO. : II-B
	SECTION : D
	REV NO. : 00 DATE : 15.02.2006
	SHEET : 5 OF 18

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-



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 6 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO. PE-SS-999-510-E001
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 15.02.2006
SHEET : 7 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 8 OF 18

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).



TITLE : TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	SPECIFICATION NO. PE-SS-999-510-E001
	VOLUME NO. : II-B
	SECTION : D
	REV NO. : 00 DATE : 15.02.2006
	SHEET : 9 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO. PE-SS-999-510-E001
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 15.02.2006
SHEET : 10 OF 18

2. ROUTINE TESTS ON ISOLATOR AND EARTH-SWITCH

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



TITLE :

**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 11 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 12 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO. PE-SS-999-510-E001
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 15.02.2006
SHEET : 13 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 14 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO. PE-SS-999-510-E001
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 15.02.2006
SHEET : 15 OF 18

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.



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO. PE-SS-999-510-E001
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 15.02.2006
SHEET : 16 OF 18

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").



TITLE :
**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.
PE-SS-999-510-E001

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 17 OF 18

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.



TITLE :

**TECHNICAL SPECIFICATION FOR
GENERATOR CIRCUIT BREAKER**

SPECIFICATION NO.

PE-SS-999-510-E001

VOLUME NO. : **II-B**


SECTION : **D**

REV NO. : **00** DATE : 15.02.2006

SHEET : 18 OF 18

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.

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 1 of 8	


DATA SHEET –B

TECHNICAL PARTICULARS [TO BE SUBMITTED ALOGWITH TECHNICAL OFFER]


SL.NO.		SPECIFIED	OFFERED
	GENERATOR CIRCUIT BREAKER		
1.01	a. Manufacturer		
	b. Country of Manufacture		
	c. Type Designation		
1.02	Applicable Standard	ANSI/IEEE (C37.013)	
1.03	Rated voltage (kV)		
1.04	Rated frequency	50Hz	
1.05	Rated continuous current (A) at ambient temperature of: 0°C 15°C 30°C 40°C 50°C		
1.06	Interrupting medium	SF6	
1.07	Breaking capability		
i)	System source fault		
	a) Rated symmetrical breaking current (kA rms)		
	b) Rated asymmetrical breaking current (kA rms)		
	c) DC component		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 2 of 8	


ii)	Generator source fault		
	a) Rated symmetrical breaking current (kA rms)		
	b) Rated asymmetrical breaking current (kA rms)		
	c) DC component		
	d) Suitability of GCB checked with Generator data.	Yes/ No	
1.08	Rated making current (kA _{peak})		
1.09	Rated short circuit duty cycle	CO -30 - CO	
1.10	Rated impulse withstand voltage (kV _{peak})		
1.11	Rated Power frequency 'dry test' withstand voltage: Earth (kV _{rms}): Across the pole (kV _{rms}):		
1.12	Type of cooling		
1.13	Maximum allowable temperature of main contacts (Deg. C)	105	
1.14	Degree of protection of breaker enclosure	Air leakage < 5%	
1.15	Whether canopy is required, if GCB is installed outdoor		
1.16	Voltage rating of motor driven pumps (in hydraulic mechanism)		
1.17	No. and KW rating of motor driven pumps		
1.18	Does GCB has provision of lockout features for open and close conditions of GCB?		
1.19	Stored energy of GCB is suitable for how many CO operations?		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 3 of 8	


1.20	Maximum current (A) under natural cooled conditions which can be carried by GCB at following ambient temperatures: --°C --°C --°C --°C 50°C		
1.21	Nominal Ratings of the basic model quoted: Normal current (A): Normal voltage (kV): Fault current (kA): Making current (kA _{peak}): Dielectric withstand voltage (kV _{rms} , kV _{peak}):		
1.22	Circuit breaker closing time (msec)		
1.23	Circuit breaker break time (msec)		
1.24	Whether specified safety interlocks and locking features provided as per the specification?		
1.25	Type of operating mechanism provided		
1.26	No. of poles: Whether three poles of the circuit breaker are gang operated?		
1.27	Whether circuit breaker has anti pumping feature?		
1.28	Whether circuit breaker has trip free mechanism?		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 4 of 8	


1.29	Whether lockout feature provided for the circuit breaker?		
1.30	Whether separate SF6 gas monitors provided for each of the three phases of the circuit breaker?		
1.31	No. of SF6 gas monitors provided for each GCB		
1.32	a) No. of trip coils provided b) Voltage rating of trip coil c) Minimum operating voltage of trip coil		
1.33	Emergency current rating during loss of coolant (if applicable)		
1.34	Time available at rated current before load reduction		
1.35	Rate at which load current should be reduced		
1.36	Reduced continuous operating current		
1.37	Rated voltage range factor K		
1.38	Rated short circuit duty cycle		
1.39	Rated permissible tripping time		
1.40	Maximum permissible temperature rise of main contacts and conducting joints for continuous rating over the ambient air temperature of 50 deg C: Copper: Silver: Silver alloy:		
1.41	Minimum creepage distance		
1.42	Clearance in air of live parts - phase to earth		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 5 of 8	


1.43	a) Control circuit suitable for aux. supply voltage of b) Mechanism motor suitable for aux. supply voltage of		
1.44	Value of capacitor included in GCB on generator transformer side (nF/phase)		
1.45	a) DOP of GCB local control panel b) Is DOP type test certificate for GCB LCP enclosed?		
1.46	Whether cable glands and lugs are included as per the specn.?		
1.47	Whether all interconnecting cables between various equipment of GCB and associated devices in bidder's scope are included?		
1.48	Whether sufficient quantity and types of spares are included for start up & commissioning of specified no. of GCBs?		
1.49	No. of series isolators provided per GCB on: Gen. trfr. side: Generator side:		
1.50	No. of earth-switches provided per GCB on: Gen. trfr. side: Generator side:		
1.51	Catalogues attached for GCB: for series isolator: for earth-switch:		
1.52	Earth switch		
	a) Manufacturer		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 6 of 8	


	b) Country of manufacture c) Type designation d) Reference Standard e) Rated service voltage f) Rated frequency g) Rated normal current at 50 deg C h) Rated short time withstand current i) Rated peak withstand current j) Rated power frequency withstand voltage k) Rated impulse withstand voltage l) No. of poles per switch m) No. of control mechanism per switch n) Ambient air temp. limits o) Control circuit suitable for aux. supply voltage of? p) Mechanism motor suitable for aux. supply voltage of?		
1.53	Series isolator		
	a) Manufacturer b) Country of manufacture c) Type designation d) Reference Standard e) Rated service voltage f) Rated frequency g) Rated normal current at 50 deg C		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 7 of 8	

	<p>h) Is series isolator fully compatible with GCB in respect of normal current ratings at various ambient temperatures?</p> <p>i) Rated short time withstand current</p> <p>j) Rated peak withstand current</p> <p>k) Rated power frequency withstand voltage</p> <p>l) Rated impulse withstand voltage</p> <p>m) No. of poles per switch</p> <p>n) No. of control mechanism per switch</p> <p>o) Ambient air temp. limits</p> <p>p) Control circuit suitable for aux. supply voltage of?</p> <p>q) Mechanism motor suitable for aux. supply voltage of?</p>		
1.54	<p>a) Whether all type tests have been conducted on GCB as per ANSI/IEEE C37.013 latest version?</p> <p>b) Have all the type tests been carried out at independent test laboratories?</p>		
1.55	Summary of Type test reports for GCB enclosed as Annex. No.		
1.56	Whether the offer includes performance of all site tests specified in the spec.?		
1.57	<p>a) Whether all type tests have been conducted on series isolator as per IEC 129?</p> <p>b) Summary of Type test reports for series isolator enclosed as Annex. No.</p>		
1.58	a) Whether all type tests have been conducted on earth-switch as per IEC 129?		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
		IIB	D
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02 Page : 8 of 8	

	b) Summary of Type test reports for earth-switch enclosed as Annex. No.		
1.59	a) Project sites and dates of commissioning of GCBs of same model and type (as quoted in 1.01 of this data sheet) - indicate for two earliest installations b) Does the equipment offered meet requirements of clause 2.29.00 of this specification		


	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-371-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	D
		Rev. : 02	
		Page : 1 of 8	

DATA SHEET –C


TECHNICAL PARTICULARS

[TO BE SUBMITTED AFTER AWARD OF CONTRACT FOR APPROVAL]


SL.NO.		SPECIFIED	OFFERED
	GENERATOR CIRCUIT BREAKER		
1.01	a. Manufacturer		
	b. Country of Manufacture		
	c. Type Designation		
1.02	Applicable Standard	ANSI/IEEE (C37.013)	
1.03	Rated voltage (kV)		
1.04	Rated frequency	50Hz	
1.05	Rated continuous current (A) at ambient temperature of: 0°C 15°C 30°C 40°C 50°C		
1.06	Interrupting medium	SF6	
1.07	Breaking capability		
i)	System source fault		
	a) Rated symmetrical breaking current (kA rms)		
	b) Rated asymmetrical breaking current (kA rms)		
	c) DC component		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
		IIB	
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02 Page : 2 of 8	


ii)	Generator source fault		
	a) Rated symmetrical breaking current (kA rms)		
	b) Rated asymmetrical breaking current (kA rms)		
	c) DC component		
1.08	Rated making current (kA _{peak})		
1.09	Rated short circuit duty cycle	CO -30 - CO	
1.10	Rated impulse withstand voltage (kV _{peak})		
1.11	Rated Power frequency 'dry test' withstand voltage: Earth (kV _{rms}): Across the pole (kV _{rms}):		
1.12	Type of cooling		
1.13	Maximum allowable temperature of main contacts (Deg. C)	105/90	
1.14	Degree of protection of breaker enclosure	Air leakage < 5%	
1.15	Whether canopy is required, if GCB is installed outdoor		
1.16	Voltage rating of motor driven pumps (in hydraulic mechanism)		
1.17	No. and KW rating of motor driven pumps		
1.18	Does GCB has provision of lockout features for open and close conditions of GCB?		
1.19	Stored energy of GCB is suitable for how many CO operations?		
1.20	Maximum current (A) under natural		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	
		Rev. : 02	
		Page : 3 of 8	


	cooled conditions which can be carried by GCB at following ambient temperatures: --°C --°C --°C --°C 50°C		
1.21	Nominal Ratings of the basic model quoted: Normal current (A): Normal voltage (kV): Fault current (kA): Making current (kA _{peak}): Dielectric withstand voltage (kV _{rms} , kV _{peak}):		
1.22	Circuit breaker closing time (msec)		
1.23	Circuit breaker break time (msec)		
1.24	Whether specified safety interlocks and locking features provided as per the specification?		
1.25	Type of operating mechanism provided		
1.26	No. of poles: Whether three poles of the circuit breaker are gang operated?		
1.27	Whether circuit breaker has anti pumping feature?		
1.28	Whether circuit breaker has trip free mechanism?		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	
		Rev. : 02	
		Page : 4 of 8	


1.29	Whether lockout feature provided for the circuit breaker?		
1.30	Whether separate SF6 gas monitors provided for each of the three phases of the circuit breaker?		
1.31	No. of SF6 gas monitors provided for each GCB		
1.32	a) No. of trip coils provided b) Voltage rating of trip coil c) Minimum operating voltage of trip coil		
1.33	Emergency current rating during loss of coolant (if applicable)		
1.34	Time available at rated current before load reduction		
1.35	Rate at which load current should be reduced		
1.36	Reduced continuous operating current		
1.37	Rated voltage range factor K		
1.38	Rated short circuit duty cycle		
1.39	Rated permissible tripping time		
1.40	Maximum permissible temperature rise of main contacts and conducting joints for continuous rating over the ambient air temperature of 50 deg C: Copper: Silver: Silver alloy:		
1.41	Minimum creepage distance		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
		IIB	
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02	
		Page : 5 of 8	


1.42	Clearance in air of live parts - phase to earth		
1.43	a) Control circuit suitable for aux. supply voltage of b) Mechanism motor suitable for aux. supply voltage of		
1.44	Value of capacitor included in GCB on generator transformer side (nF/phase)		
1.45	a) DOP of GCB local control panel b) Is DOP type test certificate for GCB LCP enclosed?		
1.46	Whether cable glands and lugs are included as per the specn.?		
1.47	Whether all interconnecting cables between various equipment of GCB and associated devices in bidder's scope are included?		
1.48	Whether sufficient quantity and types of spares are included for start up & commissioning of specified no. of GCBs?		
1.49	No. of series isolators provided per GCB on: Gen. trfr. side: Generator side:		
1.50	No. of earth-switches provided per GCB on: Gen. trfr. side: Generator side:		
1.51	Catalogues attached for GCB: for series isolator: for earth-switch:		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	
		Rev. : 02	
		Page : 6 of 8	

1.52	Earth switch		
	a) Manufacturer b) Country of manufacture c) Type designation d) Reference Standard e) Rated service voltage f) Rated frequency g) Rated normal current at 50 deg C h) Rated short time withstand current i) Rated peak withstand current j) Rated power frequency withstand voltage k) Rated impulse withstand voltage l) No. of poles per switch m) No. of control mechanism per switch n) Ambient air temp. limits o) Control circuit suitable for aux. supply voltage of? p) Mechanism motor suitable for aux. supply voltage of?		
1.53	Series isolator		
	a) Manufacturer b) Country of manufacture c) Type designation		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	IIB	
		Rev. : 02	
		Page : 7 of 8	

	d) Reference Standard e) Rated service voltage f) Rated frequency g) Rated normal current at 50 deg C h) Is series isolator fully compatible with GCB in respect of normal current ratings at various ambient temperatures? i) Rated short time withstand current j) Rated peak withstand current k) Rated power frequency withstand voltage l) Rated impulse withstand voltage m) No. of poles per switch n) No. of control mechanism per switch o) Ambient air temp. limits p) Control circuit suitable for aux. supply voltage of? q) Mechanism motor suitable for aux. supply voltage of?		
1.54	a) Whether all type tests have been conducted on GCB as per ANSI/IEEE C37.013 latest version? b) Have all the type tests been carried out at independent test laboratories?		
1.55	Summary of Type test reports for GCB enclosed as Annex. No.		
1.56	Whether the offer includes performance of all site tests specified in the spec.?		
1.57	a) Whether all type tests have been		

	1 x 600MW RAYALSEEMA EXTN.	Doc. No. PE-TS-307-510-E001	
		Volume	Section
		IIB	
	TECHNICAL SPECIFICATION FOR GENERATOR CIRCUIT BREAKER	Rev. : 02 Page : 8 of 8	

	<p>conducted on series isolator as per IEC 129?</p> <p>b) Summary of Type test reports for series isolator enclosed as Annex. No.</p>		
1.58	<p>a) Whether all type tests have been conducted on earth-switch as per IEC 129?</p> <p>b) Summary of Type test reports for earth-switch enclosed as Annex. No.</p>		
1.59	<p>a) Project sites and dates of commissioning of GCBs of same model and type (as quoted in 1.01 of this data sheet) - indicate for two earliest installations</p> <p>b) Does the equipment offered meet requirements of clause 2.29.00 of this specification</p>		