

NTPC LTD

***TELANGANA SUPER THERMAL POWER
PROJECT PHASE-1 (2X800MW)***

***TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR (ESP Package)***

BHEL DOCUMENT NO. : EPD-TS-CPBG-CPJ005-06, REV-0



**BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012**



**TELANGANA SUPER THERMAL POWER
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LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. : EPD-TS-CPBG-
CPJ005-06

VOLUME II-B

SECTION -

REVISION
0

DATE: 25/05/2018

SHEET 1 OF 1

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>
1.	TITLE SHEET
2.	CONTENTS
3.	INSTRUCTIONS FOR BIDDERS-F
4.	PROVENESS CRITERIA
5.	PROJECT INFORMATION
6.	SEC- A_SCOPE OF ENQUIRY
7.	TECHNICAL SPECIFICATION FOR LV SWITCHGEAR
8.	LT SWITCHGEAR DATASHEET
9.	PRICE SCHEDULE _ANNEXURE-A
10.	BOARDWISE BOM_ ANNEXURE-B
11.	MODULE WISE BOM_ANNEXURE-C
12.	UNIT PRICE SCHEDULE _ANNEXURE-D
13.	STANDARD E&C_ANNEXURE-E
14.	DRGS AND DISTBTN SCHDLE _ANNEXURE-K
15.	LIST OF CODES AND STANDARDS_ANNEXURE-M
16.	PACKING STANDARDS_ANNEXURE-P
17.	MANUFACTURING QUALITY PLAN FOR LV SWGR, LPBS, LMS
18.	MAKE OF COMPONENT

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

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



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REV NO. : 00 DATE: 24-05-2018

SHEET : 1 OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Sub-Qualifying Requirements Data to be filled in to meet the proveness requirements for LT Switchgears.
 - b) Un-priced copy of Annexure-A, B,C, D, E duly stamped and signed by the bidder.
 - c) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - d) No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.
 - e) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - f) A copy of sheet "List Of Contents" duly stamped and signed by the bidder.
 - g) Technical deviation/ clarification, if any
 - h) No. Of Breaker panels, No. of MCC panels, Weight & Dimensions of all boards.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. 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.
4. 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.
5. Any changes made by the bidder in the price schedule with respect to the Item description/ quantities, notes etc. from those given in various annexures of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items even if those are not in their manufacturing range.
7. No raw material/Component/Sub Assembly/Assembly/Equipment shall be sourced from China directly or indirectly for manufacture or supply.
8. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
9. Vendor should bring out technical deviation clearly in deviation sheet if any.

BIDDER'S STAMP & SIGNATURE



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SECTION -

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0

DATE: 25/05/2018

SHEET 1 OF 2

PROVENESS REQUIREMENT FOR LV SWITCHGEAR

1. Bidder/ Sub Vendor should have manufactured and supplied at least a total of four hundred & fifty (450) nos. draw out type Air Circuit Breaker Panels and / or draw out Motor Control Centre Panels complete in all respects with fault rating of at least 45kA for 1 sec. and 105kA (peak) under a single order and these panels should have been in successful operation for a period of not less than two (2) years prior to the date of Techno-Commercial bid opening.

2. Bidder/ Sub Vendor should have manufactured and supplied at least one hundred & fifty (150) nos. of Air Circuit Breakers having fault rating of at least 105 kA MAKING and 45 kA BREAKING, and their associated draw out Circuit Breaker Panels having fault withstand of at least 45kA for 1 second, which should have been in successful operation for a period of not less than two (2) years prior to the date of Techno-Commercial bid Opening.

Note: Each Single Front Panel shall be counted as one (1) Panel, Double Front Panel as one (1) Panel and Air Circuit Breaker Panel as one (1) Vertical Panel.



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VOLUME II-B

SECTION -

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0

DATE: 25/05/2018

SHEET 2 OF 2

**Sub-Qualifying Requirements Data to be filled in to meet the proveness
requirements for LT Switchgears**

S.No.	Item	Description
	LT SWITCHGEAR	
1.1		No. of draw out type Air circuit breaker panels and/or draw out motor control centre panels manufactured and supplied complete in all respects, under a single order, with fault rating of at least 45 kA (rms) for 1 sec and 105 kA (peak) which are in successful operation for a period of not less than two years prior to the date of Techno-Commercial bid opening.
1.2		No. of Air circuit breakers having fault rating of at least 105 kA making and 45 kA breaking and their associated draw out circuit breaker panels having fault withstand of at least 45 kA for 1 second which are in successful operation for a period of not less than two (2) years prior to the date of Techno-commercial bid opening.

Note : 1) Certificates from the client for the successful operation for each of the above shall be Submitted.

2) Supporting documents/ reference data as applicable shall be submitted.

Date: (Signature)...

Place: (Printed Name)...

(Designation)...

(Company seal)...

SUB-SECTION-I-B

PROJECT INFORMATION

**TELANGANA SUPER THERMAL POWER PROJECT
PHASE-I (2X800 MW)
STEAM GENERATOR ISLAND PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-9591-101-2**

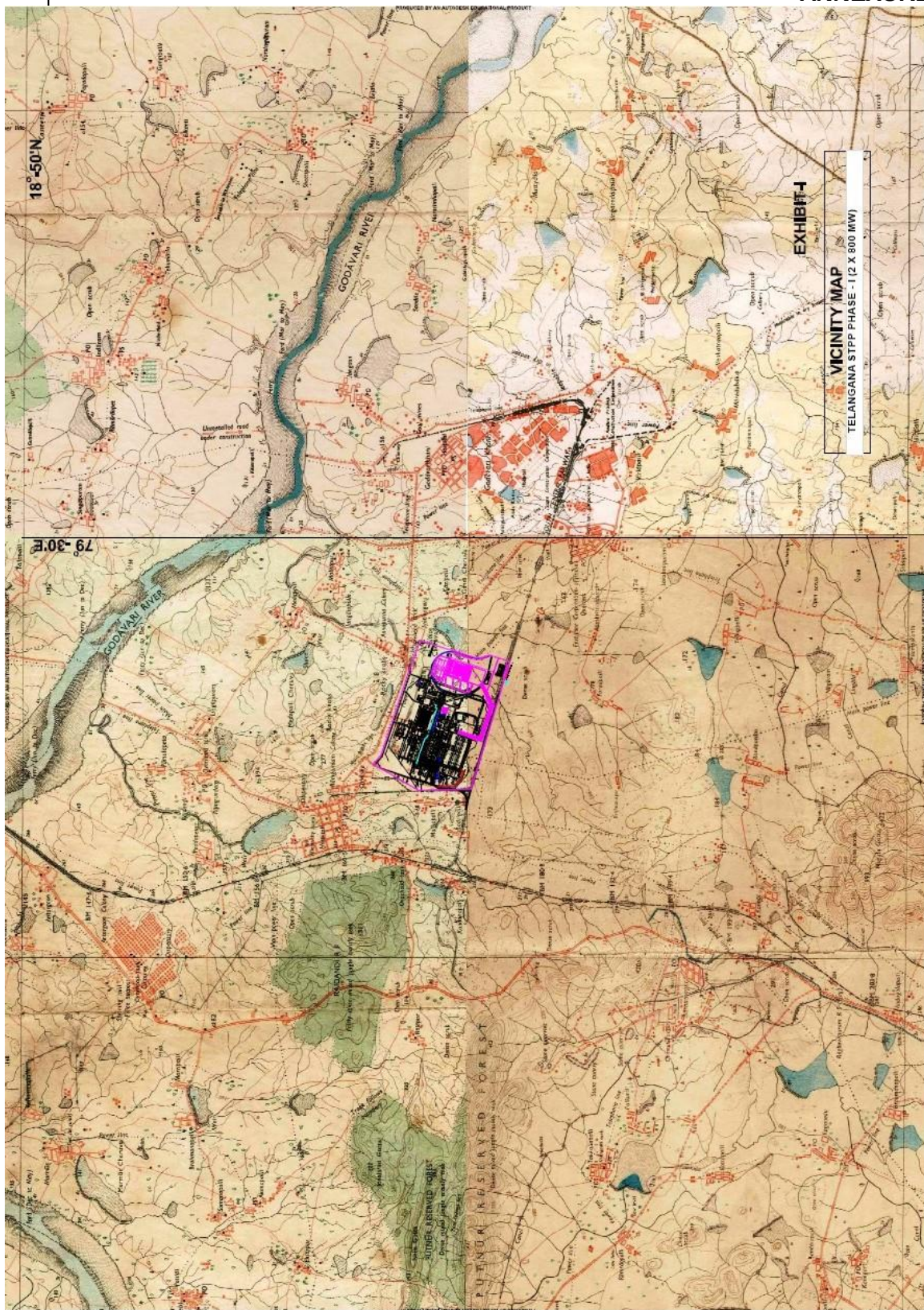
CLAUSE NO.	PROJECT INFORMATION			
	TELANGANA STPP PHASE-I (2X800 MW)			
1.00.00	BACKGROUND Ramagundam Super Thermal Power Project (RSTPP) in District Karimnagar of Telangana was conceived as a coal based super thermal power plant for implementation by NTPC. RSTPP is presently operating with 2600 MW (3x200 MW + 4x500 MW) installed capacity and are under commercial operation. As per A.P. Re-organisation Act 2014, NTPC has been mandated to set up 4000 MW Coal fired thermal power plant for Telangana State. A meeting of NTPC Senior management team with the Hon'ble Chief Minister of Telangana was held on 8th July 2014. Thereafter, a multi-disciplinary team from NTPC made a site visit along with Singareni Collieries Company Limited (SCCL) officials on 7th & 8th August 2014 to explore the land availability around Ramagundam STPS and SCCL area for locating 4000 MW power plant. Based on the team visit, NTPC informed Principal Secretary to Hon'ble Chief Minister, Govt. of Telangana vide dated 22.08.2014 confirming that NTPC is planning to set up 2 units of 800 MW under the name Telangana STPP Phase-I within NTPC's existing Ramagundam Station and 3 units of 800 MW under Phase-II of the project. After examining the various areas surveyed with M/s SCCL officials, it is found that the Phase-II can be set up in the land where M/s BPL Project was to come up at nearby areas (presently under sub-judice) only. Considering the location and optimization of available space at both locations to accommodate 4000 MW, 800 MW units have been proposed.			
2.00.00	PROJECT HIGHLIGHTS			
2.01.00	Location Telangana Super Thermal Power Project (TnSTPP), Phase-I has been located within the MGR unloading bulb of NTPC's Ramagundam Super Thermal Power Station and situated at 18° 44' 47" (N) to 18° 45' 30" (N) and longitude 79° 28' 06" (E) East to 79° 28' 36" (E). TnSTPP is located at about 51 km from district headquarter Karimnagar and at about 1 km near Ramagundam village. The site is well connected through NH-07 and NH-16 through (Hyderabad-Mancheri Road popularly known as Rajiv Rahadari). Nearest railway station Ramagundam is about 5 km from the plant which lies on the main Kazipet-Balarshah Broad Gauge line of South Central Railway. The nearest commercial airport Hyderabad is at a distance of about 210 km. Vicinity Plan of the proposed project is placed at Annexure -I.			
3.00.00	BASIC INPUTS			
3.01.00	Land The proposed two units of 800 MW capacity will be set up in the available land (about 250 acre) in MGR unloading bulb area within existing premises of RSTPP. For ash disposal land at two different locations has been identified. First location is 662 acre plot (one of three plots allotted to M/s BPL power plant. However, all the three plots have been taken back by State Govt. due non development and are sub-judice) / Govt. land to			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 1 OF 15

CLAUSE NO.	PROJECT INFORMATION 			
3.02.00 3.03.00 3.03.01 3.03.02 3.03.03 4.00.00	the tune of 600 acre being offered by State Govt. and the second is Medipally mine void of M/s SCCL. The initial disposal area (662 acre plot earlier allotted to M/s BPL) is located at about 10 km from the plant. The alternate Govt. land (600 acre) is located at about 12 km. Both Bottom ash and fly ash will be disposed-off to above area till the Medipally mine void made available for disposal. Subsequently, fly ash will be disposed-off in mine void, located about 10 km from the plant, while bottom ash will continue to be disposed-off in first location (662 acre plot) / the alternate Govt. land (600 acre). Water The expected source of water for the project is from Yellampally Barrage, on Godavari River, at a distance of about 12 km from the proposed plant. Special Chief Secretary (Energy) have assured that water shall be made available for the proposed power plant. Make up water requirement for this project would be about 4600 cum/hr (about 45 Cusecs) with ash water recirculation system and about 5900 cum/hr (about 58 Cusecs) with once through ash water system. Re-circulating type CW system with Induced draft cooling towers have been envisaged for the project. FUEL Coal Requirement, Availability and Linkage Coal requirement for the project is estimated about 6.73 million tonne/annum (about 18430 T/day) corresponding to 90% PLF considering station heat rate of 2247.97 kcal/kWh. Presently coal is received from SCCL and the same is transported through MGR system. Govt. of Telangana has conveyed in-Principal approval for transfer of coal linkage accorded to erstwhile BPL plant for 600 MW (3.5 MTPA) to NTPC for the project vide letter from Govt. of Telangana dated 13.10.2014. Further, Govt. of Telangana has requested Ministry of coal (MoC), Govt. of India vide letter dated 04.10.2014 to allot 8 MTPA coal for Telangana STPP Phase-I (2x800 MW) starting from 01.04.2018 and 12 MTPA for Telangana STPP Phase-II (3x800 MW) effective from 01.04.2019. Considering the limitation in coal availability from SCCL, coal may be received either from SCCL or other sources i.e. MCL & SECL through Indian railways. The primary fuel for the main steam generator shall be coal. The domestic coal quality parameters are indicated in Annexure-IV-2 and imported coal parameters are indicated in Annexure-IV-4. Coal Transportation Coal is envisaged to be transported to site through Indian Railway System. Fuel Oil The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Light Diesel oil (LDO) having the characteristics given at Annexure-IV-1 and HSD Oil characteristics given at Annexure-IV-3. CAPACITY Telangana STPP, Phase-I : 2x800 MW - Present proposal			
	TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	
	SUB-SECTION-IB PROJECT INFORMATION		PAGE 2 OF 15	

CLAUSE NO.	PROJECT INFORMATION 			
5.00.00	Telangana STPP, Phase-II : 3x800 MW - Future MODE OF OPERATION Base Load			
6.00.00	BENEFICIARY STATES It is proposed that 100% power will be allocated to Telangana State subject to approval by Ministry of Power.			
7.00.00	METEOROLOGICAL DATA The meteorological data from nearest observatory (Ramagundam) is placed at Annexure-II .			
8.00.00	Plant Water Scheme The Plant water scheme is included in Part-E of Technical Specification.			
8.01.00	Condenser Cooling (CW) Water System It is proposed to provide re-circulating type CW system with cooling towers. For the re-circulating type CW system it is proposed to supply clarified water as make up. Clarified water shall be pumped to the cold water channel of CW system. CW system shall be operated at a design minimum cycle of concentration (C.O.C) of about 5. Chemical treatment programme (using acid dosing and scale cum corrosion inhibitors dosing) may be employed in addition to blow down of CW water to control the CW system chemistry. The expected circulating water analysis is given in this sub-section. CW blowdown shall be drawn from the discharge of CW pumps and the same shall be led to fire water tank, ash water tank, CHP and dust suppression system. For carrying circulating water from CW pump house to TG-area and from TG area to cooling tower, steel lined concrete encased duct would be provided. For interconnecting CW duct with CW pump, condenser and cooling towers, steel pipes would be used. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.			
8.02.00	Equipment Cooling Water (ECW) System (Unit Auxiliaries) The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralized (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from CW system in a secondary circuit. The station auxiliaries such as Air compressors, Compressors of ash handling plant, compressor of mill reject system etc. shall also be cooled by Demineralized (DM) water in a closed circuit .The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator & auxiliaries and TG & its auxiliaries.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 3 OF 15

CLAUSE NO.	PROJECT INFORMATION 		
8.03.00	Ash Water System (a) It is proposed to operate ash water system in a closed circuit. The ash water from the ash dyke shall be re-circulated. During re-circulation mode, the make up to the ash water system (to compensate for the ash water blow down and evaporation loss in ash dyke) shall be supplied from CW blow down. (b) During initial stage when decanted ash water is not available, the ash water system shall be operated in once through mode and make up water to ash water system shall be given from CW blow down as well as raw water system.		
8.04.00	Other Miscellaneous Water Systems (a) CW system blow down water shall be used for meeting the Fly ash and bottom ash system requirement etc. (b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (plant effluent) collected from various areas shall be treated using oil skimmer, tube settlers, coal settling pits etc. as per requirement and treated water from effluent treatment plant shall be recycled back to the service water system for re-use. (b) The drinking water requirement of the plant shall be provided from water treatment plant. (c) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water shall be provided from demineralising plant. (d) The quality of Cooling Water & DM Water is enclosed with this sub-section as Annexure-III. (e) Effluent from various areas in TG & SG system shall be collected in respective pits in their areas and pumped to a common terminal point as shown in plant water scheme. Pits in respective areas along with pumps (2x100%) in each pit along with drives, piping, valves, fittings etc. shall be in bidder's scope.		
9.00.00	Criteria for Earthquake Resistant Design of Structures and Equipment All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section.		
10.00.00	Criteria for Wind Resistant Design of Structures and Equipment All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part-B of this section.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION PAGE 4 OF 15

CLAUSE NO.	PROJECT INFORMATION			
11.00.00	PARAMETERS FOR DESIGN / SIZING / GUARANTEES / OPERATING CAPABILITIES Tentative parameters to be used for design, sizing, guarantees and operating capabilities of Steam Generator(s) and other equipments /systems/auxiliaries etc. are given at Annexure-V-1 and Annexure-V-2 of this Sub-Section. These parameters are tentative and are for tender purpose only. Final parameters shall be intimated to the successful Bidder after finalization of Turbine Generator Island Package and hence the bidder shall keep provision for minor variation in these parameters. Annexure-V-1 gives Steam and feed water parameters under "Boiler Maximum Continuous Rating" (BMCR) conditions. Annexure-V-2 provides steam and feed water parameters under guarantee conditions i.e Valve Wide Open (VWO) 105% Turbine Maximum Continuous Rating (TMCR) & 100% TMCR load and pure sliding pressure operation of the unit at 100% TMCR, 80%TMCR, 60%TMCR & 50%TMCR. Further, Annexure-V-2 also gives Steam and feed water parameters at 800 MW load condition with both stream of HPHs out of service. All stipulated design and operating capabilities of steam generators and other equipments/systems/auxiliaries under SG Package shall be achievable under pure sliding pressure operation of the unit, without violating any design/sizing/selection stipulation or exceeding any design/safety limits. All quoted guarantees etc. shall be with reference to parameters indicated for VWO (105%TMCR) and 100% TMCR conditions in this Table.			
12.00.00	Capability of boiler while firing upto 30% imported coal blend Steam Generator and its auxiliaries shall also be capable of obtaining maximum continuous rating as specified when firing upto 30% imported coal blended with Indian coal as specified in Annexure-V-1. Typical imported coal parameters are enclosed as Annexure-IV-4 for information of bidder. System redundancies/ margins on equipment/ auxiliary sizing need not be available under such fuel firing condition unless specifically mentioned otherwise. However, equipments/ systems shall not exceed their safety limits under such firing, and shall not transgress in to factors of safety as per specification/ codes.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 5 OF 15

CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC
	ANNEXURE-I			
				
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 6 OF 15	

स्टेशन : रामगुंडम
STATION : Ramgundam

अक्षांश LAT 18°46' N LONG 79°26' E
समुद्री सतथ से ऊँचाई 156 METRES

जलवायवी सारणी
CLIMATOLOGICAL TABLE

1951 से 1980 तक के प्रयोग पर आधारित
BASED ON OBSERVATIONS FROM 1951 TO 1980

माह	वायु तापमान										वर्षा									
	AIR TEMPERATURE										RAINFALL									
	स्टेशन LOWEST PRESSURE	DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	DATE AND YEAR HIGHEST	DATE AND YEAR LOWEST	RELATIVE HUMIDITY	ALL CLOUDS	LOW CLOUDS	MONTHLY TOTAL	NO OF RAINY DAYS	TOTAL IN WETTEST MONTH WITH YEAR	TOTAL IN DRIEST MONTH WITH YEAR	HEAVIEST FALL IN 24 HOURS	DATE AND YEAR	MEAN WIND SPEED	
एच.पी.ए. HPa	हि.से. °C	हि.से. °C	हि.से. °C	हि.से. °C	हि.से. °C	हि.से. °C	हि.से. °C	हि.से. °C	हि.से. °C	प्रतिशत %	एच.पी.ए. HPa	एच.पी.ए. HPa	प्रतिशत %	ओल्ड्स ऑफ द डे Olds of day	मि.मि. mm	मि.मि. mm	मि.मि. mm	मि.मि. mm	कि.मी. प्र.घं. Kmph	
जनवरी JAN	I 998.1	20.0	16.4	30.8	15.8	33.3	10.9	35.3	28 1974	8.4 1972	68 37	15.9 14.5	1.7 0.7	7.8 0.5	53.0 1966	0.0 47.6	0.0 1379	20 1979	4.5	
फरवरी FEB	I 996.2	23.0	18.0	33.9	18.8	37.1	13.8	39.4	29 1960	9.4 1949	60 30	16.8 14.1	1.7 0.8	5.1 0.6	32.4 1975	0.0 24.0	0.0 1968	21 1988	5.3	
मार्च MAR	I 994.4	26.8	20.2	37.5	22.3	40.6	17.4	42.8	27 1953	13.0 1979	53 25	18.3 14.1	1.7 0.8	12.0 1.0	71.6 1951	0.0 39.2	0.0 1970	05 1970	6.4	
अप्रैल APR	I 991.6	30.2	23.1	40.3	26.2	43.6	21.5	45.6	29 1973	15.4 1971	53 25	22.5 16.6	2.3 0.7	15.7 1.1	68.6 1962	0.0 62.0	0.0 1961	24 1981	7.9	
मई MAY	I 987.6	32.9	23.9	42.4	29.0	45.6	23.8	47.2	19 1968	20.4 01	46 25	22.3 17.9	2.6 0.9	28.4 2.0	142.2 1977	0.0 111.2	0.0 1977	01 1977	7.9	
जून JUN	I 985.4	30.0	24.3	37.8	27.1	43.8	22.4	47.2	08 1953	19.4 1973	63 45	25.7 24.1	5.3 2.1	171.3 8.4	366.8 1956	0.0 140.7	0.0 1953	20 1953	8.4	
जुलाई JUL	I 985.4	27.0	24.2	32.5	24.5	36.8	22.0	41.0	06 1968	18.8 14	79 65	28.0 26.0	6.6 3.9	309.2 15.2	599.6 1976	104.3 130.7	0.0 1977	23 1977	7.0	
अगस्त AUG	I 986.4	26.4	24.1	31.6	24.2	35.0	22.2	37.4	28 1960	19.8 31	82 68	28.1 28.2	6.4 3.6	243.8 13.8	487.4 1953	59.6 104.4	0.0 1961	21 1961	5.8	
सितम्बर SEP	I 989.0	26.9	24.3	32.5	24.1	35.7	21.8	38.0	02 1968	17.8 30	80 66	28.4 27.7	5.1 2.3	190.7 9.2	404.8 1966	85.8 128.0	0.0 1969	20 1969	4.8	
अक्टूबर OCT	I 993.1	26.1	22.8	33.1	22.3	35.9	18.1	38.4	11 1957	15.4 14	75 55	25.2 23.2	3.1 2.1	94.5 4.4	539.6 1971	0.0 135.8	0.0 1973	24 1973	3.9	
नवम्बर NOV	I 996.7	22.8	19.0	31.2	18.1	33.9	13.8	36.6	06 1977	9.0 30	69 46	19.1 17.7	2.2 0.7	18.8 1.2	118.0 1962	0.0 70.2	0.0 1961	05 1961	3.5	
दिसम्बर DEC	I 998.5	19.7	16.3	29.9	14.9	32.6	11.0	34.5	26 1976	7.8 10	69 41	16.0 14.9	2.7 0.5	9.7 0.6	109.4 1962	0.0 101.2	0.0 1962	02 1962	3.2	
वार्षिक योग ANNUAL TOTAL	991.9	26.0	21.4	34.5	22.3	45.7	9.9	47.2	7.8	3.4	66	22.2	3.4 1.5	1107.0 58.0	1672.8 1973	565.2 1952	140.7 33	5.7 24		
औसत MEAN	987.9	32.4	22.8	30	30	30	30	33	33	33	30	30	30	24	30	33	33	33	24	

CLAUSE NO.	PROJECT INFORMATION				एनटीपीसी NTPC
	ANNEXURE-III				
	COOLING WATER ANALYSIS				
	S.No	Constituent	As	mg/l	
	1	Calcium	CaCO ₃	104	
	2	Magnesium	CaCO ₃	88	
	3	Sodium	CaCO ₃	59	
	4	Potassium	CaCO ₃	4	
		Total cations	CaCO ₃	255	
	5	HCO ₃	CaCO ₃	155	
	6	P- Alkalinity	CaCO ₃	0	
	7	Chloride	CaCO ₃	54	
	8	Sulphate	CaCO ₃	46	
		Total Anions	CaCO ₃	255	
	9	Silica, Reactive	Si	5	
	10	Iron (Total)	Fe	0.5	
	11	pH	-	7.0-7.8	
	12	Turbidity	NTU	10	
13	Total dissolved solids		250-300		
14	Temperature	Deg C	20-35		

CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC
	ANNEXURE-III			
	ANALYSIS OF DM WATER TO BE USED FOR MAKE-UP WATER TO CONDENSER			
	Sl.No.	Characteristics	Value	
	1.	Silica (Max.)	0.02 ppm as Sio2	
	2.	Iron as Fe	Nil	
	3.	Total hardness	Nil	
	4.	pH value	6.8 -7.2	
	5.	Conductivity	Not more than 0.1micro mho/cm excluding the effects of free CO2	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2		SUB-SECTION-IB PROJECT INFORMATION
				PAGE 9 OF 15

CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC
	ANNEXURE-IV-1			
	TABLE-1			
	LIGHT DIESEL OIL CHARACTERISTICS			
	AS PER IS 15770-2008			
	Characteristics	LDO		
	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively		
	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0		
	3. Sediment percent by mass (max)	0.10		
	4. Total sulphur percent by mass (max)	1.5		
	5. Ash percentage by mass (max)	0.02		
	6. Carbon residue (Rams bottom) percent by pass (max.)	1.50		
	7. Acidity inorganic	Nil		
	8. Flash point (Min.) - Pensky Martens	66 deg.C		
	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2		
	10. Water content, % by volume (max)	0.25		
	11. GCV(kcal/kg)	10,000		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2		SUB-SECTION-IB PROJECT INFORMATION
				PAGE 10 OF 15

CLAUSE NO.	PROJECT INFORMATION					
	एनटीपीसी NTPC					
	ANNEXURE-IV-2					
	TABLE-1 – A					
	DOMESTIC COAL CHARACTERISTICS					
S No.	Characteristics (As received basis)	Range of 95% coal supplies			Range of 5% coal supplies	
		Column -1	Column-2	Column-3	Range of Adequacy coal	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	Worst	Best
1.1	Total Moisture (%)	14	17	11.5	17.5	10
1.2	Ash (%)	40	44	34	44.5	32
1.3	Volatile matter (%)	22	19	24	18.75	25
1.4	Fixed carbon (%)	24	20	30.5	19.25	33
2.0	ULTIMATE ANALYSIS					
2.1	Carbon (%)	34	30	41.65	28.85	44.41
2.2	Hydrogen (%)	3.1	2.3	3.4	2.3	3.5
2.3	Sulphur (%)	0.4	0.6	0.35	0.6	0.35
2.4	Nitrogen (%)	1.2	0.9	1.23	0.84	0.57
2.5	Oxygen (%) (By difference)	7.3	5.2	7.87	5.41	9.17
2.6	Total Moisture (%)	14	17	11.5	17.5	10
2.7	Ash (%)	40	44	34	44.5	32
2.8	GCV (kcal/kg)	3500	3000	4200	2900	4400
2.9	Hard grove index	50	45	70	45	70
2.10	YGP Index (mg/kg)	75	80	70	85	65
3.0	ASH ANALYSIS					
3.1	Silica (%)	58.59	56.81	60.2	56.29	60.42
3.2	Alumina (%)	26.77	27.42	26.1	27.5	25.9
3.3	Iron Oxide (%)	8.8	9.8	7.8	10.1	7.6
3.4	Titania (%)	1.66	1.78	1.56	1.86	1.52
3.5	Phosphoric Anhydride (%)	0.19	0.1	0.24	0.08	0.32
3.6	Lime (%)	1.39	1.48	1.32	1.52	1.28
3.7	Magnesia (%)	1	1.13	0.97	1.17	0.92
3.8	Sulphuric Anhydride (%)	0.05	0.04	0.1	0.04	0.15
3.9	Sodium Oxide (%)	0.2	0.08	0.4	0.08	0.5
3.10	Balance Alkalies (By Difference) (%)	1.35	1.36	1.31	1.36	1.39
4.0	ASH FUSION RANGE (Under reducing atmosphere)					
4.1	Initial Deformation Temperature (degree Celsius)	1150	1100	1200	1100	1200
4.2	Hemispherical temperature (degree Celsius)	1300	1250	1350	1250	1350
4.3	Flow temperature (degree Celsius)	1400	1350	1400	1350	1400
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2		SUB-SECTION-IB PROJECT INFORMATION		PAGE 11 OF 15

CLAUSE NO.	PROJECT INFORMATION			
	TABLE-2 ANNEXURE-IV-3 HIGH SPEED DIESEL OIL CHARACTERISTICS [AS PER IS 1460-2005 (BS-II)]			
	S. No.	Particulars	Unit	Value
	1.	PHYSICAL PROPERTIES		
		a. Distillation volume recovery @ 350 ⁰ C	% vol. (min)	85
		b. Distillation volume recovery @ 370 ⁰ C	% vol. (min)	95
		c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
		d. Density @ 15 Degree C	kg/m ³	820 – 860
		e. Pour Point		
		- Summer	Degree C (max)	15
		- Winter	Degree C (max)	03
		f. Cold Filter Plugging Point		
		- Summer	Degree C (max)	18
		- Winter	Degree C (max)	06
		g. Flash Point (Abal)	Degree C (max)	35
		h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
	2.	HEATING VALUE		
		a. Higher Heating Value (HHV)	Kcal/Kg	11,000
		b. Lower Heating Value (LHV)	Kcal/Kg	10,300
	3.	ACIDITY		
		a. Inorganic	mg KOH/g	Nil
		b. Total	mg KOH/g	0.2 (max.)
	4.	Copper Strip Corrosion 3 hours @100 ⁰ C	No.	1 (max)
	5.	RCR on 10% residue	% wt.	0.3 (max)
	6.	CONTAMINANTS		
		a. Ash	ppm (wt.)	100 (max)
	b. Sediments	% wt	0.05 (max)	
	c. Total Sulphur	% wt	0.05 (max)	
	d. Water Content	% volume	0.05 (max)	
	e. Trace Metals			
	- Na + K	ppm (wt)	0.30 (max)	
	- Vanadium	ppm (wt)	0.50 (max)	
	- Lead	ppm (wt)	0.50 (max)	
	- Calcium	ppm (wt)	2.0	
	- Ni + Zn	ppm (wt)	Nil	
7.	Nitrogen content (FBN)	% wt.	0.015	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 12 OF 15

CLAUSE NO.	PROJECT INFORMATION एनटीपीसी NTPC																																																																																																																																																										
	ANNEXURE-IV-4 TABLE – 4 TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS <table> <tr> <th data-bbox="419 454 496 483">Sl.No.</th><th data-bbox="523 454 751 521">Characteristics (as received basis)</th><th colspan="2" data-bbox="1010 454 1182 483">Imported Coal</th></tr> <tr> <th></th><th></th><th data-bbox="1058 528 1134 557">Worst</th><th data-bbox="1238 528 1299 557">Best</th></tr> <tr> <td data-bbox="419 600 459 629">1.0</td><td data-bbox="523 600 759 629">Proximate Analysis</td><td></td><td></td></tr> <tr> <td data-bbox="419 636 459 665">1.1</td><td data-bbox="523 636 730 665">Total Moisture (%)</td><td data-bbox="1082 636 1106 665">20</td><td data-bbox="1238 636 1262 665">16</td></tr> <tr> <td data-bbox="419 672 459 701">1.2</td><td data-bbox="523 672 619 701">Ash (%)</td><td data-bbox="1082 672 1106 701">10</td><td data-bbox="1238 672 1262 701">10</td></tr> <tr> <td data-bbox="419 707 459 736">1.3</td><td data-bbox="523 707 730 736">Volatile Matter (%)</td><td data-bbox="1082 707 1106 736">30</td><td data-bbox="1238 707 1262 736">45</td></tr> <tr> <td data-bbox="419 743 459 772">1.4</td><td data-bbox="523 743 722 772">Fixed Carbon (%)</td><td data-bbox="1082 743 1106 772">40</td><td data-bbox="1238 743 1262 772">29</td></tr> <tr> <td data-bbox="419 779 459 808">1.5</td><td data-bbox="523 779 627 808">Total (%)</td><td data-bbox="1070 779 1106 808">100</td><td data-bbox="1238 779 1262 808">100</td></tr> <tr> <td data-bbox="419 815 459 844">2.0</td><td data-bbox="523 815 735 844">Ultimate Analysis</td><td></td><td></td></tr> <tr> <td data-bbox="419 851 459 880">2.1</td><td data-bbox="523 851 651 880">Carbon (%)</td><td data-bbox="1066 851 1121 880">56.4</td><td data-bbox="1230 851 1286 880">62.4</td></tr> <tr> <td data-bbox="419 887 459 916">2.2</td><td data-bbox="523 887 679 916">Hydrogen (%)</td><td data-bbox="1082 887 1106 916">4.5</td><td data-bbox="1238 887 1262 916">4.9</td></tr> <tr> <td data-bbox="419 922 459 952">2.3</td><td data-bbox="523 922 659 952">Sulphur (%)</td><td data-bbox="1082 922 1106 952">0.9</td><td data-bbox="1238 922 1262 952">0.8</td></tr> <tr> <td data-bbox="419 958 459 987">2.4</td><td data-bbox="523 958 667 987">Nitrogen (%)</td><td data-bbox="1082 958 1106 987">0.9</td><td data-bbox="1238 958 1262 987">0.5</td></tr> <tr> <td data-bbox="419 994 459 1023">2.5</td><td data-bbox="523 994 831 1023">Oxygen (%) (By difference)</td><td data-bbox="1082 994 1106 1023">7.3</td><td data-bbox="1238 994 1262 1023">5.4</td></tr> <tr> <td data-bbox="419 1030 459 1059">2.6</td><td data-bbox="523 1030 699 1059">Carbonates (%)</td><td data-bbox="1082 1030 1090 1059">0</td><td data-bbox="1238 1030 1246 1059">0</td></tr> <tr> <td data-bbox="419 1066 459 1095">2.7</td><td data-bbox="523 1066 719 1095">Phosphorous (%)</td><td data-bbox="1082 1066 1090 1095">0</td><td data-bbox="1238 1066 1246 1095">0</td></tr> <tr> <td data-bbox="419 1102 459 1131">2.8</td><td data-bbox="523 1102 730 1131">Total Moisture (%)</td><td data-bbox="1082 1102 1106 1131">20</td><td data-bbox="1238 1102 1262 1131">16</td></tr> <tr> <td data-bbox="419 1137 459 1167">2.9</td><td data-bbox="523 1137 619 1167">Ash (%)</td><td data-bbox="1082 1137 1106 1167">10</td><td data-bbox="1238 1137 1262 1167">10</td></tr> <tr> <td></td><td data-bbox="523 1173 587 1202">Total</td><td data-bbox="1070 1173 1106 1202">100</td><td data-bbox="1238 1173 1262 1202">100</td></tr> <tr> <td data-bbox="419 1209 475 1238">2.10</td><td data-bbox="523 1209 691 1238">GCV (Kcal/Kg)</td><td data-bbox="1066 1209 1121 1238">5800</td><td data-bbox="1225 1209 1281 1238">6500</td></tr> <tr> <td data-bbox="419 1245 475 1274">2.11</td><td data-bbox="523 1245 722 1274">Hard Grove Index</td><td data-bbox="1082 1245 1106 1274">45</td><td data-bbox="1238 1245 1262 1274">60</td></tr> <tr> <td data-bbox="419 1281 475 1310">2.12</td><td data-bbox="523 1281 671 1310">YGP (mg/kg)</td><td data-bbox="1070 1281 1106 1310">100</td><td data-bbox="1238 1281 1262 1310">70</td></tr> <tr> <td data-bbox="419 1317 459 1346">3.0</td><td data-bbox="523 1317 683 1346">Ash Analysis</td><td></td><td></td></tr> <tr> <td data-bbox="419 1352 459 1382">3.1</td><td data-bbox="523 1352 711 1382">Silica (SiO₂) (%)</td><td data-bbox="1066 1352 1121 1382">32.74</td><td data-bbox="1230 1352 1286 1382">34.94</td></tr> <tr> <td data-bbox="419 1388 459 1417">3.2</td><td data-bbox="523 1388 751 1417">Alumina(Al₂O₃) (%)</td><td data-bbox="1070 1388 1106 1417">30.5</td><td data-bbox="1230 1388 1286 1417">28.43</td></tr> <tr> <td data-bbox="419 1424 459 1453">3.3</td><td data-bbox="523 1424 794 1453">Iron Oxides(Fe₂O₃) (%)</td><td data-bbox="1070 1424 1106 1453">18.2</td><td data-bbox="1230 1424 1262 1453">15.2</td></tr> <tr> <td data-bbox="419 1460 459 1489">3.4</td><td data-bbox="523 1460 679 1489">Titania (TiO₂)</td><td data-bbox="1070 1460 1106 1489">1.56</td><td data-bbox="1230 1460 1262 1489">1.76</td></tr> <tr> <td data-bbox="419 1496 459 1525">3.5</td><td data-bbox="523 1496 895 1525">Phosphoric Anhydride(P₂O₅) (%)</td><td data-bbox="1070 1496 1106 1525">0.44</td><td data-bbox="1230 1496 1262 1525">0.54</td></tr> <tr> <td data-bbox="419 1532 459 1561">3.6</td><td data-bbox="523 1532 699 1561">Lime (CaO) (%)</td><td data-bbox="1070 1532 1106 1561">6.12</td><td data-bbox="1230 1532 1262 1561">7.62</td></tr> <tr> <td data-bbox="419 1568 459 1597">3.7</td><td data-bbox="523 1568 759 1597">Magnesia (MgO) (%)</td><td data-bbox="1070 1568 1106 1597">1.83</td><td data-bbox="1230 1568 1262 1597">1.93</td></tr> <tr> <td data-bbox="419 1603 459 1632">3.8</td><td data-bbox="523 1603 799 1632">Sulphuric Anhydride (%)</td><td data-bbox="1070 1603 1106 1632">6.95</td><td data-bbox="1230 1603 1262 1632">7.65</td></tr> <tr> <td data-bbox="419 1639 459 1668">3.9</td><td data-bbox="523 1639 818 1668">Sodium Oxide (Na₂O) (%)</td><td data-bbox="1082 1639 1106 1668">0.3</td><td data-bbox="1238 1639 1262 1668">0.4</td></tr> <tr> <td data-bbox="419 1675 475 1704">3.10</td><td data-bbox="523 1675 874 1704">Balance alkalies (by difference)</td><td data-bbox="1070 1675 1106 1704">1.36</td><td data-bbox="1230 1675 1262 1704">1.56</td></tr> <tr> <td></td><td data-bbox="523 1711 587 1740">Total</td><td data-bbox="1070 1711 1106 1740">100</td><td data-bbox="1238 1711 1262 1740">100</td></tr> <tr> <td data-bbox="419 1747 459 1776">4.0</td><td data-bbox="523 1747 823 1805">Ash Fusion Temperature reducing temperature</td><td></td><td></td></tr> <tr> <td data-bbox="419 1812 459 1841">4.1</td><td data-bbox="523 1812 855 1841">Initial deformation Temp (°C)</td><td data-bbox="1070 1812 1121 1841">1100</td><td data-bbox="1238 1812 1289 1841">1250</td></tr> <tr> <td data-bbox="419 1848 459 1877">4.2</td><td data-bbox="523 1848 823 1877">Hemispherical Temp. (°C)</td><td data-bbox="1070 1848 1121 1877">1300</td><td data-bbox="1238 1848 1289 1877">1350</td></tr> <tr> <td data-bbox="419 1883 459 1912">4.3</td><td data-bbox="523 1883 715 1912">Flow Temp. (°C)</td><td data-bbox="1070 1883 1121 1912">1400</td><td data-bbox="1238 1883 1289 1912">1400</td></tr> </table>			Sl.No.	Characteristics (as received basis)	Imported Coal				Worst	Best	1.0	Proximate Analysis			1.1	Total Moisture (%)	20	16	1.2	Ash (%)	10	10	1.3	Volatile Matter (%)	30	45	1.4	Fixed Carbon (%)	40	29	1.5	Total (%)	100	100	2.0	Ultimate Analysis			2.1	Carbon (%)	56.4	62.4	2.2	Hydrogen (%)	4.5	4.9	2.3	Sulphur (%)	0.9	0.8	2.4	Nitrogen (%)	0.9	0.5	2.5	Oxygen (%) (By difference)	7.3	5.4	2.6	Carbonates (%)	0	0	2.7	Phosphorous (%)	0	0	2.8	Total Moisture (%)	20	16	2.9	Ash (%)	10	10		Total	100	100	2.10	GCV (Kcal/Kg)	5800	6500	2.11	Hard Grove Index	45	60	2.12	YGP (mg/kg)	100	70	3.0	Ash Analysis			3.1	Silica (SiO ₂) (%)	32.74	34.94	3.2	Alumina(Al ₂ O ₃) (%)	30.5	28.43	3.3	Iron Oxides(Fe ₂ O ₃) (%)	18.2	15.2	3.4	Titania (TiO ₂)	1.56	1.76	3.5	Phosphoric Anhydride(P ₂ O ₅) (%)	0.44	0.54	3.6	Lime (CaO) (%)	6.12	7.62	3.7	Magnesia (MgO) (%)	1.83	1.93	3.8	Sulphuric Anhydride (%)	6.95	7.65	3.9	Sodium Oxide (Na ₂ O) (%)	0.3	0.4	3.10	Balance alkalies (by difference)	1.36	1.56		Total	100	100	4.0	Ash Fusion Temperature reducing temperature			4.1	Initial deformation Temp (°C)	1100	1250	4.2	Hemispherical Temp. (°C)	1300	1350	4.3	Flow Temp. (°C)	1400	1400
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TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 13 OF 15																																																																																																																																																								

CLAUSE NO.	PROJECT INFORMATION		एनटीपीसी NTPC																																	
	Annexure – V-1 Salient data for design and sizing of equipment at BMCR Condition <table><tr><th>Sl. No.</th><th>Description</th><th>BMCR condition, 3% MU, 77 mmHg</th></tr><tr><td>1</td><td>Steam flow at Superheater Outlet (T/hr)</td><td>2580</td></tr><tr><td>2</td><td>Pressure at SH outlet (kg/cm²-abs)</td><td>281</td></tr><tr><td>3</td><td>Pressure at Turbine inlet (kg/cm²-abs)</td><td>270</td></tr><tr><td>4</td><td>Temperature at Superheater outlet (° C)</td><td>603</td></tr><tr><td>5</td><td>Steam flow to Reheater (T/hr)</td><td>1995</td></tr><tr><td>6</td><td>Steam Pressure at HP Turbine Exhaust (Kg/cm²-abs)</td><td>68.3</td></tr><tr><td>7</td><td>Steam temperature at HP Turbine exhaust (°C)</td><td>378</td></tr><tr><td>8</td><td>Steam Temperature at Reheater Outlet (°C)</td><td>603</td></tr><tr><td>9</td><td>Pressure drop through the Reheater including cold and hot Reheat piping (kg/cm²)</td><td>10% of HPT Exhaust Pressure</td></tr><tr><td>10</td><td>Feed Water Temperature at Economizer inlet (°C)</td><td>307.6</td></tr></table> Note : The parameters given here are tentative and will be finalized after receiving form TG supplier.			Sl. No.	Description	BMCR condition, 3% MU, 77 mmHg	1	Steam flow at Superheater Outlet (T/hr)	2580	2	Pressure at SH outlet (kg/cm ² -abs)	281	3	Pressure at Turbine inlet (kg/cm ² -abs)	270	4	Temperature at Superheater outlet (° C)	603	5	Steam flow to Reheater (T/hr)	1995	6	Steam Pressure at HP Turbine Exhaust (Kg/cm ² -abs)	68.3	7	Steam temperature at HP Turbine exhaust (°C)	378	8	Steam Temperature at Reheater Outlet (°C)	603	9	Pressure drop through the Reheater including cold and hot Reheat piping (kg/cm ²)	10% of HPT Exhaust Pressure	10	Feed Water Temperature at Economizer inlet (°C)	307.6
Sl. No.	Description	BMCR condition, 3% MU, 77 mmHg																																		
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TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2	SUB-SECTION-IB PROJECT INFORMATION																																	
			PAGE 14 OF 15																																	

CLAUSE NO.	PROJECT INFORMATION एनटीपीसी NTPC							
	Annexure-V-2 Salient data for design and sizing of equipment at Pure Sliding Pressure Condition							
Sl.No.	Description	105% TMCR Guarantee condition	100% TMCR Guarantee condition	800MW (100%) PSP condition	640 MW (80%) PSP condition	480 MW (60%) PSP condition	400 MW (50%) PSP condition	800 MW (Both stream of HPHs out of service)
1	Steam flow at Superheater Outlet (T/hr)	2470.6	2324.5	2320.1	1821.4	1353.1	1127.9	1927.5
2	Pressure at Turbine inlet (kg/cm2-abs)	270	270	262	207	155	130	270
3	Pressure at SH Outlet (kg/cm2-abs)	To be derived by the bidder based on the SH outlet Pressure of 281 kg/cm2 (abs) at BMCR condition						
4	Temperature at Superheater outlet (°C)	603	603	603	603	603	603	603
5	Steam flow to Reheater (T/hr)	1998	1889	1885	1509.2	1146.4	967.4	1923.6
6	Steam Pressure at HP Turbine exhaust (Kg/cm2-abs)	68.7	65	64.9	52.3	40	33.8	68.8
7	Steam temperature at HP Turbine exhaust (°C)	378.5	373.5	375.5	381.2	387.5	390.9	391.2
8	Steam Temperature at Reheater Outlet (°C)	603	603	603	603	603	603	603
9	Pressure drop through the Reheater including Cold and Hot Reheater piping (kg/cm2)	10% of HPT Exhaust Pressure for BMCR condition and correspondingly lower for different conditions						
10	Feed Water Temperature at Economizer inlet (°C)	308.4	305	305.2	292.9	277	266.9	187.6
	Notes : (1) The parameters given here are tentative and will be finalized after receiving form TG supplier. (2) The above parameters are at 0% Make-up with average condenser back pressure of 77 mm of Hg. (3) The Final Feed Water Temperature during All HP heater out can go down till 176°C.							
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE			TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9591-101-2			SUB-SECTION-IB PROJECT INFORMATION		PAGE 15 OF 15

VOLUME - IIB

SECTION – 'A'

SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, relay parameterization and site support, one suitable Ethernet switch per board, inspection and testing at manufacturer's works, proper packing and delivery to site of **LOW VOLTAGE SWITCHGEAR** as mentioned in different sections of this specification for 2x800MW TELENGANA SUPER THERMAL POWER PROJECT PHASE-I.
- 2.0 It is not the intent to specify herein all the details of design & 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 vendor's guarantee.
- 3.0 The general terms and conditions, instruction to tenderer and other attachment referred to elsewhere are hereby made part of the tender specification.
- 4.0 The tendered shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Deviations, if any should be brought out very clearly on deviation sheet enclosed with specification only. Otherwise it will be presumed that the tenderer's offer is in line with what has been stated/ asked for in this specification.
- 6.0 The offer should be complete with technical data, catalogues, brochures and drawings as applicable.
- 7.0 Qualification data: In order to be able to propose to the client the proven-ness of the equipments/ item offered, the bidder is required to elaborate details of experience, capabilities, reference list etc. in the offer.
- 8.0 The documents shall be in English language and MKS system of units.

SUB-SECTION – B-06

LT SWITCHGEARS & LT BUSDUCTS

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	DESIGN PHILOSOPHY / PRACTICE FOR LV BOARD SIZING The sizing of LV boards shall be primarily dependent on the following conditions such as total load connected onto a Board, diversity factors for various loads connected, Fault Level and Voltage Regulation Considerations. As far as practicable the system shall provide segregated supplies to main and standby auxiliaries so that failure of supply to main auxiliary shall in no way jeopardize the standby auxiliary feed. Automatic changeover at critical switchgear/ MCC sections shall be provided as necessary to prevent the loss of a unit or to ensure the equipment safety.			
1.01.00	Design Considerations:			
1.01.01	Sizing of LT boards a) Input KVA for a Drive = (Rating KW X Load Factor) / (Efficiency X Power Factor) where values of load factor , power factor and efficiency are defined below: b) Load (service) factor for 415 V loads is taken as 0.85 c) Power factor 415 V Uni-Directional drives is taken as 0.8 and efficiency as 0.85 d) Power factor of 415 V bidirectional drive Loads is taken as 0.65 and efficiency as 0.8 for motor rating less than 15 KW For motor ratings above 15 KW and above the corresponding values are 0.75 and 0.8. e) The Finally selected Bus Bar ratings for switchboards, MCC s and ACDB and Busduct shall include a 10 % margin over the calculated values. f) The LDB' s shall be considered to be loaded to 70 % of their KVA rating Lighting load of 100KVA shall be considered on each section of main switchgears with incomer from transformer as indicated in the tender SLD. g) A spare capacity of about 10 % shall be kept for addition of loads during detail engineering as many of the LT loads cannot be predicted during the Rating selection of the Board. h) Busbar Ratings of valves/dampers boards shall be derived by summing up to 5% of the total KVA load connected. With the largest Value /damper Connected. i) ESP consumption for 100 % BMCR operation shall be considered and further this load shall be uniformly divided among ESP Switchgears.			
1.02.00	Layout Criteria The switchboards can be split into two sections based on layout constraints in case of long switchboards to optimize Switchgear room layouts. The two sections of the split shall be connected by Bus duct/Cable as per layout requirements.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 1 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS 	
1.03.00	Spare capacity and Future Requirements Each of the LV switchboards shall be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 20% spare modules of each rating and type of module.	
1.04.00	Standardization The LV Boards shall be fed through either LT auxiliary transformers. MCC, and Distributed boards are fed further through these main boards. The Standard rating of the main boards fed through Unit Auxiliary Service Transformers shall be 4000 Amp .Other Standard ratings used shall be 3000,2500, 2000 Amp, 1600 Amp, 1000 Amp, 600 Amp, 400 & 250 Amp. Preferred ratings for LV Busduct rating are 4000 Amp, 3000 Amp, 2500 Amp and 1600 amp. It shall be preferred to have all LV Switchboards for the entire plant from a One/Two/Three manufacturer from maintainability and spares management point of view. It shall be preferred to follow a standardization of Terminal Numbers across all LV Modules for ease of Interconnection and standardization.	
1.05.00	Plant control cable Interconnections a) Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5 b) Cable size for motor space heater application shall be 2CX2.5 c) Interconnections for Current Transformer terminals shall use two cores of 1.5mm ² size per phase d) Core identification shall be using core color for up to 5-core cable and core number for cable with more cores e) Separate control cables shall be used for current transformers. f) At least one spare core shall be made available in each of the control cable	
1.00.00	CODES AND STANDARDS	
1.1.00	All equipment shall, generally, comply with the updated issues of (a.) Applicable Indian Standards (b.) Indian Electricity Act. (c.) Indian electricity rules	
1.2.00	Equipment complying with any other authoritative / internationally recognized standards such as IEC, British, U.S.A., German, etc. will also be considered if it ensures performance equivalent or superior to Indian Standards. In such cases the contractor shall clearly indicate the standard adopted and furnish the copy of latest English version of the same along with the bid and bring out the salient features for comparison.	
1.3.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as published one month prior to the date of opening of bids. In case of conflict between this specification and those	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 2 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	(IS codes, Standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following codes and standards.			
	IS: 5	Colors for ready-mixed paints and enamels.		
	IS: 694	PVC insulated cables for working voltages upto and including 1100V.		
	IS: 722	A.C. Electricity Meters		
	IS: 1248	Electrical Indicating instruments		
	IS/IEC: 60947-1	Degree of protection provided by enclosures for low voltage Switchgear and Control gear		
	IS/IEC: 60947-2	A.C. circuit Breakers		
	IS: 2551	Danger Notice Plates		
	IS: 2629	Hot dip galvanising		
	IS: 2705	Current Transformers		
	IS/IEC: IEC-60947-4-1	Contactors and motors starter for voltages not exceeding 1000 V AC or 1200 V DC		
	IS: 3043	Code of practice for earthing.		
	IS: 3072	Code of practice for installation and maintenance of Switchgear		
	IS: 3156	Voltage Transformers		
	IS: 3202	Code of practice for climate proofing of electrical equipment.		
	IS: 3231	Electrical relays for power system protection.		
	IS/IEC 60947	Air-Break Switches, air break disconnectors, air break disconnector and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC.		
	IS/IEC 60947-1 / IEC-60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 3 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS: 5082	Wrought Aluminum and Aluminum alloys for electrical purposes.		
	IS: 6005	Code of practice of phosphating of iron and steel.		
	IS/IEC 60947-5-1 / IEC-60947-5-1	LV switchgear and Control gear Control current devices and switching element.		
	IS: 8623 (3 parts) / IEC: 60439	Specification for factory built assemblies of Switchgear & Control gear for voltages upto and including 1000 V AC & 1200 V DC.		
	IS: 8686	Static Relays		
	IS: 13703 / IEC: 60269	HRC Cartridge fuses		
	IS: 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.		
	IS: 11171	Specification for dry type transformers.		
	IEC: 60255	Electrical Relays		
	IEC: 61850	Communication networks and systems in substations		
	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals		
	IS: 12021	Specification of control transformers for switchgear and Control gear for voltage not exceeding 1000V AC.		
	IEC: 60947-7-1	Terminal blocks for copper conductors		
	IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips		
	IEC 60439(1&2)/ IS 8623(1&2)	Bus trunking system (sandwich busduct)		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 4 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC	
2.00.00	TECHNICAL PARAMETERS	
2.1.00	POWER SUPPLY	
2.1.1	AC SYSTEM	
	1) Voltage 415 V $\pm$ 10%, 3 Phase, 4 wire, solidly earthed 2) Frequency 50 Hz +/- 5% 3) Combined variation (in volts & frequency) 10% absolute sum 4) Fault Level 50KA(RMS)	
2.1.2	DC SYSTEM	
	1) System Voltage 240VDC 2-Wire, Unearthed 2) Fault Level 20 KA	
2.1.3	CONTROL SUPPLY VOLTAGE	
	1) Trip & closing coil of circuit breaker 240V DC/120V DC 2) Spring charging motor 240V DC/120V DC 3) MCC control supply 110V AC Neutral solidly earthed 4) Space heater & lighting 240V AC Neutral solidly earthed	
2.2.00	CUBICLE DATA Busbar Rating 1) Continuous Current rating As per requirement 2) Short time rating where a) CB is used as incomer 50KA(RMS) for one sec b) Fuse protection is used in Incomer Prospective current of 50KA(RMS) for the fuse clearing time	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 5 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
2.3.00	3)	Dynamic Rating where		
	a)	CB is used as incomer	105KA(PEAK)	
	b)	Fuse Protection is used in incomer	Prospective current of 105KA (PEAK) as limited by fuse	
	4)	Busbar insulation		
	a)	For switchgear	PVC Sleeve insulated	
	b)	For MCC	PVC Sleeve insulated	
	c)	ACDB	PVC Sleeve insulated	
	d)	DCDB	PVC Sleeve insulated	
	e)	For fuse boards	PVC Sleeve insulated/ epoxy coated	
	CIRCUIT BREAKER			
	1)	Type	Air break spring charged stored energy type	
	2)	Operating duty	B-3 MIN-MB-3 MIN-MB	
	3)	Symmetrical interrupting	50KA(RMS)	
	4)	Short circuit rating	105KA(PEAK)	
	5)	Short Circuit Breaking current		
	a)	AC Component	50KA(RMS)	
	b)	DC Component	As per IS/IEC 60947	
	6)	Short time withstand	50KA(RMS) for one sec	
7)	No of aux. contacts	4 NO + 4 NC for DDCMIS interface		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 6 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC	
2.4.00	METERS 1) Accuracy class 2.0 2) One min. power frequency withstand test voltage 2.0 KV (rms)	
2.5.00	CURRENT TRANSFORMERS 1) Type Cast Resin Bar Primary 2) Voltage class and frequency 650 V, 50 HZ 3) Class of insulation E or better 4) Accuracy class & burden a) For protection 5P20, 5VA PS Class for REF b) For metering class 1.0, 5VA (min) class 0.2s, 5VA (min) for feeders indicated in SLD ,if any 5) Short time withstand a) For CT Associated with circuit breaker 50KA(RMS) for 1 sec b) For CT Associated with fuse protected feeders Prospective current of 50KA(RMS) for the Fuse clearing time 6) Dynamic withstand a) For CTs Associated with circuit breaker 105KA(PEAK) b) For CT Associated with fuse protected feeders Prospective current of 105KA(PEAK) as Limited by fuse	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 7 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
2.6.00	BUSDUCT			
	1) Type	Non-Segregated		
	2) One minute power frequency withstand voltage	2.5 kV		
	3) One second short ckt withstand current	50KA(RMS)		
	4) Momentary dynamic current withstand	105KA(PEAK)		
	BUSDUCT (SANDWICH TYPE)			
	1) Type	Bus Trunking		
	2) Rated Insulation voltage	1000V		
	3) One second short ckt withstand current	50KA(RMS)		
	4) Momentary dynamic current withstand	105KA(PEAK)		
	5) Power frequency withstand voltage	3.5kv		
	6) Impulse withstand voltage	8kV		
	7) Insulation	Class F		
	2.7.00	VOLTAGE TRANSFORMERS		
1) Type		Cast Resin		
2) Voltage Ratio		415 / 110 V for line PT		
		415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V for Bus PT		
3) Method of Construction		Vee Vee		
4) Accuracy Class		0.5		
		0.2 for feeders indicated in SLD ,if any		
5) Rated Voltage factor		1.1continuous, 1.5 for 30 sec.		
6) Class of insulation	E or better			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 8 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.8.00	7) One minute power frequency withstand voltage	2.5 KV	
	HRC FUSES		
	1) Voltage Class	650 Volts	
	2) Rupturing capacity	80 KA (rms) for AC ckt. 20 KA for DC ckt.	
2.9.00	CONTACTORS		
	Type	Air break electro magnetic	
	2) Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives	
2.10.00	RELAYS		
	1) Power frequency withstand voltage	2.5KV for 1 sec. or 2.0 KV for 1 min.	
2.11.00	CONTROL TRANSFORMERS		
	1) Type	Dry / Cast Resin	
	2) Voltage Ratio	415 / 110 with taps ± 5% in steps of 2.5%	
	3) Class of insulation	Class-B or better	
	4) One minute power frequency withstand voltage	2.5 KV	
	5) Rating	1.5 x Adequate for application.	
2.12.00	LIGHTING TRANSFORMER / WELDING TRANSFORMER		
	1) Type & Rating	Dry type / 100 KVA	
	2) Voltage Ratio	415/415V, +/- 5% taps in steps of 2.5%	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 9 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC	
2.13.00	3) Class of insulation B or better	
	4) One minute power frequency withstand voltage 2.5 KV	
	5) Enclosure protection IP-42	
	TRANSDUCERS	
	1) Current transducers	
	a) Input 0-1 A (CT secondary)	
	b) Rated frequency 50HZ	
	c) Output 4-20 mA (2 Nos. decoupled)	
	d) Over current Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds	
	e) Accuracy 1.0	
2.14.00	2) Voltage Transducers	
	a) Input 110 V(VT secondary) ,50 HZ (for AC)/240 V DC (for DC)	
	b) Output 4-20 mA (2 Nos. decoupled)	
	c) Accuracy 1.0	
	MCCB	
	1) Rated voltage 415V	
	2) Rated insulation level 690V	
	3) Rated ultimate &Service S.C. breaking capacity 50KA	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 10 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	4)	Rated making capacity	105KA	
	5)	Utilization category	A	
3.00.00	CONSTRUCTIONAL DETAILS OF SWITCHBOARDS			
3.1.00	All Switchboards i.e., 415 V Switchgears, Motor Control Centres (MCCs), AC Distribution Boards (ACDBs), 220 V DC Distribution Boards (DCDBs) and Solenoid Valve Distribution Boards, shall be of metal enclosed, indoor, floor-mounted, free-standing type.			
3.2.00	All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.			
3.3.00	All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.			
3.4.00	The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.			
3.5.00	All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.			
3.6.00	Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above. The enclosure for outdoor oil filtration panels shall be constructed of stainless steel sheets in order to have protection against corrosion. The Degree of protection for outdoor panels shall be IP:65. The panels shall be mounted on a pedestal at a height of 500mm from ground level.			
3.7.00	All switchboards shall be of uniform height not exceeding 2450 mm.			
3.8.00	Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
PAGE 11 OF 66				

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.			
3.13.00	All 415V switchgear (circuit-breaker) panels shall be of single-front type. MCCs and DBs shall be of single-front / double-front construction as per the requirements. All single-front switch boards shall be provided with single-leaf, hinged or bolted covers at the rear. The bolts shall be of captive type. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more. In case of double-front MCCs, if this cannot be achieved for panels adjacent to a breaker panel, suitable dummy panel shall be provided by the Contractor wherever necessary.			
3.14.00	All ACDBs, DCDBs and Solenoid Valve DBs shall be of fixed module type. All 415V circuit-breaker modules and contactor controlled motor modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. The equipment pertaining to a draw out type incomer or feeder module shall be mounted on a fully withdrawable chassis which can be drawn out without having to unscrew any wire or cable connection. Suitable arrangement with cradle/ rollers, guides along with tool/lever operated racking in/out mechanism shall be provided for smooth and effortless movement of the chassis. For modules of size more than half the panel height, double guides shall be provided for smooth removal or insertion of module. All identical module chassis of same size shall be fully interchangeable without having to carryout any modifications. Suitable interlock shall be provided in DCDB for prevention of opening of Isolator (Incomer) when the bus coupler is open and vice-versa.			
3.15.00	All disconnecting contacts for power and control circuits of drawout modules shall be of robust and proven design, fully self aligning and spring-loaded. Both fixed and moving contacts shall be silver-plated and replaceable. The spring-loaded power and control drawout contacts shall be on withdrawable chassis and the same on fixed portion shall not be accepted. Detachable plug and socket type control terminals shall also be acceptable.			
3.16.00	Individual opening in the vertical bus enclosure shall permit the entry of moving contacts from the drawout modules into vertical droppers.			
3.17.00	As indicated in schematic drawings of DDCMIS controlled modules, contractor shall supply & mount two (2) coupling relays in the corresponding modules.			
3.18.00	All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to Employer's approval. The Contractor shall submit dimensional drawings showing complete internal details of busbars and module components, for each type and rating for approval of Employer.			
3.19.00	Employer reserves the right to alter the cable entries, if required during detailed engineering, without any additional commercial implication.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 13 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
3.20.00	Each switchboard shall be provided with undrilled, removable type gland plate, which shall cover the entire cable alley. Contractor shall ensure that sufficient cable glanding space is available for all the cables coming in a particular section through gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall preferably be provided in two distinct parts for the easy of terminating addition cables in future. The gland plate shall be provided with gasket to ensure enclosure protection. Recommended drilling chart of gland plates for all power and control cables in the vertical panels shall be indicated by the Contractor in the respective G.A. drawings of the boards.		
3.21.00	The Contractor shall consider layout of panels in a switchboard consisting of various feeder modules in a straight line, unless specified otherwise. The actual composition and disposition of various modules in a switchboard shall be finalised during detailed engineering. The Contractor shall provide adopter panel / dummy panel required to meet various configuration / arrangement of busbars adopted by the Contractor. The Switchboards fed from indoor transformer will be flange connected to the same and the same shall be located as close as desirable to the transformer. The details of transformer flanges for those transformers not being supplied under this package shall be given to the contractor for matching the connections. The switchboards fed from outdoor transformers of rating 1MVA and above shall preferably be connected through busducts. Busduct connections wherever applicable shall be preferably in a straight line alignment. The centre line of the busduct will be finalized during detailed engineering. Adopter panels and dummy panels shall be provided wherever required.		
3.22.00	Adequate space in a separate compartment shall be identified for mounting of Ethernet Switch (19" rack mounting) in all switchgears provided with numerical relays. Further, mounting of Ethernet switch in the above compartment and inter-panel wiring of Ethernet cable for connection of numerical relays to Ethernet switch shall be in the contractor's scope. Arrangement to provide required control supply to Ethernet switch shall be made in the switchgear.		
3.23.00	CLEARANCES The minimum clearance in air between phases and between phases and earth for the entire run of horizontal and vertical busbars and bus-link connections at circuit-breaker shall be 25 mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal and vertical busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars upto switch / fuses shall be fully shrouded / insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits.		
4.00.00	CONSTRUCTIONAL DETAILS OF AC & DC FUSE BOARDS		
4.1.00	All fuse boards shall be metal enclosed, fixed type, non-compartmentalized construction, suitable for indoor/ outdoor mounting on wall or steel structure.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 14 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS 	
4.2.00	The fuse board frame shall be fabricated using suitable mild steel structures or pressed and shaped cold rolled sheet steel of thickness not less than 2.0 mm. The frames shall be enclosed by cold rolled sheet steel of thickness not less than 1.6 mm.	
4.3.00	The fuse boards shall be provided with doors on the front. The doors shall preferably be in two halves with hinges at the extreme ends and locking facility at the centre.	
4.4.00	Suitable EPDM/Neoprene gaskets shall be provided to make fuse boards completely dust and vermin-proof with a degree of protection of IP-52 for indoor and IP-54 for outdoor application, as per IS/IEC 60947.	
4.5.00	Each DC fuse board shall comprise of the following : (e.) 1 no. 63 A switch as incomer (f.) 100 A fully insulated (PVC sleeved or epoxy coated) busbars. (g.) 8 nos. 16A outgoing Fuse feeders. (h.) 1 no. auxiliary contactor for supply monitoring. (i.) 1 no. indicating lamp with resistor and blue coloured lens.	
4.6.00	Each AC fuse board shall comprise of the following : (j.) 1 no. 63A TPN switch as incomer. (k.) 100 A, 3-phase, 4-wire, fully insulated (PVC sleeved or epoxy coated) busbars. (l.) 9 nos. 16 A single phase switch fuse units and 3 nos. 16 A TPN switch fuse units as outgoing feeders or alternatively 16 amps MCCB can be provided. (m.) 3 nos. indicating lamps with resistors and coloured lenses (R, Y, B) for incoming supply monitoring.	
4.7.00	The fuses shall be mounted in an insulating fuse carrier and it shall be possible to replace the outgoing feeder fuses without disturbing the other feeders. The handle of incoming switch shall be mounted on the door of the fuse board, with padlocking facility in both 'ON' and 'OFF' positions. The outgoing feeder switches shall preferably be of rotary type.	
4.8.00	Cable entry facilities shall be provided at top / bottom with removable gland plates of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2 SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 15 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
5.00.00	POWER BUSBARS AND INSULATORS All 415 V Switchboards, MCCs and ACDBs shall be provided with three phase and neutral busbars as specified in BOM. Two separate sets of vertical busbars shall be provided in each panel of double front MCCs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. DCDBs shall be provided with two (2) busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.			
5.1.00	All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.			
5.2.00	The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.			
5.3.00	All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The busbar insulators shall be supported on the main structure.			
5.4.00	All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminum joints shall be provided with suitable bimetallic washers.			
5.5.00	All busbars shall be color coded as per IS: 375.			
5.6.00	Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.			
5.7.00	The Contractor shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.			
6.00.00	AUXILIARY BUSBARS AND CONTROL TRANSFORMERS			
6.1.00	AC CONTROL SUPPLY BUSBAR Each bus-section of all Switchgears and MCCs shall be provided with two (2) nos. 415V / 110V control transformers. The 110V AC control supply from the control transformers shall			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 16 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	be run through the MCC by means of two sets of control supply busbars of electrolytic copper. In case of one transformer failure, whole bus section can be fed through single transformer. The control supply to different modules shall be tapped individually from the control supply busbars.			
6.2.00	DC CONTROL SUPPLY BUSBARS Electrically controlled circuit breaker boards shall be provided with DC control supply busbars. The manually controlled breakers shall also be provided with such busbars in case relays are provided. Each section of the switchboard shall be provided with a DC supply by the Contractor. The Contractor shall provide suitable terminals, switch-fuse etc. to receive the DC supply and distribute the same through above mentioned control busbars to the required modules of the respective section. The DC control supply bus of one section shall be coupled to the control supply of other section through a switch located in the bus-coupler breaker panel. The DC supply to the bus-coupler breaker may be given from any of the control buses. For emergency switchgear, Contractor shall provide two DC supplies. The contractor shall provide suitable diodes to derive the control supply through diode auctioneering from the above two supplies. Power Supply to Numerical Relay and Ethernet switch shall be an independent circuit with switch and fuse tapped from the panel DC supply. Exact scheme for segregation of switchgear & numerical relay DC supplies shall be finalized during detailed engineering.			
6.3.00	SPACE HEATER BUSBARS Panel and motor space heaters shall be fed from separate AC auxiliary busbars running throughout the switchboard. The supply for these busbars shall be tapped from incomer, before the isolating switch/ circuit breaker. Incoming circuit to space-heater bus shall have an isolating switch, HRC fuse and neutral link of suitable rating. Suitable terminals shall also be provided to facilitate energisation of space-heater bus from outside during long shutdowns of unit / switch-board.			
6.4.00	CONTROL TRANSFORMERS The control transformers shall be 415 V/110 V with neutral point-earthed, of insulation class 'B' or better. The sizing of Control transformers shall be carried out by Contractor considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15 watts should also be considered for each module, for remote auxiliary relays and lamps to be connected in the control circuit of modules. Contractor shall also ensure that control transformers are adequately designed for meeting the momentary loading requirements & the voltage drop during this condition shall not be more than 5%.			
7.00.00	EARTH BUS AND EARTHING			
7.1.00	A galvanized steel / Copper / Aluminum earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 17 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
7.2.00	The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth, as indicated in "Technical Parameters", without exceeding the allowable temperature rise.		
7.3.00	Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Contractor's earthing conductors. The horizontal earth bus shall project out of the switchboard ends and shall have predrilled holes for this connection. All joint splices to earth bus shall be made through at least two bolts, and taps by proper lug and bolt connection.		
7.4.00	All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.		
7.5.00	The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all positions, i.e. SERVICE & ISOLATED, as well as throughout the intermediate travel.		
7.6.00	Each module frame shall get engaged to the vertical earth bus before the disconnecting contacts on the module are engaged to the vertical busbars.		
7.7.00	All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.		
7.8.00	VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.		
7.9.00	All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.		
8.00.00	CIRCUIT BREAKERS		
8.1.00	Circuit breakers shall be three pole, air break, horizontal draw out type, and shall have fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameters of continuous current rating and fault making / breaking capacity only after provision of cooling fans or special device shall not be acceptable.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 18 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
8.2.00	Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.		
8.3.00	There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLLY WITHDRAWN" position. It shall be possible to close the door in "Test" position. The circuit breaker rack in and rack out from Service to Test, Test to Isolated position or vice-versa shall be possible only in the door closed position.		
8.4.00	All circuit breakers shall be provided with "6 NO" and "6NC" potential free auxiliary contacts. These contacts shall be in addition to those required, for internal mechanism of the breaker and should be directly operated from breaker operating mechanism. In case the manufacturer does not have a proven arrangement for providing the required number of circuit breaker auxiliary contacts on the fixed portion of the cubicle, necessary electrically reset latched relays shall be provided complete with all wiring in series with service position limit switch contacts, for multiplying the circuit breaker mounted auxiliary contacts and provide 4 NO and 4 NC contacts. Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 240 V DC respectively.		
8.5.00	Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE ", "TEST" AND "SPRING CHARGED" positions.		
8.6.00	Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency.		
8.7.00	All circuit breakers shall be provided with the following interlocks :		
8.7.1	Movement of a circuit breaker between "SERVICE" and "TEST" position shall not be possible unless it is in open position. Attempted withdrawal of a closed circuit breaker shall preferably not trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exists between the fixed and draw out contact at the time of breaker trip so that no arcing takes place even with the breaker carrying its full rated current.		
8.7.2	Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 19 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS													
8.7.3	Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.													
8.7.4	A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.													
8.7.5	Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.													
8.8.00	Circuit breaker shall be provided with anti-pumping feature (soft) and trip free feature, even if mechanical anti-pumping feature is provided.													
8.9.00	Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.													
8.10.00	Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Contractor's scope of supply.													
8.11.00	Circuit breaker shall be provided with Power operated mechanism as follows. <table><tr><td>1.</td><td>Power operated mechanism shall be provided with a universal motor suitable for operation on 240 V DC / 240 AC Control supply, with voltage variation from 198 V to DC to 242 V DC . Motor insulation shall be class "E" or better.</td></tr><tr><td>2.</td><td>The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage.</td></tr><tr><td>3.</td><td>Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.</td></tr><tr><td>4.</td><td>The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.</td></tr><tr><td>5.</td><td>Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.</td></tr></table>				1.	Power operated mechanism shall be provided with a universal motor suitable for operation on 240 V DC / 240 AC Control supply, with voltage variation from 198 V to DC to 242 V DC . Motor insulation shall be class "E" or better.	2.	The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage.	3.	Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.	4.	The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.	5.	Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.
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TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 20 OF 66										

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
8.12.00	6.	All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage from 187-242 V DC. The trip coil shall operate satisfactorily at all values of voltage from 154-242V DC /77 V-121 V DC		
	7.	Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.		
	8.	It shall not be possible to open the ACB panel door in breaker closed condition. Further, the racking mechanism shall be accessible only after opening the breaker panel door.		
	Note: The circuit breakers for DC applications shall have manually operated mechanism of spring charged, stored energy type. The closing operation of the circuit breaker shall charge the tripping spring. Necessary interlocks shall be provided to inhibit closing of the circuit breaker unless the closing spring is fully charged.			
	TELESCOPIC TROLLEY Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear. The quantity of telescopic trolleys to be supplied shall be adequate for the number of switchgears / switchgear rooms.			
	AIR BREAK SWITCHES Air break switches shall be of heavy duty, single throw, group operated, load break, fault make type when associated with fuses. All switches for motor circuits shall be of utilization category AC-23A with 1NO +1NC auxiliary contact, which shall be wired to the control circuit as shown in the schematic drawings. All switches for other outgoing feeders shall be of utilization category AC-22A. All switches for DC circuits shall be suitable for 240 V DC and shall be of DC-22 utilization category.			
	Continuous current rating of the switches shall be selected from the 'Module Selection tables' for various feeders.			
	The combination of switch-fuse unit would be preferred. However, if separate switch and fuses are provided, switch shall be located before fuses.			
	The main switches shall be operable from outside the module door. The switch handle shall clearly indicate the position of switch. Switch operating handles shall be provided with			
	TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 21 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	padlocking facilities. However, incomer switches of switchboards shall be provided with padlocking facility in both 'ON' and 'OFF' positions.			
10.05.00	Interlocks shall be provided such that the cubicle door will not open when the switch is in closed position and the switch will close only when the door is closed.			
10.06.00	Switches and fuses for AC/DC control supply and heater supply wherever required, shall be mounted inside the cubicles. Toggle switch is not acceptable.			
10.07.00	Even if a single phase feeder is required for certain applications, Contractor shall provide TPN switch, fuse-bases and cable/ link connections between switch/fuse and vertical busbars for all the three phases, so that changing from single phase feeder to three phase feeder is possible without any modification other than inserting fuses at site.			
10.00.00	MCCB			
10.1.00	MCCB shall be fixed type/part of withdraw able feeder module as per specification, three pole, air break type having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.			
10.2.00	MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status(on/off etc).			
10.3.00	MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch ,shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturers discrimination table.			
10.4.00	The auxiliary contacts of the MCCB shall be fed to the digital inputs available in the numerical relays of Incomer/bus coupler/motor circuit breaker feeders , for integration in to the numerical relay network.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 22 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS		
11.00.00	CONTROL AND SELECTOR SWITCHES		
11.1.00	Control and selector switches shall be of heavy duty, rotary type with escutcheon plates clearly marked to show the positions. The control & selector switches should be as per IS/IEC 60947 Part V section 1. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.		
11.2.00	Ammeter and voltmeter selector switches shall have four stay put positions with adequate number of contacts for 3-phase 4-wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondary.		
11.3.00	Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.		
11.4.00	The contact ratings shall be at least the following :		
	1.	Make and carry, continuously, 10 A at 240 V DC and 110 V AC	
	2.	Breaking current at 240 V DC, 1 A (inductive)	
	3.	Breaking current at 110 V AC and 0.3 lagging p.f., 5A	
12.00.00	CONTACTORS		
12.1.00	Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS/IEC 60947 Part-4 Section- 1.		
12.2.00	Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced.		
12.3.00	Direct-on-line contactors shall be of utilization category AC3. Reversing starters shall comprise of Forward and Reverse contactors mechanically and electrically interlocked with each other. These contactors shall be of utilization category AC4. DC contactors shall be of DC3 utilization category. For CHP conveyor motors, minimum rating of power contactors shall be 240% of full load current of the motors. For other CHP drives, minimum rating of power contactors shall be 160% of full load current of motor.		
12.4.00	The number of normally open (NO) and normally closed (NC) auxiliary contacts of a contactor shall be as per requirement shown in the respective module drawings. It shall, however, be not less than 2NO+2NC.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 23 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
12.5.00	Operating coil of contactors shall be of 110 V AC unless otherwise specified elsewhere. The contactor shall operate satisfactorily between 85% and 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage.			
12.6.00	Contactors for DC drives shall have a coil voltage of 240 V DC. DC operated contactor coil shall have an economy resistor and shall be suitable for satisfactory continuous operation at 187-242 V DC/ 93.5-121 V			
13.00.00	FUSES			
13.1.00	All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.			
13.2.00	Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.			
13.3.00	Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.			
13.4.00	Fuse ratings shall be selected by the Contractor from the 'Module Selection Tables' for various feeder ratings. However, the fuse ratings for motor feeders given in the 'Motor Module Selection Table' are indicative only, and the same shall be coordinated by the Contractor to achieve class-II protection coordination and also to match the motor characteristics. Switch rating shall in no case be less than the fuse rating.			
13.5.00	The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.			
14.00.00	INSTRUMENT TRANSFORMERS			
14.1.00	All current and voltage transformers shall be completely encapsulated, cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the specified ambient temperature. The class of insulation shall be 'E' or better.			
14.2.00	All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum RMS short circuit breaking and peak making current ratings of the associated switchgear.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 24 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
14.3.00	All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block where star point formation and earthing shall be done.			
14.4.00	Current transformers may be multi or single-core type. All voltage transformers shall be single phase type.			
14.5.00	The bus VTs shall be housed in a separate compartment. All VTs shall have readily accessible HRC current limiting fuses on both primary and secondary sides.			
14.6.00	All CTs shall be provided with supports independent of busbar / busbar supports.			
14.7.00	The CTs shall be located in such a way that they can be easily approached for maintenance without necessitating shut down of adjacent feeders.			
15.00.00	NUMERICAL RELAYS & NETWORKING			
15.1.00	All relays in protective circuits shall be flush mounted on panel front with connections from the inside. The protective relays shall be communicable numerical relays. These numerical relays shall be of types as proven for the application and shall be subject to Employer's approval. Numerical relays shall have appropriate setting ranges, accuracy, resetting ratio and other characteristics to provide required sensitivity. All equipments shall have necessary protections as detailed in the standard scheme drawings.			
15.2.00	The circuit breaker will normally be controlled from remote control panels (DDCMIS) through closing and shunt trip coils. Additionally, control shall be carried out from the Switchgear SCADA System through the Numerical relay. The Local control console of the relay flush mounted on the switchgear would normally be used only for testing of circuit breaker in isolated position, and for tripping it in an emergency. Provision for closing & tripping of the circuit breaker locally from laptop through serial port shall be possible to facilitate commissioning activities. The basic control scheme of breaker feeders shall be developed as per the schematic logics in the relay. The schematics shall be developed in soft inside the relay. Numerical relays shall be interfaced with DDCMIS through 24V DC signal for closing / opening operations.			
15.3.00	The numerical relay shall be capable of measuring and storing values of a wide range of quantities, events, faults and disturbance recordings. The alarm / status of each of protection function and trip operation shall be communicated to DDCMIS. The numerical relays shall have built in feature / hardware interface to provide such inputs to DDCMIS for analog / digital values. All the numerical relays shall have communications on three ports; local front port communication to laptop and a dual port on IEC 61850 to communicate with Employer's data concentrator through LAN and Ethernet switches. Ethernet switches shall be connected through Fibre Optic cable to Numerical Relay network by Employer. The connection from the Numerical relay to Ethernet switch shall be in Contractors scope and sufficient length of cat 5e Ethernet cable shall be provided for the same.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
PAGE 25 OF 66				

CLAUSE NO.	TECHNICAL REQUIREMENTS		
15.4.00	All relays and timers shall be rated for control supply voltage as mentioned elsewhere under parameters and shall be capable of satisfactory continuous operation between 80-120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used.		
15.5.00	The protective relays shall have at least 10 Nos programmable potential free contacts. Programmable Auxiliary relays shall have contacts as required.		
15.6.00	Failure of a control or auxiliary supply and deenergisation of a relay shall not initiate any circuit breaker /contactor operation. All relay digital output contacts shall withstand a minimum test voltage of 2kV AC rms for one minute.		
15.7.00	All the numerical relays shall have adequate processor memory for implementing the programmable scheme logic required for the realization of the protection / control schemes, in addition to the built in protection algorithms.		
15.8.00	Relays shall be suitable for electrical measurement including voltage, current, power (active/reactive) and energy parameters.		
15.9.00	Relays shall have separate output for individual functionality and the master trip shall be software configurable in case of multi output relays. Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping		
15.10.00	Preferably comprehensive single numerical relay shall have provision of both current and voltage inputs. The current operated relay shall have provision for 4 sets of CT inputs, 3 nos. for phase fault & 1 CT input for earth fault. Relay shall be suitable for both residually connected CT input as well as CBCT input. The voltage-operated relay shall have provision for 3 PT inputs. Relays shall be suitable for CT secondary current of 1A / 5A selectable at site. Relays used in incomers and bus couplers shall have provision of two sets of voltage signal inputs for the purpose of synchronization.		
15.11.00	All CT & PT terminals shall be provided as fixed type terminals on the relay to avoid any hazard due to loose connection leading to CT opening or any other loose connection. In no circumstances Plug In type connectors shall be used for CT / PT connections. Contractor to ensure the same for all protective relay models offered.		
15.12.00	All numerical relay shall have key pad / keys to allow relay settings from relay front. All hand reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable. Manual resetting shall be possible from remote.		
15.13.00	Relays shall have suitable output contact for breaker failure protection.		
15.14.00	Relays shall have self diagnostic feature with self check for power failure, programmable routines, memory and main CPU failures.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 26 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS		
15.15.00	Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI programmable characteristics. Relays shall have self reset auxiliary contacts of programmable type.		
15.16.00	Design of the relay must be immune to any kind of electromagnetic interference. Contractor to submit all related type test reports for the offered model along with the offer.		
15.17.00	Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature. All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc. Relays shall be provided with suitable harsh environment coating for protection against failure due to high temperature, humidity and dust.		
15.18.00	Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.		
15.19.00	Time clock synchronization feature shall be provided for synchronization of clocks of numerical relay and metering LAN with data concentrator time clock. Required hardware and software interface to receive GPS/Time signal to achieve time synchronization shall be supplied by the Contractor. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system.		
15.20.00	Relays shall be suitable to accept both AC & DC supplies with range 110V or 240V with tolerance of 70 % to 120 % of rated voltage & shall be finalized during detailed engineering.		
16.00.00	OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS		
16.1.00	For control from DDCMIS, 24V DC signal shall be provided from DDCMIS to the numerical relays. Preferably, no separate coupling relays shall be provided.		
16.2.00	Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre trip and post trip conditions.		
16.3.00	Schematics requiring auxiliary relays /timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer function for protection function shall be as required. Auxiliary relays for interlocking purpose shall be of self reset type.		
16.4.00	Bus no volt condition shall be configured to a output contact of the relay of all incomers for suitably interfacing with DDCMIS.		
16.5.00	Timer functions shall be programmable for on/off delays.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 27 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
16.6.00	The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis.			
16.7.00	The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery back up for real time clock in the event of power supply failure shall be provided.			
16.8.00	200 time tagged events /records should be able to store with time stamping Last 5 faults storage including the indication, protection operated , fault location relay and operating time, currents, voltage and time.			
16.9.00	Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be shall be provided. The results of the self reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be shall be available on the user interface.			
16.10.00	The alarm/status of each individual protection function and trip operation shall be communicated to DDCMIS.			
16.11.00	Sequence of events shall have 1 ms resolution at device level.			
16.12.00	Measurement accuracy shall be 1 % for RMS Current and voltage (20-120% of rated value).			
16.13.00	It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.			
16.14.00	Required no. of extra digital inputs shall be provided in the numerical relay for digital inputs from various outgoing MCCB feeders on that switchgear section.			
16.15.00	At least two licensed copies of necessary software for numerical relay configuration / setting / disturbance analysis and other utilities shall be supplied. Numerical relay configuration for all relays being supplied under the package shall be carried out in line with the approved schematics and shall be submitted for Employer's approval. Setting calculations and relay settings configured in relay software for all relays shall be submitted for Employer's approval. Approved relay configuration / settings shall be loaded in all the relays prior to dispatch to site.			
17.00.00	TRAINING The Contractor shall arrange for training on system design, engineering, operation and maintenance of Numerical relays at the principal's facility for duration of two (2) man-months.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 28 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Workshop Training at site shall aim for familiarization of Site Engineers for commissioning and day to day O & M of Numerical Relays and trouble shooting. The scope shall include Two No's of Numerical Relay and Training for a batch of 20 Engineers at Project Site. One such Workshop shall be organized before the commissioning of First LV Switchboard and the Second workshop shall be conducted before Unit Commissioning. Employer shall provide the required Infrastructure such as Training Conference room, Projection systems etc.			
18.00.00	INDICATING INSTRUMENTS			
18.1.00	All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96mm square size with 90 degree linear scale and shall have an accuracy class of 1.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.			
18.2.00	All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.			
18.3.00	All instruments shall have white dials with black numerals & lettering. Black knife edge pointer shall be provided for meters.			
18.4.00	Ammeters provided for motor feeders (for motors of rating $\geq 30\text{kW}$ & $< 100\text{kW}$) shall have a compressed scale at the upper current region to cover the starting current upto 6.0 times the CT primary current.			
18.5.00	All motor feeders of rating $\geq 30\text{ kW}$ and $< 110\text{ kW}$ shall be provided with Multifunction Digital Energy Meter with communication facility to display the current, voltage, power factor, power energy related data locally as well as communicate these for remote metering/audit/analysis purposes. These meters shall The technical specification for Digital indicating energy meter shall be as follows: a) Input Voltage:110VAC / 240VDC b) Input Current:1A c) Size:96X96 SQ.MM d) Power & Energy Accuracy: 1.0 e) Mounting: Flush mounting f) Type: True RMS 3-PHASE V,I, kW,PF & kWH indication g) 4 Digit, seven segment LED display/LCD display, with floating decimal h) Communication: In built RS 485 bus port i) Operating Frequency: 45 HZ-65HZ j) Dielectric Test: 2KV RMS for 1 minute k) Over Current: 10 times for 3 sec.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 29 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC	
	l) Aux supply: 90V-300V AC/DC m) Compliance: EMC/EMI n) Field programmable CT ratio o) Analog Current Output (4-20 mA)	
19.00.00	PUSH BUTTONS	
19.1.00	Push-buttons shall be of spring return, push-to-actuate type. Their contacts shall be rated to make, continuously carry and break 10 A at 110 V AC and 1 A (inductive) at 240 V DC.	
19.2.00	All push buttons shall have two (2) normally open and two (2) normally closed contact, unless specified otherwise. The contact faces shall be of silver alloy.	
19.3.00	All push-buttons shall be provided with integral escutcheon plates marked with its function.	
19.4.00	The color of the button shall as follows : Green for motor START, breaker CLOSE , valve/ damper OPEN commands. Red for motor trip, breaker open, valve / damper close commands. Black for all annunciation functions, overload reset and miscellaneous commands including reverse for clinker grinder etc.	
19.5.00	All push buttons on panels shall be located in such a way that Red push button shall always be to the left of Green push button. In case of clinker grinder etc. the push buttons would be black - red-green from left to right.	
19.6.00	All emergency push buttons shall have mushroom knobs.	
20.00.00	INDICATING LAMPS	
20.1.00	Indicating lamps shall be of CLUSTER LED type . The lamps shall have escutcheon plates marked with its function, wherever necessary.	
20.2.00	Lamps shall have translucent lamp-covers of the following colours, as warranted by the application : Red for motor ON, valve / damper OPEN, breaker CLOSE. Green for motor OFF , valve / damper CLOSE, breaker OPEN. White for motor AUTO TRIP.	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 30 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Blue	for all healthy conditions (e.g. control supply, and also for SPRING CHARGED").		
	Amber	for all Alarm Conditions (e.g. overload). Also for "SERVICE" and "TEST" position indications.		
20.3.00	Bulbs and lamp covers shall be easily replaceable from the front of the cubicle. The method of mounting indicating lamp fittings on panels shall prevent their rotation under the action of lamp removal or replacements, reliance upon the tightness of ring nut for the purpose is not sufficient.			
20.4.00	Indicating lamps should be located just above the associated push-button / control switches. Red lamps shall invariably be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along the centre line of control switch / push button pair. Blue and Amber should normally be located above the Red and Green lamps.			
20.5.00	When associated with push-buttons, red lamps shall be directly above the green push-button and green lamp shall be directly above the red push button.			
20.6.00	All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.			
21.00.00	SPACE HEATER			
21.1.00	Space heaters shall be provided in the switchboards wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
21.2.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary switches and fuses shall be provided.			
21.3.00	The circuit for each panel and motor space heater should have an isolating switch, HRC fuse and isolating link. In addition, the space heater circuit of each panel shall also have a thermostat of suitable rating.			
22.00.00	INTERNAL WIRING			
22.1.00	All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.			
22.2.00	All intercubicle and interpanel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the Contractor.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 31 OF 66

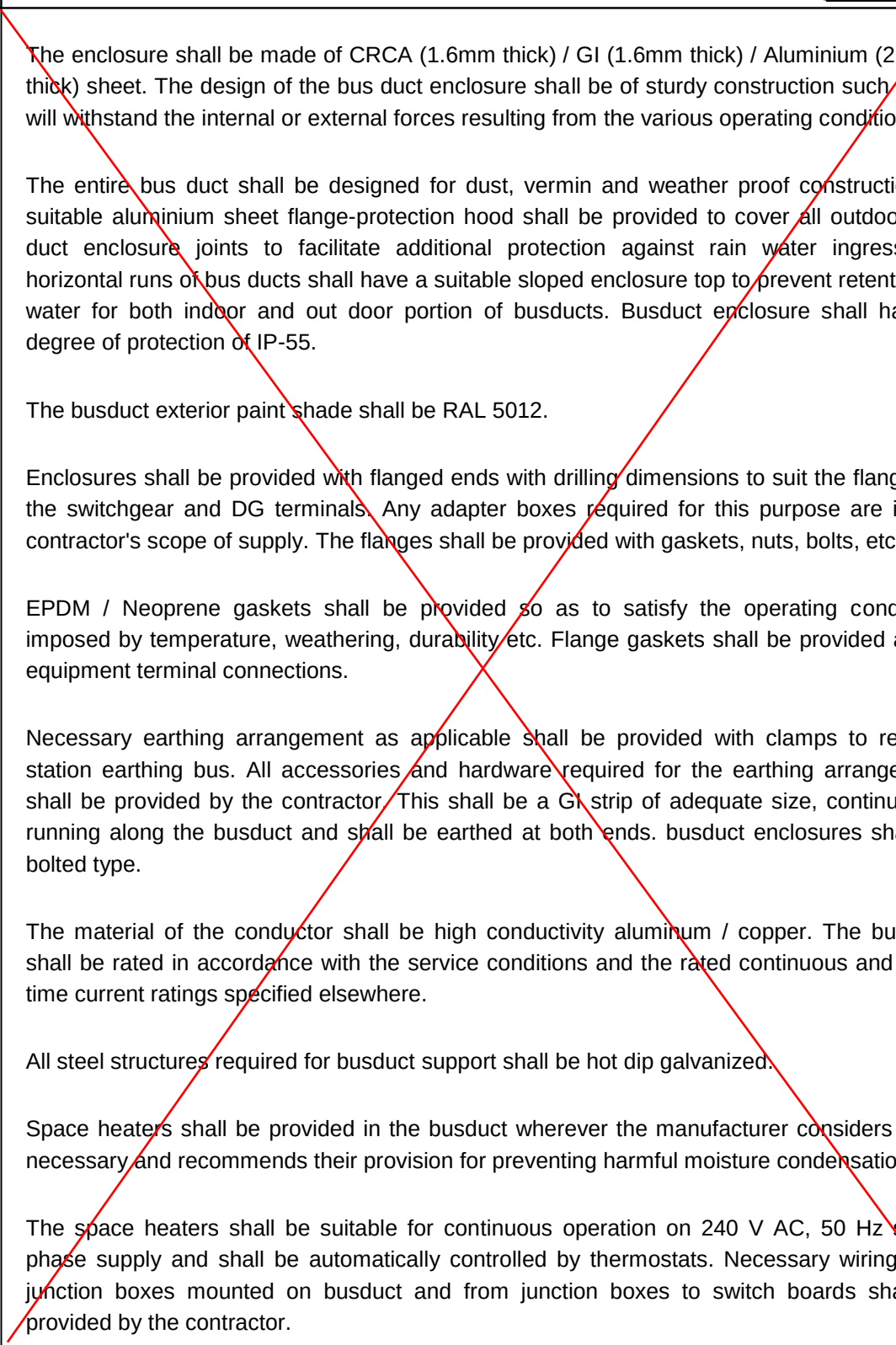
CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
22.3.00	All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, color coded, PVC insulated wires. Conductor size shall be 1.5 mm ² (min.) for control circuit wiring and 2.5 mm ² (min) for CT and space heater circuits.		
22.4.00	Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.		
22.5.00	All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.		
22.6.00	All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.		
22.7.00	Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.		
22.8.00	Wiring for equipment, which are to be supplied by the Contractor and for which the Contractor has to provide mounting arrangement in his panels, shall also be provided by the Contractor, upto the terminal blocks.		
22.9.00	All connections from vertical busbars for individual modules above 100 A shall be by Copper / Aluminum links only. The cable connections for modules less than 100 A shall be selected in such a way that there will not be any melting / shorting in case of a short circuit inside the module and the cable shall have current rating to carry the let through energy of the corresponding fuses in case of a fault. The insulation of the cable and its cross section shall be decided considering the high ambient temperature within the module. For all modules where use of cable is envisaged by the Contractor specific approval from the Employer regarding cable details are to be taken. For power wiring color coded wire insulation / tapes shall be provided.		
23.00.00	CONTROL TERMINAL BLOCKS		
23.1.00	Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.		
23.2.00	Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing,		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 32 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	The local push button stations shall be metal enclosed, suitable for outdoor / indoor mounting on wall or steel structures. The enclosure shall be die-cast aluminum or cold-rolled sheet steel of at least 1.6 mm thickness. LPBS shall be painted to shade no. RAL: 9002. isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.			
23.3.00	In all circuit breaker panels MCC modules at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.			
23.4.00	All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq. mm each, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping. However for DDCMIS terminals shall be suitable for 1.5 mm2 cable.			
23.5.00	All terminals shall be numbered for identification and grouped according to the function. Engraved white-in-black labels shall be provided on the terminal blocks.			
25.06.00	Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.			
25.07.00	Terminal blocks shall be arranged with at least 100mm clearance between two sets of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.			
24.00.00	POWER CABLE TERMINATION			
24.1.00	Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armored / unarmored and PVC sheathed cables. The size and type of cable for individual modules shall, preferably, be as indicated in the 'Module Selection Tables'. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc. for cables shall be provided by the contractor to suit the final cable sizes. The Local push button stations enclosure made of FRP (Fiberglass Reinforced Polymer) may also be offered. The FRP enclosure shall be of SMC Hot press Molded, Halogen free and flame retardant as per UL94, V-0. The thickness of the FRP enclosure shall be at least 4mm. The color of the FRP type LPBS shall be of RAL 7035 and the hinges, nuts & bolts shall be of Polyamide/Stainless Steel material			
24.2.00	All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 33 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC								
25.00.00	LOCAL PUSH BUTTON STATIONS											
25.1.00	The enclosure shall be provided with a hinged guard at the front, covering full length, to avoid inadvertent operation of push buttons Support structure for mounting the LPBS shall also be supplied by Contractor.The local push button stations shall be dust and vermin proof and shall have a degree of protection of IP -55 as per IS/IEC 60947. The DOP shall be IP-65 in case the same are located in dusty areas.											
25.2.00	The push button stations shall be suitable for bottom cable entry and shall be provided with removable undrilled gland plates or knockouts. Adequate space shall be available inside the push button station enclosure for terminating external cables directly on pushbutton terminals. Overall size of push button stations shall be subject to Employer's approval.											
25.3.00	The push button station shall comprise of a latched type EMERGENCY STOP push button with two (2) NO and two (2) NC contacts.											
26.00.00	LOCAL MOTOR STARTERS											
26.1.00	Local motor starters shall be suitable for manual switching of 415 V, 3-phase, squirrel cage motors rated upto 5.5 KW. They shall have constructional features similar to those specified for local push button stations.											
26.2.00	Each starter shall comprise of : <table><tr><td>1.</td><td>A 3-pole contactor, mechanically latched type.</td></tr><tr><td>2.</td><td>Start push button, colored green.</td></tr><tr><td>3.</td><td>Stop push button, colored red.</td></tr><tr><td>4.</td><td>Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.</td></tr></table>				1.	A 3-pole contactor, mechanically latched type.	2.	Start push button, colored green.	3.	Stop push button, colored red.	4.	Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.
1.	A 3-pole contactor, mechanically latched type.											
2.	Start push button, colored green.											
3.	Stop push button, colored red.											
4.	Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.											
26.3.00	The start push button, when pressed, shall preferably remain in depressed position and shall be released along with the contactor when the stop push button is pressed or when thermal overload relay operates.											
26.4.00	Local starters shall be suitable for loop-in and loop-out of incoming cable and for one outgoing cable to motor. Final cable sizes and number of lugs required will be intimated to the contractor. Support structure for mounting in local motor starters shall be supplied by the Contractor.											
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 34 OF 66								

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
27.00.00	NAME PLATES AND LABELS		
27.1.00	All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations and local motor starters shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.		
27.2.00	All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to Employer's approval.		
27.3.00	Suitable stenciled paint mark shall be provided inside the panel/module for identification of all equipment in addition to the plastic sticker labels, if provided. These labels shall be positioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring drawings.		
27.4.00	Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.		
28.00.00	METAL ENCLOSED NON SEGREGATED PHASE BUSDUCT(AIR INSULATED)		
28.1.00	Three phase and neutral metal enclosed non segregated phase bus duct assemblies shall be supplied for incoming connections from the transformers to the switch boards and inter connecting sections between switch boards, wherever transformer rating is 1000KVA and above. The rating of the incoming and interconnecting bus ducts shall be same as the rating of the switchboard.		
28.2.00	The enclosure shall be made of minimum 3 mm thick aluminum alloy. The section of the bus duct shall be rectangular. The design of the bus duct enclosures shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.		
28.3.00	The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminum sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of bus ducts. Bus duct enclosure shall have a degree of protection of IP-55.		
28.4.00	The inside of the bus enclosure may be treated with black paint to enable efficient heat dissipation. The matt paint used shall be suitable for temperature experienced during continuous loading of the bus conductor. The bus duct exterior paint shade shall be RAL 5012.		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
			PAGE 35 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
28.5.00				
28.6.00				
28.7.00				
28.8.00				
28.9.00				
28.10.00				
28.11.00				
28.12.00				
28.13.00				
29.00.00	BUS TRUNKING SYSTEM (SANDWICH TYPE BUSDUCT)			
29.1.00	Three phase Bus trunking system conforming to IEC 60439 (Parts 1 & 2) / IS 8623 (Parts 1 & 2) shall be provided for connecting the Main and Standby DG sets to Turbine Unit Emergency Switchgears as indicated in the BOQ.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 36 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
29.2.00	The enclosure shall be made of CRCA (1.6mm thick) / GI (1.6mm thick) / Aluminium (2.5mm thick) sheet. The design of the bus duct enclosure shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.			
29.3.00	The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminium sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of busducts. Busduct enclosure shall have a degree of protection of IP-55.			
29.4.00	The busduct exterior paint shade shall be RAL 5012.			
29.5.00	Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and DG terminals. Any adapter boxes required for this purpose are in the contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc.			
29.6.00	EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.			
29.7.00	Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the contractor. This shall be a GI strip of adequate size, continuously running along the busduct and shall be earthed at both ends. busduct enclosures shall be bolted type.			
29.8.00	The material of the conductor shall be high conductivity aluminum / copper. The busbars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings specified elsewhere.			
29.9.00	All steel structures required for busduct support shall be hot dip galvanized.			
29.10.00	Space heaters shall be provided in the busduct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
29.11.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on busduct and from junction boxes to switch boards shall be provided by the contractor.			
30.00.00	PAINTING All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid.			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 37 OF 66

CLAUSE NO.	TECHNICAL REQUIREMENTS			
31.00.00	After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Employer. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.			
	GASKETS The gaskets, wherever specified, shall be of good quality EPDM / Neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.			
32.00.00	TEMPERATURE –RISE The temperature rise of the horizontal and vertical busbars and main bus links including all power drawout contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current. The above temperature rise limits are applicable for busducts also without any current derating.			
33.00.00	DERATING OF EQUIPMENTS The Contractor shall ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified. The Contractor shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and ambient temperature of 50 deg C.			
34.00.00	PROTECTION CO-ORDINATION It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers / fuses / motor starters, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of Type II class of Co-ordination as per IS: 8544.			
35.00.00	TESTS AND TEST REPORTS GENERAL (a.) All equipments to be supplied shall be of type tested design. The Contractor shall submit for Employer's approval the reports of all the type tests as listed in this			
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 38 OF 66

specification and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

(b.) In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost either at third party lab or in presence of client/Employer's representative and submit the reports for approval.

(c.) All routine tests as per the specification and relevant standards shall be carried out..

The following type test certificates on each type & rating of L.T. Switchgear and MCC panel shall be submitted.

1)	Switchgear / MCC panels of each rating		
	a)	Short time withstand test.	
	b)	Temperature rise test.	
	c)	Degree of protection test	
2)	Circuit breaker of each rating		
	a)	Test sequence 1	
		-	Dielectric properties.
		-	Mechanical operation and operational performance capability
		-	Verification of dielectric withstand.
		-	Verification of temperature-rise
	b)	Combined test sequence (With Circuit breakers mounted inside the Switchgear panel)	
		-	Rated short-time withstand current
		-	Rated service short-circuit breaking capacity

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC																																			
			-	Verification of dielectric withstand																																			
			-	Verification of temperature-rise																																			
	3)	MCC modules of any three ratings, as selected by the Employer, for class - II protection Co-ordination.																																					
	4)	Test for single phasing protection feature on 3 nos. bimetallic thermal overload relay selected by Employer. The relay shall be tested for compliance with manufacturer's printed / declared characteristic curve.																																					
35.1.00	For the following equipment the contractor shall submit the reports of all the type tests as per applicable standards and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employer's representative and submit the reports for approval. (a.) NUMERICAL RELAYS (b.) LOCAL PUSH BUTTON STATION (c.) LOCAL MOTOR STARTER (g) MCCB																																						
35.2.00	Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for Employer's review. <table><tr><th>S. No.</th><th>TEST ITEMS</th><th>Standard</th></tr><tr><td>1</td><td>Dimensions of structure and visual inspection</td><td>IEC 60297-3-101</td></tr><tr><td rowspan="2">2</td><td>Functional requirements:</td><td rowspan="2">Relevant IEC 60255-100 series</td></tr><tr><td>– Steady-state simulation</td></tr><tr><td></td><td>– Dynamic simulation</td><td></td></tr><tr><td rowspan="2">3</td><td>Product safety requirements</td><td rowspan="2">IEC 60255-27</td></tr><tr><td>(including the dielectric tests and thermal short time rating)</td></tr><tr><td rowspan="2">4</td><td>EMC requirements:</td><td rowspan="2">IEC 60255-26</td></tr><tr><td>– Emission</td></tr><tr><td></td><td>– Immunity</td><td></td></tr><tr><td rowspan="2">5</td><td>Energizing quantities:</td><td></td></tr><tr><td>– Burden</td><td>N/A</td></tr><tr><td></td><td>– Change of auxiliary energizing quantity</td><td>IEC 60255-11</td></tr><tr><td>6</td><td>Contact performance</td><td>N/A</td></tr></table>				S. No.	TEST ITEMS	Standard	1	Dimensions of structure and visual inspection	IEC 60297-3-101	2	Functional requirements:	Relevant IEC 60255-100 series	– Steady-state simulation		– Dynamic simulation		3	Product safety requirements	IEC 60255-27	(including the dielectric tests and thermal short time rating)	4	EMC requirements:	IEC 60255-26	– Emission		– Immunity		5	Energizing quantities:		– Burden	N/A		– Change of auxiliary energizing quantity	IEC 60255-11	6	Contact performance	N/A
S. No.	TEST ITEMS	Standard																																					
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TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT																																			
PAGE 40 OF 66																																							

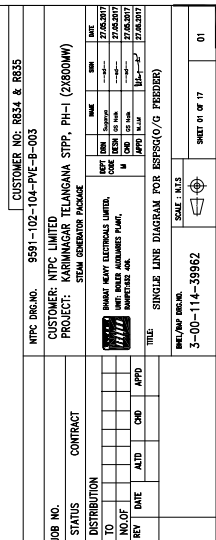
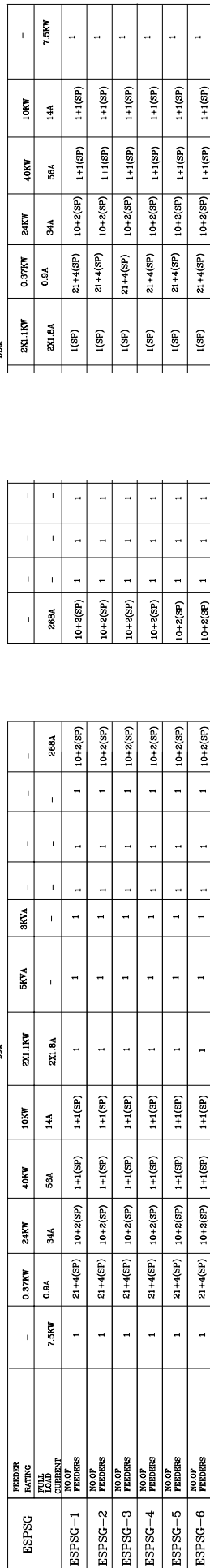
CLAUSE NO.	TECHNICAL REQUIREMENTS				
37.05.00	7	Communication requirements	Relevant IEC protocol standards		
	8	Climatic environmental requirements:	IEC 60068-2-14,		
		– Cold	IEC 60068-2-1,		
		– Dry heat	IEC 60068-2-2,		
		– Change of temperature	IEC 60068-2-78,		
		– Damp heat	IEC 60068-2-30, IEC 60255-27		
	9	Mechanical requirements: – Shock	IEC 60255-21-1,		
		– Vibration	IEC 60255-21-2,		
		– Bump	IEC 60255-21-3		
		– Seismic			
	10	Enclosure protection	IEC 60529, IEC 60255-27		
	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet. All routine tests as per the specification and relevant standard IS 8623 shall be carried out. An indicative lists of tests / checks is mentioned as QA chapter . However, the manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.				
	37.06.00	All procedures for type tests shall be approved by Employer before commencement of type tests. However, the following points may be specifically noted.			
		1)	For temperature rise tests, the connection arrangement between the source and the test equipment shall be such that the temperature gradient in the connection piece of cable at a distance of one meter away from the test equipment shall be restricted to 5 deg C.		
		2)	Milli Volt drop test shall be done on switching devices before and after the type tests.		
3)		Bolt tightness of busbar joints shall be checked with torque wrench before and after short time rating tests on the circuit breaker and MCC panels.			
37.07.00	Routine checking to observe compliance to degree of protection, first numeral , on switchboard enclosures and busbar chambers shall be as under :				
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION –VI, PART-B BID DOC NO : CS-9591-101-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	
PAGE 41 OF 66					

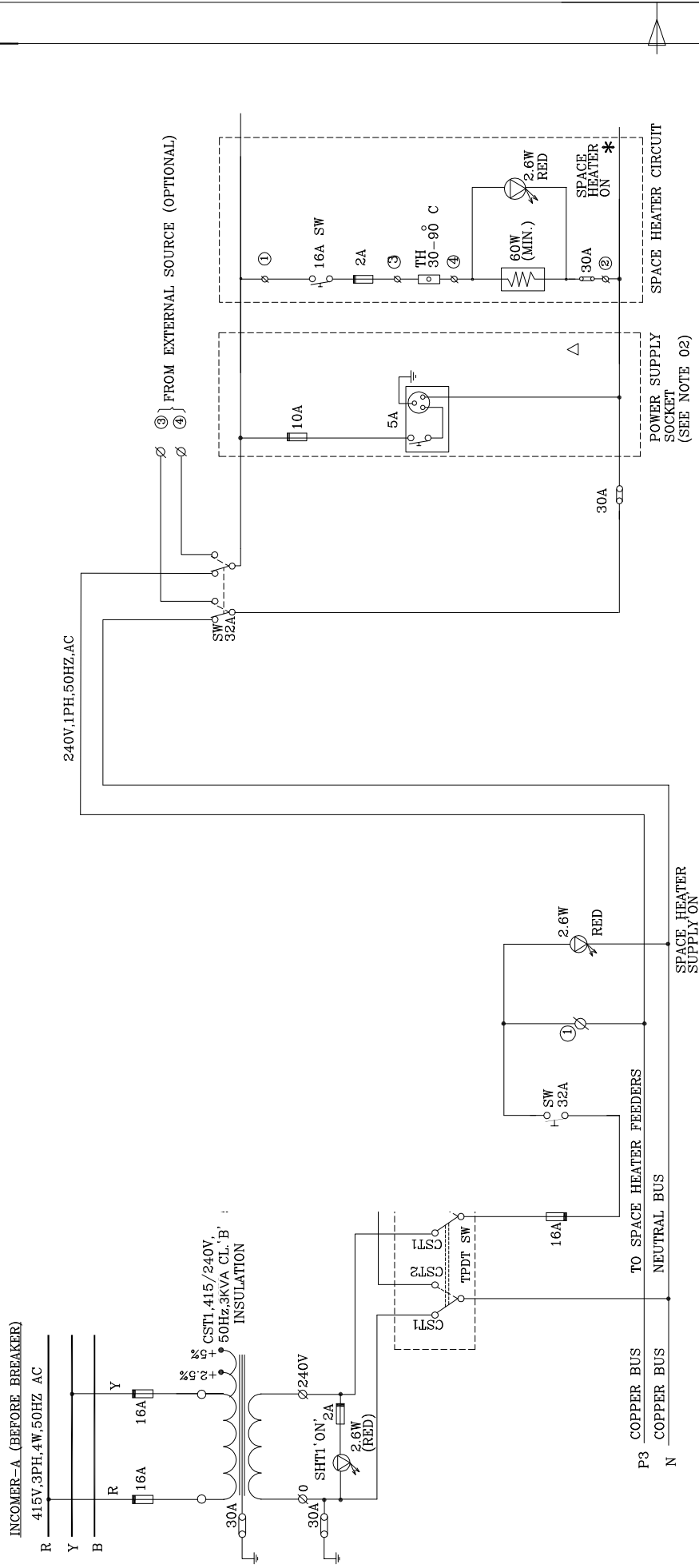
Specification for Ethernet switch:

1. Each of the Numerical relay shall be connected on to two Ethernet Switches.
2. The network of each Data Concentrator shall consist of two separate rings of Ethernet switches connected through Fibre Optic cable. Each IED, located in individual switchgear panel, shall be connected to two Ethernet switches pertaining to each of the redundant rings mounted in the corresponding MV/LV Switchgear through Cat5e Ethernet cable.
3. Ethernet switches shall be 'substation hardened', and shall comply to IEC61850-3 for communications and environment requirements. The Ethernet switches shall be of managed type with two (2) No of Fibre optic cable ports and Sixteen / Eight Copper ports to achieve the LAN configuration indicated in the drawings. The Ethernet switches shall have features to support the dual redundant rings as shown in the architecture drawings. These switches shall be mounted inside the switchgear Panels and shall be suitable for accepting dual redundant power supplies. The FO ports shall be Single-mode 1000Mbps ports and copper ports shall be 10/100Mbps ports.
Necessary software for configuration and real-time network monitoring shall be provided along with the Ethernet switches. Network monitoring feature shall be integrated with the SCADA software to provide complete network status on the HMI.

SL.NO	DESCRIPTION	DRAWING NO
01	SINGLE LINE DIAGRAM FOR ESPSG(O/G FEEDER)	3-00-114-39962/01
03	CONTROL SUPPLY TRANSFORMER CIRCUIT	3-00-114-39964/00
04	SPACE HEATER	3-00-114-39965/00
05	P & C CIRCUITS FOR RAPPING MOTORS	3-00-114-39966/00
06	P & C CIRCUITS FOR DUST DENSITY MONITORS	3-00-114-39967/00
07	P & C CIRCUITS FOR HOPPER HEATERS	3-00-114-39968/00
08	P & C CIRCUITS FOR SHAFT INSULATOR HEATERS	3-00-114-39969/00
09	P & C CIRCUITS FOR SUPPORT INSULATOR HEATERS	3-00-114-39970/00
10	ASH LEVEL INDICATOR CIRCUIT (HIGH)	3-00-114-39971/00
11	ASH LEVEL INDICATOR CIRCUIT (LOW)	3-00-114-39972/00
12	ARECA-II TO RELAY BUFFER TB DIAGRAM	3-00-114-39973/00
13	INTERCONNECTION BETWEEN ACP/ESPSWG & EC (FOR ASH LEVEL HIGH SIGNAL)	3-00-114-39974/00
14	MARSHALLING MODULE FOR SSPB OF GDRM, CERM, EERM AND HOPPER HEATER FEEDBACK	3-00-114-39975/00

NTPC DRG.NO.		9591-102-104-PYE-B-003		CUSTOMER NO: R834 & R835	
JOB NO.		CUSTOMER: NTPC LIMITED		PROJECT: KANINAGAR TELANGANA STPP, PH-I (2X800MW)	
STATUS		CONTRACT		STUDY CONTRACT PACKAGE	
DISTRIBUTION					
TO					
NO OF					
REV	DATE	APPD	CDD	DATE	DATE
TITLE		LIST OF DRAWINGS DESPFG			
DWG/APP. DRG.NO.		3-00-114-39979		SCALE : N.T.S	
				SHEET 17 OF 17	
				01	



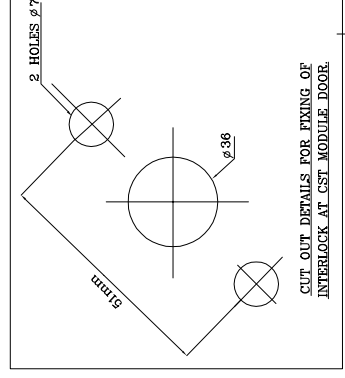


NOTE:

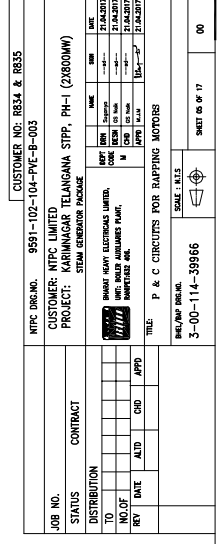
01. SPACE HEATER CIRCUIT TRANSFORMER SHALL BE LOCATED IN SEPARATE MODULE.
- 02.* THE SPACE HEATER CIRCUIT SHOWN IS FOR ONE CABLE ALLEY. NUMBER OF SUCH CIRCUIT DEPENDS UPON THE NUMBER OF CABLE ALLEY.
- 03.△ THREE NOS INDUSTRIAL TYPE POWER SUPPLY SOCKET PER PANEL SHALL BE LOCATED IN THE MIDDLE PANEL CABLE ALLEY AND AT BOTH EXTREME PANEL CABLE ALLEY.

LEGEND:

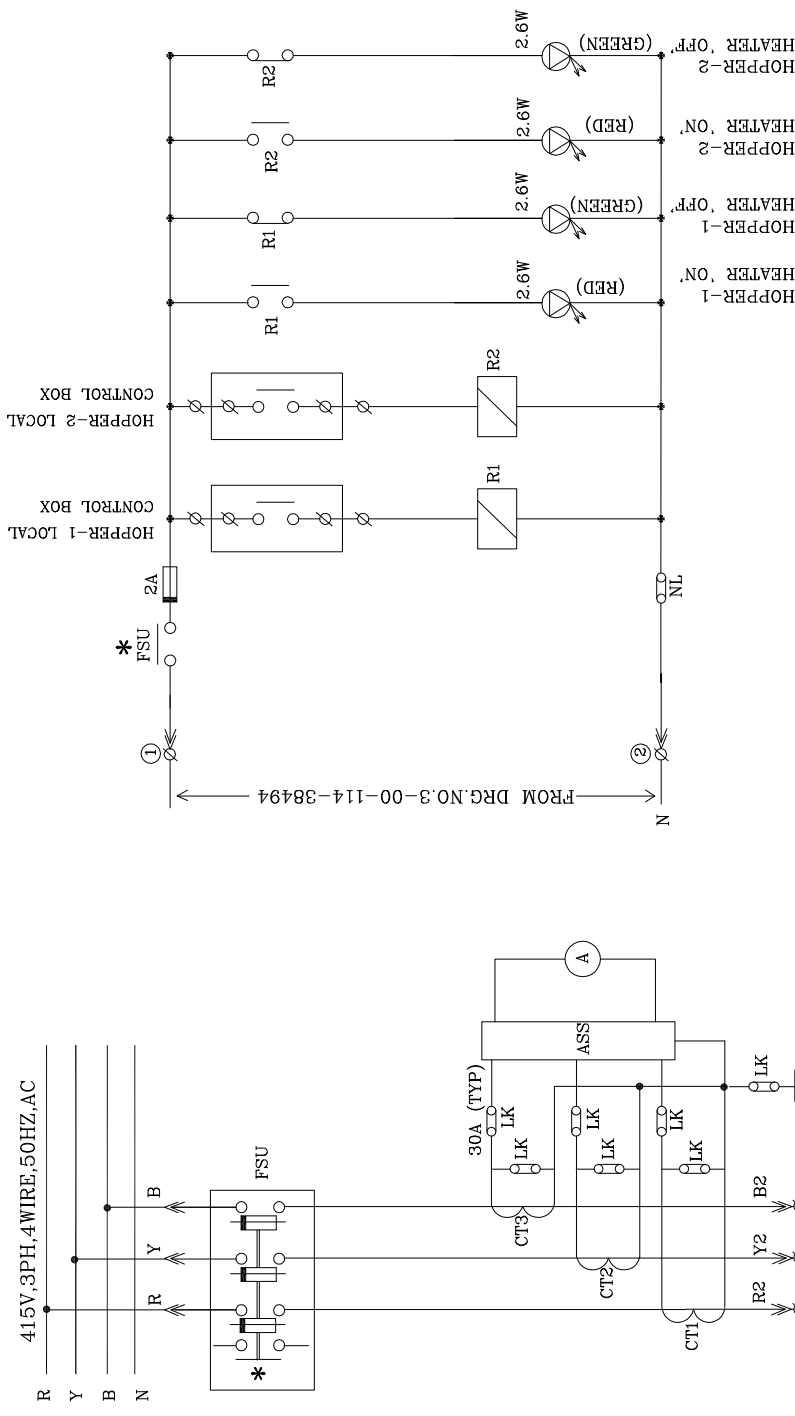
SHT - SPACE HEATER TRANSFORMER



CUSTOMER NO. R634 & R635									
MFG. DRG. NO. 9391-102-104-PYE-B-003 CUSTOMER: NTEC LIMITED PROJECT: STEAM GENERATOR TELANGANA STTP, PH-I (2X800MW) STEAM GENERATOR PACKAGE									
DISTRIBUTION STATUS CONTRACT NO. OF REV DATE AUTO CVD APPD									
SHANT KAWA ELECTRICALS LIMITED, UNIT NO. 102, KAWA INDUSTRIAL ESTATE, HEMETRAK 406, 									
DATE 21-03-2017 DESIGNED BY 102-104-PYE-B-003 CHECKED BY 102-104-PYE-B-003 DRAWN BY 102-104-PYE-B-003 APPROVED BY 102-104-PYE-B-003									
TITLES: SP-ACYS: HEATER INTL/DWG. DRG. NO. 9391-102-104-PYE-B-003 SCALE: 1:1.5  SHEET 04 OF 17 3-00-114-39865									



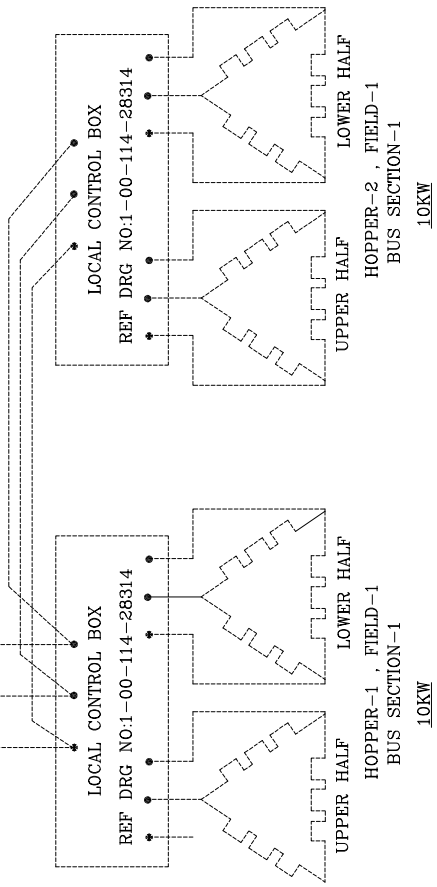
ALL DIMENSIONS ARE IN MILLIMETERS



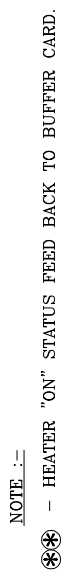
△ TO BE LOCATED TO SUIT CABLE GROUPING INDICATED BELOW.
CONTROL CABLE GROUPING CHART FOR HEATER 'ON' FEEDBACK

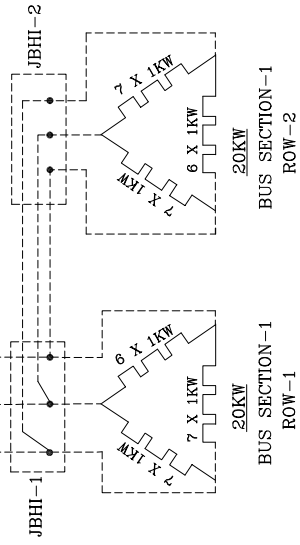
ITEM	CABLE SIZE	QTY/ ESPSG
HOPPER LOCAL CONTROL BOX	4X12C-1.5	2

FEEDBACK SIGNAL TO BUFFER CARD



NTPC DRG. NO. 9591-102-10A-PVE-B-003		CUSTOMER NO. R834 & R835	
CUSTOMER: NTPC LIMITED		PROJECT: KALKAJI LANGANA STPP, PH-I (23800MW)	
STATUS: CONTRACT		STEAM GENERATOR PACKAGE	
DISTRIBUTION		NTPC LIMITED	
TO: NTPC LIMITED		NTPC LIMITED	
NO. OF: 1		1	
REV: 1		1	
DATE: 10/01/2017		10/01/2017	
BY: 10/01/2017		10/01/2017	
TITLE: P & C CIRCUITS FOR HOPPER HEATERS		SCALE: 1:1	
SHEET NO. 17		SHEET OF 17	

[illegible]



ITEM	CABLE SIZE	QTY/ ESPSG
SUPPORT INSULATOR HEATER THERMOSTAT	1X3C-1.5	2

NTPC DRG NO. 9591-102-104-PVE-9-003										CUSTOMER NO: R834 & R835									
CUSTOMER: NTPC LIMITED																			
PROJECT: KARIMNAGAR TELANGANA STPP, PH-I (2800MW)																			
STEAM GENERATOR PACKAGE																			
BANK NEW ELECTRICALS LIMITED, UNIT: BULK PURCHASES FIRM, IMPORTERS & AG.																			
DATE 25.04.2017 TIME 12:04:20 PM BY 25.04.2017 12:04:20 PM 25.04.2017																			
NOF 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567																			

NOTE :

01. THE JUNCTION BOXES AND ALI ARE SUPPLIED DIRECTLY TO SITE BY BHEL AND THE SAME ARE NOT IN THE PANEL MANUFACTURER'S SCOPE.

*02. INSTANTANEOUS CONTACT

**03. DELAYED CONTACT TO TRIP ELECTRONIC CONTROLLER.

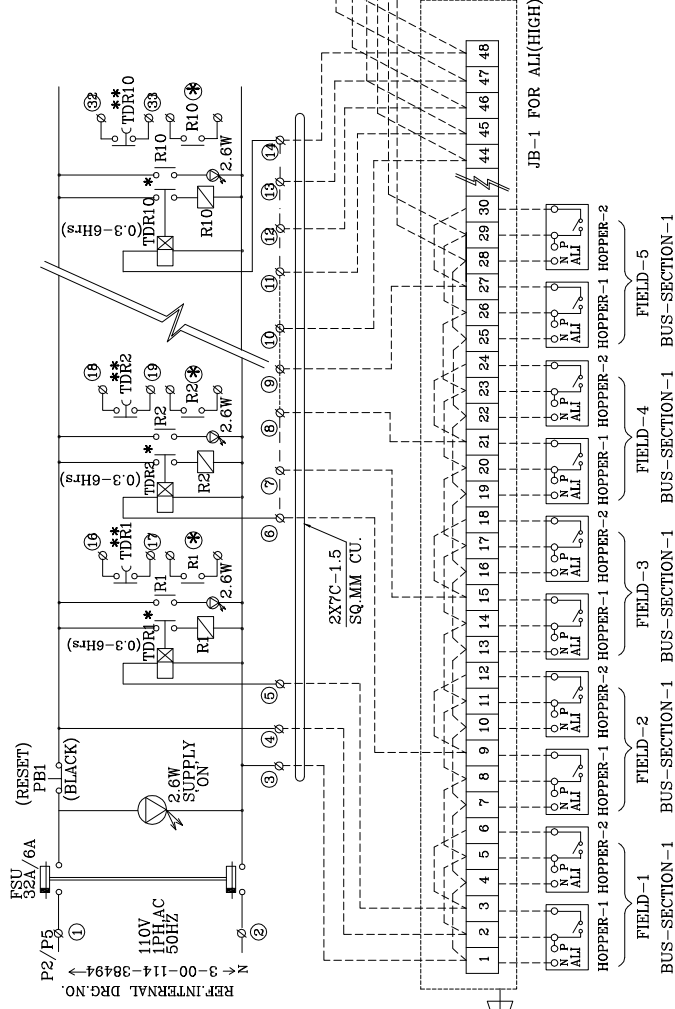
04. TOTALLY 10 TDR , 10 AUXILIARY CONTACTORS AND 11 LAMPS ARE APPLICABLE FOR EACH MODULE.

05. THE SCHEME SHOWN HERE IS FOR ONE ROW OF ESP BUS SECTION. THE SCHEME FOR ANOTHER ESP BUS SECTION IS IDENTICAL.

TOTALLY TWO NOS ALI HIGH MODULE ARE APPLICABLE FOR EACH ESPSG.

06. THE NUMBER OF ALI HIGH FOR ONE ESP BUS SECTION IS TWENTY (20).

07. CONTACTS MARKED ④ THUS FROM R1 TO R10 FOR CUSTOMER USE.



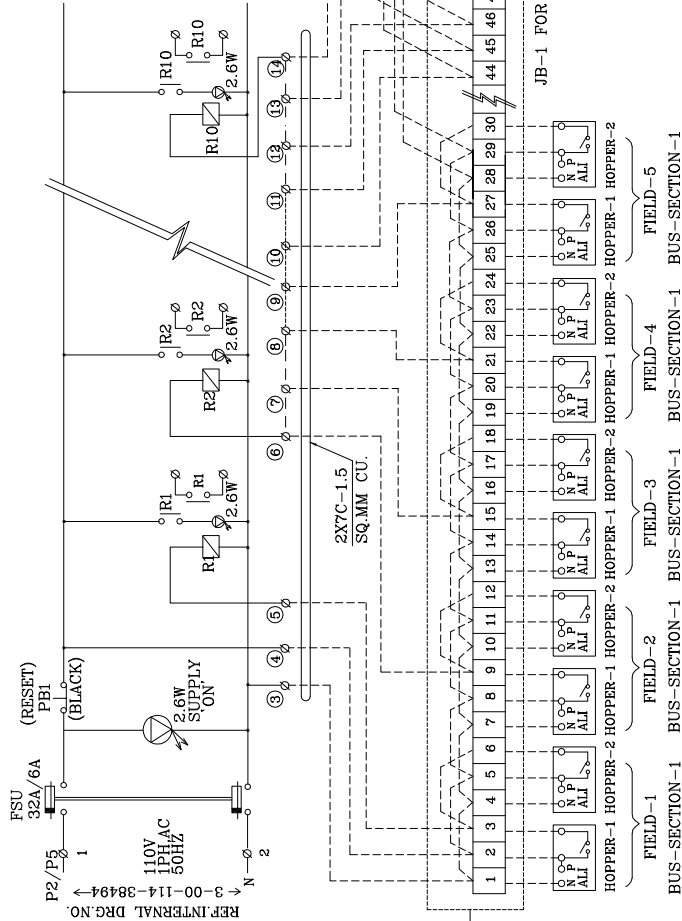
CONTROL CABLE GROUPING CHART :

ITEM	CABLE SIZE	QTY/ESPSG
TO TRIP ELECTRONIC CONTROLLER	1X3C-1.5SQMM	20
ESPSG TO JB FOR ALI	2X7C-1.5SQMM	2
JB-1 TO JB-2	1X10C-1.5SQMM	2

CUSTOMER NO. R834 & R835	
MPC DES.NO. 9591-102-104-PVE-B-003	
CUSTOMER: NPC LIMITED	
PROJECT: KARNAGAR TELANGANA STPP, PH-1 (2X800MW)	
STATION GENERATOR PACKAGE	
STATUS CONTRACT	
DISTRIBUTION	
NO. OF	REV
DATE	DATE
CHD	CHD
APPD	APPD
TITLE: ASH LEVEL INDICATOR CIRCUIT (HIGH)	
SCALE: 1:1	
SHEET 18 OF 17	

NOTE :

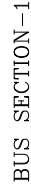
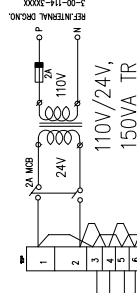
01. THE JUNCTION BOXES AND ALI ARE SUPPLIED DIRECTLY TO SITE BY BHEL AND THE SAME ARE NOT IN THE PANEL MANUFACTURER'S SCOPE.
02. TOTALLY 10 AUXILIARY CONTACTORS AND 11 LAMPS ARE APPLICABLE FOR EACH MODULE.
03. THE SCHEME SHOWN HERE IS FOR ONE ROW OF ESP BUS SECTION. THE SCHEME FOR ANOTHER ESP BUS SECTION IS IDENTICAL. TOTALLY TWO NOS ALI LOW MODULES ARE APPLICABLE FOR EACH ESPSG.
04. THE NUMBER OF ALI LOW FOR ONE ESP BUS SECTION IS TWENTY (20).



CONTROL CABLE GROUPING CHART :

ITEM	CABLE SIZE	QTY/ ESPSG
ESPSG TO JB FOR ALI	2X7C-1.5SQMM	2
JB-1 TO JB-2	1X10C-1.5SQMM	2

NTPC DRG. NO. 9591-102-10A-PVE-B-003		CUSTOMER NO: RB34 & RB35	
JOB NO.		CUSTOMER: NTPC LIMITED	
STATUS		PROJECT: KASIMAGAR TELANGANA STPP, PH-I (2X800MW)	
CONTRACT		STEAM GENERATOR PACKAGE	
DISTRIBUTION		BHEL	
TO		BHEL HEAVY ELECTRICALS LIMITED,	
NO. OF		BHEL HEAVY ELECTRICALS UNIT,	
REV		BHEL HEAVY ELECTRICALS UNIT,	
DATE		BHEL HEAVY ELECTRICALS UNIT,	
ALT		BHEL HEAVY ELECTRICALS UNIT,	
APP		BHEL HEAVY ELECTRICALS UNIT,	
TITLE		ASH LEVEL INDICATOR CIRCUIT (LOW)	
SCALE: 1:1		BHEL HEAVY ELECTRICALS UNIT,	
3-00-114-39972		SHEET 11 OF 17	



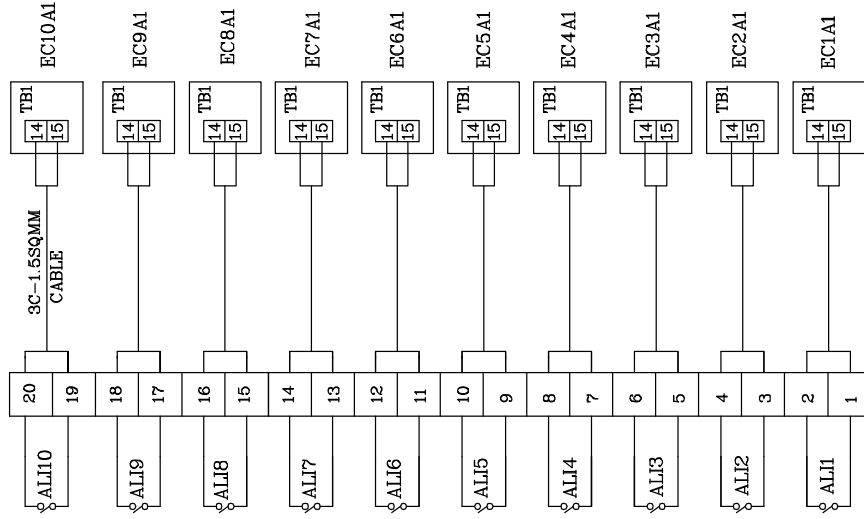
01. RELAY CARD – 340(L)x120(W)x60(H) DIN RAIL MOUNTED.
02. BUFFER CARD – 310(L)x90(W)x60(H) DIN RAIL MOUNTED.
03. THESE TERMINAL BLOCKS AND TERMINAL LOOPINGS SHOWN ARE TO BE PROVIDED BY THE PANEL(ESPG) MANUFACTURER IN A SEPARATE MODULE.
04. THE ARRANGEMENT SHOWN IS FOR BUS SETION-1 . FOR BUS SECTION-2 THE SCHEME IS IDENTICAL.

ESPSG

BUS SECTION-1

EC PANEL

ESP BUS SECTION-1

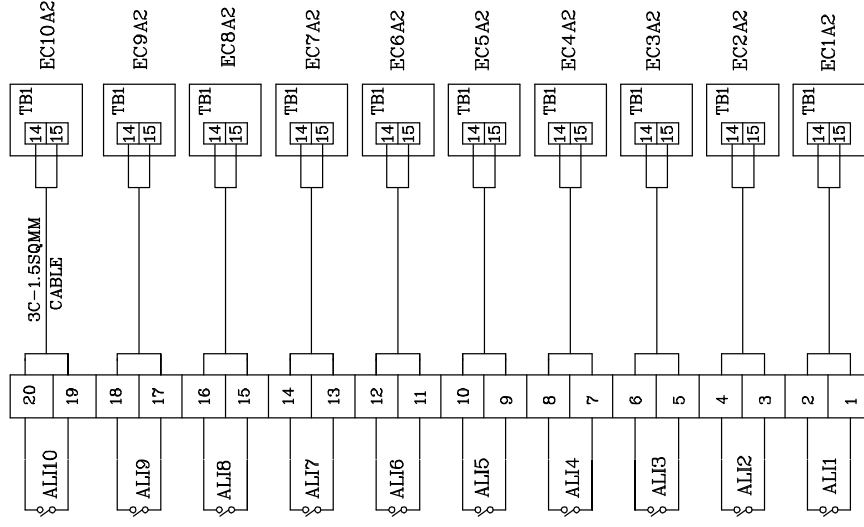


ESPSG

BUS SECTION-2

EC PANEL

ESP BUS SECTION-2



NOTE :

01. ' ' ' - THESE TERMINAL BLOCKS AND TERMINAL LOOPINGS SHOWN ARE TO BE PROVIDED BY THE PANEL(ESPSG) MANUFACTURER IN A SEPARATE MODULE.

NOTE:

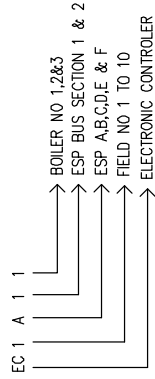
1. THE ABOVE SKETCH INDICATES INTERCONNECTION FOR 1 ESP. SIMILAR INTERCONNECTIONS APPLICABLE FOR OTHER ESP's.

LEGEND

ESPSG : ESP SWITCHGEAR PANEL

EC : ELECTRONIC CONTROL PANEL

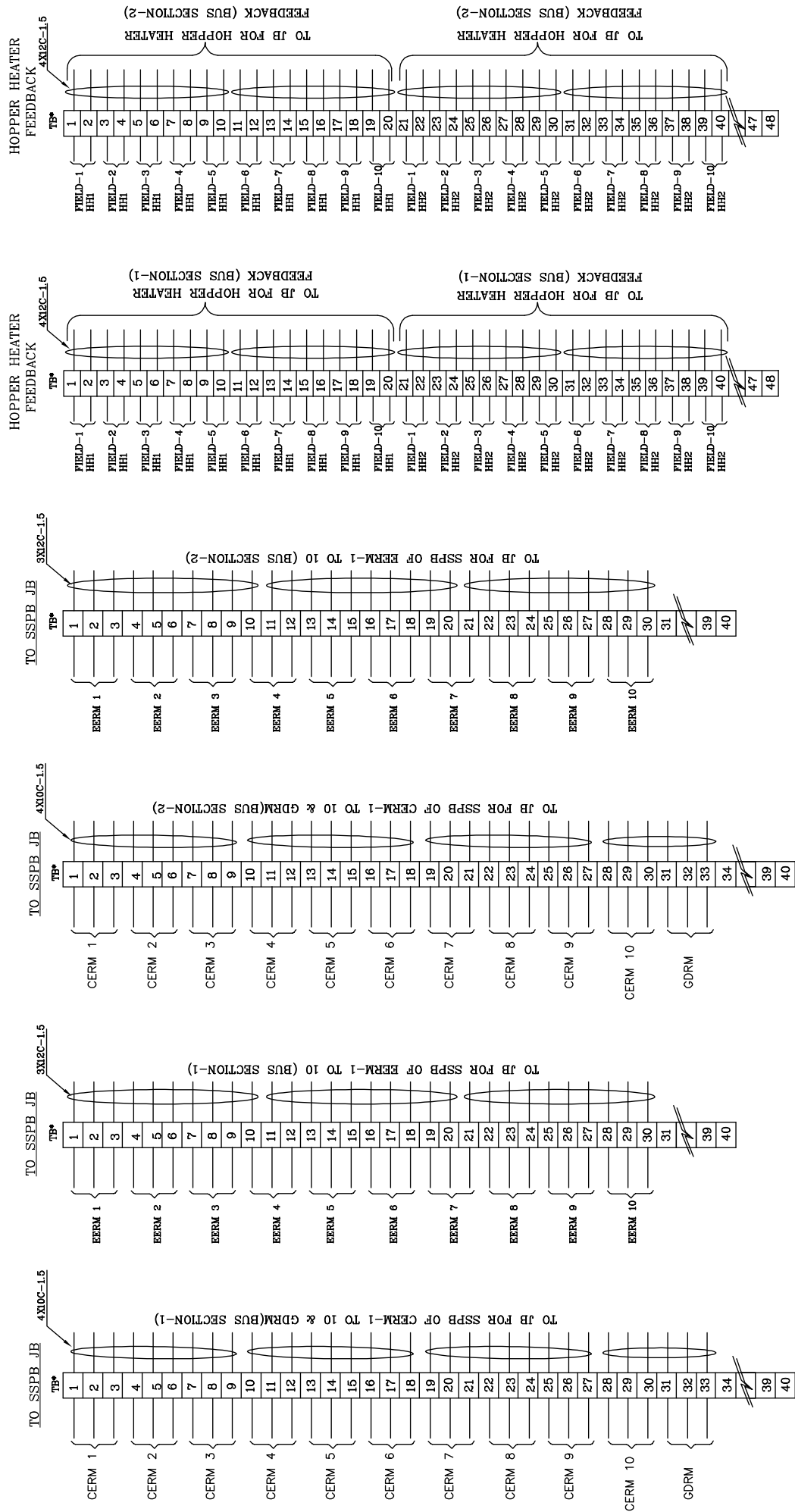
EC LEGEND



CUSTOMER NO:

NTPC DRG.NO.		NTPC LIMITED	
JOB NO.		STEAM GENERATOR	
STATUS		CONTRACT	
DISTRIBUTION		BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RAIPETSSZ 408.	
TO		DEPT CODE	M
NO.OF		CHD	M
REV		APPD	M
DATE		ALTD	
CHD		APPD	
TITLE: INTERCONNECTION BETWEEN ACP & EC(FOR ASH LEVEL HIGH SIGNAL)			
BHEL/BAP DRG.NO. 3-00-114-			
SCALE : N.T.S.			
00			

ALL DIMENSIONS ARE IN MILLIMETRES



NOTE :

01. ' * ' - THESE TERMINAL BLOCKS AND TERMINAL LOOPINGS SHOWN ARE TO BE PROVIDED BY THE PANEL MANUFACTURER IN A SEPERATE MODULE.

CUSTOMER NO: R834 & R835									
NTPC DRG.NO. 9591-102-104-PVE-B-003									
NTPC LIMITED KARIMNAGAR TELANGANA STPP, PH-I (2X800MW) STEAM GENERATOR PACKAGE									
 BHARAT HEAVY ELECTRICALS LIMITED, UNIT, BOILER AUXILIARIES PLANT, RAIPUR-1612 406.									
DISTRIBUTION		TO		NO. OF		REV		DATE	
CONTRACT		ALTD		CHD		APPD			
TITLE:		MARSHALLING MODULE FOR SSPS OF GDRM & CERM EERM AND HOPPER HEATER FEEDBACK							
BHEL/R&P DRG.NO.		SCALE : 1:1.5							
3-00-114-39975				SHEET 14 OF 17		00			

SL NO	DESCRIPTION	DRAWING NO
01	LIST OF DRAWING FOR ESP SWITCHGEAR STANDBY PANEL	3-00-114-40067/00

NTPC DRG NO. 9591-102-104-PVE-B-003		CUSTOMER NO. R834 & R835	
JOB NO.		CUSTOMER: NTPC LIMITED	
STATUS		PROJECT: KARIMNAGAR TELANGANA STPP. PH-I (21800MW)	
CONTRACT		STEAM GENERATOR PACKAGE	
DISTRIBUTION		NTPC NTPC LIMITED	
TO		NTPC NTPC LIMITED	
NO. OF		NTPC NTPC LIMITED	
REV		NTPC NTPC LIMITED	
DATE		NTPC NTPC LIMITED	
ALT		NTPC NTPC LIMITED	
APPD		NTPC NTPC LIMITED	
TITLE		LIST OF DRAWINGS ESP SWITCHGEAR STANDBY PANEL	
DRAWING NO.		3-00-114-40067	
SCALE		A1:5	
SHEET NO. OF 04		00	

SUB-SECTION – DB4

LT SWITCHGEAR

CLAUSE NO.	DATA REQUIREMENTS		
	LT Switchgears & LT Busducts PART-I TECHNICAL INFORMATION AND DATA TO BE SUBMITTED WITH THE PROPOSAL SWITCHGEAR & MCC a) General i) Manufacturer's Name ii) Type designation iii) Country of origin b) Rated voltage c) Symmetrical short circuit withstand current at rated voltage of switchgear /MCC cubicle. 		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 1 OF 10

CLAUSE NO.	DATA REQUIREMENTS			
1.00.00	PART-II TECHNICAL INFORMATION AND DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT SWITCHGEAR & MCC a) General i) Manufacturer's Name ii) Type designation iii) Country of origin b) Rated voltage c) Symmetrical short circuit withstand current at rated voltage of switchgear /MCC cubicle. d) Peak short circuit withstand current e) Rated current at ambient f) Degree of protection as per IS:13947 i) Breaker / MCC cubicles ii) Busbar chamber g) Cubicle sheet metal details i) Cold rolled / hot rolled ii) Thickness, structural & load bearing members iii) Thickness, front & rear iv) Thickness, Sides & top v) Thickness of gland plates h) Painting shade & Thickness as per IS :5 i) External surfaces(front & rear) ii) Extreme end covers i) Minimum Clearance in air for Busbars i) Between phases ii) Between phase & earth j) Standard height, width & depth of typical panel i) Circuit breaker panel ii) MCC panels (S.F./D.F.)			
	TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 2 OF 10

CLAUSE NO.	DATA REQUIREMENTS					
2.00.00	iii) Circuit breaker panel with Bus trunking /Bus Duct Termination	.....				
	iv) ACDB/DCDB	.....				
	v) AC/DC Fuse boards	.....				
	k) Width of cable alley	.....				
	l) Shrouding arrangement in cable alley provided or not	YES/NO				
	m) Earth busbar size & material	.....				
	n) Approx. Weight of one panel With circuit breaker	.....				
	o) Recommended dynamic loading for foundation design	.....				
	p) Approx. weight of one MCC panel	.....				
	q) Form of Internal Separation as per IEC-61439-2	.....				
	POWER BUSBARS & INSULATORS					
	a) Material & applicable standards	.....				
	b) Bare/painted / epoxy insulated/sleeved	.....				
	c) Continuous current rating at an ambient temp. of 50°C	.....				
	d) Temperature rise over design ambient temperature for continuous current rating deg. C	.....				
	e) Material of the support insulators	.....				
	f) One second current rating (kA)	.....				
	3.00.00	CONTROL SUPPLY TRANSFORMER				
		a) Make				
		b) Type				
		c) Material & class of insulation				
		d) Voltage rating & taps				
		e) Continuous rating (VA)				
4.00.00		CIRCUIT BREAKER				
		a) Manufacturer's name and country of manufacturer				
		b) Manufacture's type and designation				
		c) Rated Voltage				
		d) Rated operating duty				
		e) Design ambient temperature				
		f) Rated current at design ambient temperature				
		TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 3 OF 10

CLAUSE NO.	DATA REQUIREMENTS						
	g) Derating factor for site operating conditions inside panel h) Continuous current at ambient temp. i) Rated symmetrical breaking current j) Rated peak making current k) Rated short time rating (for 1 sec.) l) Rated peak momentary rating m) Number of openings, the circuit breaker is capable of performing without inspection, replacement of contacts or other parts at 100% rated breaking current n) No. of breaker auxiliary contacts provided on fixed portion of breaker & their rating o) Trip free and anti pumping features have been provided (Furnish description) p) Power operating mechanism q) Spring charging motor details i) Type ii) Rating Watts iii) Rated voltage iv) Class of insulation v) Time for fully charging the closing spring r) Emergency Manual charging facility provided s) Limits of voltage for satisfactory operation of the following devices as percentage of normal voltage i) Motor ii) Closing coil iii) Tripping coil t) Manual operating mechanism u) i) Type of Releases provided ii) Available range of following parameters for each type of release offered v) i) Maximum Tripping Time ii) Maximum Closing time w) i) Closing coil VA ii) Tripping coil VA x) Telescopic trolley YES/NO YES/NO <tr><td>TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE</td><td>TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2</td><td>DB4: LT SWITCHGEAR</td><td>PAGE 4 OF 10</td></tr>			TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 4 OF 10
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 4 OF 10				

CLAUSE NO.	DATA REQUIREMENTS
5.00.00	i) Make ii) Type designation iii) Dimensions AIR BREAK SWITCHES (The following details shall be furnished for each type & rating) a) Make b) Type c) Applicable standards d) Rated current at design ambient temperature (Amps) e) Design ambient temperature Deg C f) Rated breaking current (kA) g) Maximum through fault current withstand kA h) Door interlock as specified has been provided ? YES/NO i) No. of auxiliary contacts and its rating
	6.00.00 CONTROL/SELECTOR SWITCH a) Make b) Type Designation c) Voltage grade
	7.00.00 CONTACTOR (The following details shall be furnished for each type and rating) a) Make b) Type & applicable standards c) Rated voltage of main and auxiliary contacts d) Rated voltage of coils e) Limits of operation i) Supply voltage variation +/-% ii) Supply frequency variation for closing (+/-)% iii) Drop out voltage % f) Rated (thermal) current A g) Rated duty
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2 DB4: LT SWITCHGEAR PAGE 5 OF 10

CLAUSE NO.	DATA REQUIREMENTS			
8.00.00	h)	Rated utilisation category as per IS:13947	.....	
	i)	Rated breaking capacity kA	.....	
	j)	Rated making capacity - kA	.....	
	k)	Coil VA burden	.....	
9.00.00	AUXILIARY CONTACTOR			
	a)	Make	.....	
	b)	Type	.....	
	c)	Catalogue attached as Annexure No.	.....	
10.00.00	FUSES			
	a)	Make	.....	
	b)	Type	.....	
	c)	Category	.....	
11.00.00	CURRENT TRANSFORMERS			
	(The following details shall be provided for each type & rating)			
	a)	Make	.....	
	b)	Applicable standards	.....	
	c)	Ratio	.....	
	d)	VA Rating	.....	
	e)	Accuracy class	.....	
	f)	Class & type of insulation	.....	
	VOLTAGE TRANSFORMERS			
	a)	Make	.....	
	b)	Ratio	.....	
	c)	VA Rating	.....	
12.00.00	d)	Accuracy class	.....	
	e)	Over voltage factor	.....	
	f)	Class & type of insulation	.....	
	Numerical relays			
12.00.00	a)	General Technical Details and Drawings Enclosed	.....	
	b)	Make/Model No	.....	

TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 6 OF 10
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CLAUSE NO.	DATA REQUIREMENTS		
	c) Place of Manufacture d) Hardware version number e) Firmware version number f) Rated Voltage Vn (phase-to-neutral) g) Rated Current In h) Rated Frequency i) Over voltage capability - continuous j) Over voltage capability – 3s k) Burden on voltage transformers (VA per phase) l) Over current capability - continuous m) Over current capability – 1s n) Burden on current transformers (VA per phase) o) Reference standards p) Operating principle q) No Of communication Ports r) Compliance to IEC-61850 s) Built-in functions provided in the relay (list out) t) Protection Functions u) Measurements v) Monitoring Functions w) Control functions x) Detailed Technical Catalogue for offered Relays enclosed y) Spares and Repairs a) State availability of spares in country and spares holding in country of origin b) Maximum repair turnaround time c) Define the proposed repair strategy d) Recommended spares list z) List of reference sites in operation for more than 1 year		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE	TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 7 OF 10

CLAUSE NO.	DATA REQUIREMENTS
13.00.00	THERMAL OVERLOAD RELAY & SINGLE PHASING PREVENTER (The following details shall be furnished for each type & rating) a) Make & type designation b) Catalogue
14.00.00	VOLTMETER a) Make b) Type c) Catalogue
15.00.00	AMMETER a) Make b) Type c) Catalogue
16.00.00	PUSH BUTTONS a) Make b) Type designation c) Catalogue
17.00.00	INDICATING LAMPS a) Make b) Type c) Catalogue
18.00.00	LOCAL STARTERS a) Make & Type b) Catalogue
19.00.00	415 V NON SEGREGATED BUSDUCTS a) Manufacturer's name & address b) Type of busduct c) Material and cross section of busbars d) Rated voltage (volts) e) Maximum voltage at which busduct can operate continuously (volts) f) Continuous current rating of busbars (Amps)
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2 DB4: LT SWITCHGEAR PAGE 8 OF 10	

CLAUSE NO.	DATA REQUIREMENTS		
20.00.00	g) Short circuit current ratings & duration (kA /Sec) h) Momentary current rating kA peak i) Temperature rise over the ambient temperature i) Busbars ii) Enclosures j) Material of support insulator k) No. and arrangement of support insulators l) Material of Gaskets m) One minute power frequency withstand voltage (kV) n) Minimum creepage distance over insulator (mm) o) Conductor treatment p) Clearance (mm) i) Phase to Phase ii) Phase to earth q) Average weight per meter of busduct (kg) r) Material and thickness of Busduct s) Shape & size of enclosure	LIGHTING / WELDING TRANSFORMERS a) Make b) Voltage Ratio c) kVA Rating d) Vector Group e) Type of Cooling f) Percentage impedance g) Details of taps provided h) Class of insulation i) Degree of protection for enclosure j) Whether mounted inside MLDB or outside k) If it is mounted outside dimension of the enclosure	
	21.00.00 MCCB		
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR PAGE 9 OF 10

CLAUSE NO.	DATA REQUIREMENTS			
22.00.00	a)	Rated voltage		
	b)	Rated insulation level	.....	
	c)	Rated ultimate &Service S.C.breaking capacity	.....	
	d)	Rated making capacity	.....	
	e)	Utilization category	.....	
	Ethernet switches (For Networking of Numerical Relays)			
	a)	Compliance to IEC 61850	.....	
	b)	No of Ports	.....	
	c)	Power supply to Ethernet Switches	.....	
TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800MW) STEAM GENERATOR ISLAND PACKAGE		TECHNICAL DATA SHEETS SECTION-VI, PART-G BID DOC NO:CS-9591-101-2	DB4: LT SWITCHGEAR	PAGE 10 OF 10



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

Annexure-A
PRICE SCHEDULE

Sr.No.	ITEM NO.	ITEM NAME	UOM	TOTAL QTY.	RATING(A)	UNIT PRICE	TOTAL PRICE
1	ELTELENBAP01	ESP SWITHGEAR STANDBY PANEL-A	EA	2	4000		
2	ELTELENBAP02	ESP SWITHGEAR STANDBY PANEL-B	EA	2	4000		
3	ELTELENBAP03	ESP SWITHGEAR PANEL DFDO	EA	12	3200		
4	ELTELENBAP04	E&C SPARE	SET	1			

NOTES:

1. SUMMATION OF ALL UNIT RATES OF MODULES SHALL BE EQUIVALENT TO TOTAL BOARD COST QUOTED, VARIANCE OF +/- 5% IS ACCEPTABLE. BEYOND 5% OFFER WILL NOT BE CONSIDER AS VALID OFFER. IN UNIT ADDITION-DELETION PRICES, PRICES QUOTED FOR COMPONENTS SHALL BE AS PER LIST PRICE OF CONCERNED MANUFACTURES. IF ANY ABNORMAL PRICES ON HIGHER SIDE OBSERVED OFFER MAY BE REJECTED.

2. ALL LT PCC/ MCC/ DBs SHALL BE SUPPLIED ALONGWITH THE INTEGRAL BASE FRAMES, FOUNDATION BOLTS, CABLE GLANDS & LUGS AND TOOLS & TACKLES AS MENTIONED IN DIFFERENT SECTIONS. ALL FIXING NUTS & BOLTS TOGETHER WITH FOUNDATION BOLTS SHALL ALSO BE SUPPLIED.

3. ITEM WISE PRICES WITH DESCRIPTION AND RATING OF EACH ITEM COMPLYING TO LIST FURNISHED IN THE SCHEDULE OF UNIT PRICES SHALL BE FURNISHED IN SCHEDULE OF UNIT PRICE.

4. FOR DETAILED BOARD WISE BOM, REFER ANNEXURE-B.

5. FOR DETAILED MODULE WISE BOM, REFER ANNEXURE-C.

6. ADDITION/DELETION OF QUANTITIES SHALL BE APPLICABLE AT THE QUOTED PRICE. THE UNIT RATE OF SUPPLY OF ALL EQUIPMENTS & SERVICES QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES, WHICH MAY BE TO THE EXTENT OF $\pm 30\%$ OF THE TOTAL CONTRACT VALUE DERIVED ON THE BASIS OF ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.

a. COMPLETE DIMENSIONS OF ALL THE BOARDS INCLUDING NO OF ACB, MCC. GA DRAWING SHALL BE DULY SUBMITTED FOR ALL BOARDS.

b. DIMENSIONS OF EACH TYPE OF PANEL.

c. MODULE SIZE OF EACH TYPE OF FEEDER.

d. MINIMUM CLEARANCES REQUIRED ON ALL SIDES FOR EACH TYPE OF PANEL.

e. NO. of VERTICAL (including PCC, MCC etc.) of EACH PANLES TO BE GIVEN, ELSE YOUR OFFER WILL BE REJECTED..

7. DOUBLE COMPRESSION, NICKLE PLATED BRASS CABLE GLANDS & HEAVY DUTY LUGS OF NTPC APPROVED MAKE FOR EXTERNAL POWER, CONTROL & EARTHING CONNECTIONS AT SUPPLIED EQUIPMENT END AND FOUNDATION BOLT ARE IN THE SCOPE OF BIDDER. BIDDER TO QUOTE ALL EQUIPMENT WITH CABLE GLANDS, LUGS AND FOUNDATION BOLTS.



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

Annexure-B
BOARD WISE BOM

Name of the Board: ESP STANDBY PANEL-A				
TYPE OF CONNECTION: TOP/SIDE BUSDUCT ENTRY				
DOUBLE FRONT D/O TYPE				
FLOOR MOUNTED				
DESCRIPTION	RATING	MODULE TYPE	ACTUAL	REMARKS
INCOMER-1	4000A	DAET (I/C)	1	BUSDUCT ENTRY
INCOMER-2	630A	DAE (I/C)	1	CABLE ENTRY
BREAKER O/G	4000A	DAE/DAE-TIE (O/G)	6	BUSDUCT ENTRY
ESP & ID FAN EMR. MCC	400A	E/E3	2	CABLE ENTRY
MLDB	250A	E/E3	2	CABLE ENTRY
CHIMNEY LIGHTING	250A	E/E3	2	CABLE ENTRY
ESP AC MCC	400A	E/E3	2	CABLE ENTRY
BUS PT	100VA	G1	1	
ETHERNET SWITCH			2	



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

Annexure-B
BOARD WISE BOM

Name of the Board: ESP STANDBY PANEL-B				
TYPE OF CONNECTION: TOP/SIDE BUSDUCT ENTRY				
DOUBLE FRONT D/O TYPE				
FLOOR MOUNTED				
DESCRIPTION	RATING	MODULE TYPE	ACTUAL	REMARKS
INCOMER-1	4000A	DAET (I/C)	1	BUSDUCT ENTRY
BREAKER O/G	4000A	DAE/DAE-TIE (O/G)	6	BUSDUCT ENTRY
ESP & ID FAN EMR. MCC	400A	E/E3	2	CABLE ENTRY
MLDB	250A	E/E3	2	CABLE ENTRY
CHIMNEY LIGHTING	250A	E/E3	2	CABLE ENTRY
ESP AC MCC	400A	E/E3	2	CABLE ENTRY
BUS PT	100VA	G1	1	
ETHERNET SWITCH			2	



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

Annexure-B
BOARD WISE BOM

Name of the Board: ESP SWITCHGEAR PANEL				
TYPE OF CONNECTION: TOP/SIDE BUSDUCT ENTRY				
DOUBLE FRONT D/O TYPE				
FLOOR MOUNTED				
DESCRIPTION	RATING	MODULE TYPE	ACTUAL	REMARKS
INCOMER-1	3200A	DAET (I/C)	1	BUSDUCT ENTRY
INCOMER-2	3200A	DAE (I/C)	1	BUSDUCT ENTRY
EOH	32A	E/E3	2	CABLE ENTRY
RAPING MOTOR	0.37KW	RM	50	CABLE ENTRY
HOPPER HEATER	24KW	HH	24	CABLE ENTRY
SUPPORT INSULATOR HEATER	40KW	HI	4	CABLE ENTRY
SHAFT INSULATOR HEATER	10KW	HS	4	CABLE ENTRY
DUST DENSITY MONITOR	1.1KW	DDM	2	CABLE ENTRY
CONTROL SUPPLY	5KVA	CS	1	
SPACE HEATER SUPPLY	3KVA	SH	1	
ASH LEVEL INDICATOR(HIGH)	6A	ALI(H)	2	CABLE ENTRY
ASH LEVEL INDICATOR(LOW)	6A	ALI(L)	2	CABLE ENTRY
3D LEVEL	6A	E/E3	2	CABLE ENTRY
ELECTRONIC CONTROLLER	400A	E/E3	24	CABLE ENTRY
BUS PT	100VA	G1	1	
ARECA MARSHALLING MODULE		ARECA	2	
MARSHALING MODULE FOR SSPB OF RAPING MOTOR AND HOPPER HEATER FEEDBACK		MM	2	
ETHERNET SWITCH			2	



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**Annexure-C
MODULE WISE BOM**

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
1	DAET (I/C)	PMCC INCOMER OF 1600A, 2500A, 3000A, 3200A, 4000A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	15
		CONTROL FUSE 16A	4
		FUSE BASE 32A	19
		Indicating Lamp	5
		CURRENT TRANSFORMER (PROTECTION & METERING) 10VA,CL-5P20	3
		CURRENT TRANSFORMER (PROTECTION) with VDR 10VA,CL-PS	3
		POTENTIAL TRANSFORMER -CAST RESIN, OVER VOLTAGE FACTOR 1.2 CONT./1.5 FOR 30 SEC. 415/110,50 VA CL-0.5 INSL CL-E	1
		Auxiliary Contactor 3NO+1NC	3
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A,220 V DC	2
		2POLE 2POSI SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTERCTION • RESTRICTED EARTRH FAULT PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMNET • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THERSHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Breaker Contact Multiplication relay	1

2	DAE (I/C)	MCC INCOMER OF 400A, 630A, 800A, 1000A, 1250A, 1600A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	15
		CONTROL FUSE 16A	4
		FUSE BASE 32A	19
		Indicating Lamp	5
		CURRENT TRANSFORMER (PROTECTION & METERING) 10VA,CL-5P20	3
		POTENTIAL TRANSFORMER -CAST RESIN, OVER VOLTAGE FACTOR 1.2 CONT./1.5 FOR 30 SEC . 415/110,50 VA CL-0.5 INSL CL-E	1
		Auxiliary Contactor 3NO+1NC	3
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A,220 V DC	2
		2POLE 2POSI SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMENT • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Breaker Contact Multiplication relay	1



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**Annexure-C
MODULE WISE BOM**

3	DAE/DAE-TIE (O/G)	OUTGOING BREAKER FEEDER OF 630A, 800A, 1000A, 1250A, 1600A, 2500A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	8
		CONTROL FUSE 16A	2
		FUSE BASE 32A	10
		Indicating Lamp	5
		CURRENT TRANSFORMER (PROTECTION & METERING) 10VA, CL-5P20	3
		POTENTIAL TRANSFORMER -CAST RESIN, OVER VOLTAGE FACTOR 1.2 CONT./1.5 FOR 30 SEC. 415/110, 50 VA CL-0.5 INSL CL-E	1
		Auxiliary Contactor 3NO+1NC	3
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		2POLE 2POSI SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMENT • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Breaker Contact Multiplication relay	1
4	G1	BUS PT MODULE FOR PCC / PMCC SHALL COMPRISE OF:	
		CONTROL FUSE-6A	7
		FUSE BASE-32A	7
		POTENTIAL TRANSFORMER -415/ROOT3 /110/ROOT3, 50 VA CL-0.5 INSL CL-E	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS(FIXED)	As required
5	CS	EACH CONTROL SUPPLY OUTGOING SHALL COMPRISE OF:	
		CONTROL FUSE-16A	4
		CONTROL FUSE-63A	4
		FUSE BASE-63A	8
		AUX. CONTACTOR , 2NO+2NC, CV. 110 V AC	4
		Indication Lamp	4
		NEUTRAL LINK-32A	6
		Rotary On/OFF Switch	1
		CONTROL TERMINALS(FIXED)	As required
		POWER TERMINALS	As required
		CONTROL TRANSFORMER, DRY TYPE, CAST RESIN, 415/110V	2
		4POLE, 2POSI, SELECTOR SWITCH FOR CONTROL TRF.-25A, 110V AC	2



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**Annexure-C
MODULE WISE BOM**

6	SH	EACH CONTROL SUPPLY OUTGOING SHALL COMPRISE OF:	
		CONTROL FUSE-16A	4
		CONTROL FUSE-63A	4
		FUSE BASE-63A	8
		AUX. CONTACTOR , 2NO+2NC,CV. 110 V AC	4
		Indication Lamp	2
		NEUTRAL LINK-32A	6
		Rotary On/OFF Switch	1
		CONTROL TERMINALS(FIXED)	As required
		POWER TERMINALS	As required
		CONTROL TRANSFORMER, DRY TYPE, CAST RESIN, 415/240V	1
7(A)	E/E3	TPN AC OUTGOING MCCB OPERATED FEEDER FOR RATING 100A AND ABOVE	
		MCCB TP MICROPROCESSOR BASED ADJ. O/L,S/C & E/F RELEASE	1
		EXTENDED ROTARY HANDLE	1
		MCCB AUXILIARY CONTACT 1C/O	1
		MCCB TRIP CONTACT 1C/O	1
		INDICATION LMAP	3
		NETURAL LINK EQUIVALENT TO MCCB RATING	1
7(B)	E/E3	TPN AC OUTGOING SFU OPERATED FEEDER FOR RATING below 100A	
		3 POLES SFU	1
		POWER FUSE	3
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
8	E1	SP AC OUTGOING SFU OPERATED FEEDER FOR RATING below 100A	
		(TP)SWITCH FUSE UNIT	1
		HRC FUSE (POWER)	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
9	RM	RAPING MOTOR 0.37KW	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-4A	1
		FUSE BASE-32A	1
		POWER CONTACTOR(AC) WITH 2NO+2NC AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	2
		OVERLOAD RELAY, BUILT IN SPPR FEATURE 1NO+1NC AUX. & INDEPENDENT MOUNTING TYPE	1
		MOUNTING KIT FOR O/L RELAY	1
		RESET CORD ACTUATOR	1
		Indication lamp	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		AUTO/Manual selector switch 10A	1
10	DDM	DUST DENSITY MONITORS (2X1.1KW)	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-4A	2
		FUSE BASE-32A	1
		POWER CONTACTOR(AC) WITH 2NO+2NC AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	3
		OVERLOAD RELAY, BUILT IN SPPR FEATURE 1NO+1NC AUX. & INDEPENDENT MOUNTING TYPE	2
		MOUNTING KIT FOR O/L RELAY	2
		RESET CORD ACTUATOR	2
		Indication lamp	5
		NEUTRAL LINK-32A	2
		CONTROL TERMINALS (DRAWOUT)	30
		Rotary On/OFF Switch	1



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**Annexure-C
MODULE WISE BOM**

11	HH	HOPPER HEATER 24KW	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-4A	1
		FUSE BASE-32A	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	2
		Indication lamp	4
		Current Transformer	3
		NEUTRAL LINK-32A	1
		Ammeter	1
		Ammeter Selector Switch	1
		CONTROL TERMINALS (DRAWOUT)	As required
		CT Shorting Link	As required
12	HS	SHAFT INSULATOR HEATER 10KW	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-4A	1
		FUSE BASE-32A	1
		3P POWER CONTACTOR(AC) WITH 2NO+2NC AUX CONTACT COIL VOLTAGE 110V AC	1
		Indication lamp	2
		Current Transformer	3
		NEUTRAL LINK-32A	1
		Ammeter	1
		Ammeter Selector Switch	1
		CONTROL TERMINALS (DRAWOUT)	As required
		Rotary On /off Switch 16A	1
13	HI	SUPPORT INSULATOR HEATER 40KW	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-4A	1
		FUSE BASE-32A	1
		3P POWER CONTACTOR(AC) WITH 2NO+2NC AUX CONTACT COIL VOLTAGE 110V AC	1
		Indication lamp	2
		Current Transformer	3
		NEUTRAL LINK-32A	1
		Ammeter	1
		Ammeter Selector Switch	1
		CONTROL TERMINALS (DRAWOUT)	As required
		Rotary On /off Switch 16A	1
14	ALI(H)	ASH LEVEL INDICATOR (HIGH)	
		(DP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	2
		Aux. Contactor 2NO+2NC,240VAC	10
		Indication Lamp	11
		Timer with 2C/O contact,240VAC	10
		Push Button with 1NC CONTACT	1
		CONTROL TERMINALS (Fixed)	As required
15	ALI(L)	ASH LEVEL INDICATOR (LOW)	
		(DP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	2
		Aux. Contactor 2NO+2NC,240VAC	10
		Indication Lamp	11
		Push Button with 1NC CONTACT	1
		CONTROL TERMINALS (Fixed)	As required



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

Annexure-C
MODULE WISE BOM

16	ARECA	ARECA MARSHALING MODULE	
		CONTROL TRANSFORMER, DRY TYPE, CAST RESIN, 110/24V	1
		CONTROL TERMINALS (Fixed)	As required
17	MM	MARSHALING MODULE FOR SSPB OF RAPING MOTOR AND HOPPER HEATER FEEDBACK	
		CONTROL TERMINALS (Fixed)	As required



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

Annexure-D
UNIT PRICE SCHEDULE

UNIT PRICE SCHEDULE FOR ESPSWITCHGEAR			
MODULE TYPE	RATING	UNIT PRICE	REMARKS
DAET (I/C)	4000A		
DAET (I/C)	3200A		
DAE (I/C)	3200A		
DAE (I/C)	630A		
DAE/DAE-TIE (O/G)	4000A		
E/E3	400A		
E/E3	250A		
G1	100VA		
E/E3	32A		
RM	0.37KW		
HH	24KW		
HI	40KW		
HS	10KW		
DDM	1.1KW		
CS	5KVA		
SH	3KVA		
ALI(H)	6A		
ALI(L)	6A		
E/E3	6A		
ARECA			
MM			
Empty Panel with Horizontal & Vertical Busbar, Support & Auxiliary Busbar			
DFDO MCC	4000/630A		
DFDO MCC	3200/630A		
PCC	4000/4000A		
PCC	3200/3200A		
PCC	4000/630A		



TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)

ANNEXURE-E
E C SPARE

LIST OF E&C SPARE FOR ESPSWITCHGEARS (ESP PACKAGE)

SL.NO	Description	Rating	Total Qty	UNIT PRICE
1	MCCB FOR 400A FEEDER	400A	2	
2	MCCB FOR 250A FEEDER	250A	2	
3	INDICATING LAMP WITH LENS ASSEMBLY- RED	220VDC	10	
4	INDICATING LAMP WITH LENS ASSEMBLY- YELLOW	220VDC	10	
5	INDICATING LAMP WITH LENS ASSEMBLY- GREEN	220VDC	10	
6	DRAWOUT CONTROL TERMINAL BLOCKS (FIXED)		10	
7	DRAWOUT CONTROL TERMINAL BLOCKS (MOVING)		10	
8	BREAKER DRAWOUT HANDLE		4	
9	BREAKER HANDLING TROLLEY		2	
10	300MM DUMMY PANEL	4000A	4	
11	POWER FUSE LINK FOR RAPPING MOTOR FEEDER	6A	60	
12	POWER FUSE LINK FOR SHAFT INSULATOR FEEDER	25A	18	
13	POWER FUSE LINK FOR HOPPER HEATER FEEDER	63A	60	
14	POWER FUSE LINK FOR EOH FEEDER	32A	12	
15	CONTROL FUSE LINK(COMPLETE SET)	4A	12	
16	MCCB FOR 400A FEEDERS	400A	4	
17	POWER FUSE LINK FOR SUPPORT INSULATOR HEATER FEEDER	125A	2	
18	POWER FUSE LINK ASH LEVEL HIGH FEEDER	6A	24	
19	INDICATING LAMP WITH LENS ASSEMBLY- RED	110VAC	30	
20	INDICATING LAMP WITH LENS ASSEMBLY- GREEN	110VAC	30	
21	INDICATING LAMP WITH LENS ASSEMBLY- AMBER	110VAC	30	
22	DRAWOUT CONTROL TERMINAL BLOCKS (FIXED)		30	
23	DRAWOUT CONTROL TERMINAL BLOCKS (MOVING)		30	
24	BREAKER DRAWOUT HANDLE		24	
25	BREAKER HANDLING TROLLEY		2	
26	300MM DUMMY PANEL	3200A	12	



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)
TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-K)**

SPECIFICATION NO. EPD-TS-CPBG-CPJ005-06
VOLUME NO. : **II-B**
SECTION :
REV NO. : **00** DATE: 03.02.2018
SHEET : **1** OF **1**

ANNEXURE-K

DRAWINGS AND DOCUMENTS DISTRIBUTION SCHEDULE



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-K)**

SPECIFICATION NO. EPD-TS-CPBG-CPJ005-05

VOLUME II B

SECTION

REV NO. 00 DATE 25/05/2018

SHEET 1 OF 1

ANNEXURE-K

NO. OF DRAWINGS/DOCUMENTS REQUIRED FROM VENDOR

SL.NO.	DESCRIPTION	PRINTS	CD-ROM	MANUALS
1	DRAWING /DOCUMENTS –FIRST SUBMISSION	3		
2	DRAWING /DOCUMENTS-SUBSEQUENT REVISED SUBMISSION	5		
3	DRAWING /DOCUMENTS-FINAL (AFTER CATEGORY –I APPROVAL)	5	5	
4	DRAWING AS BUILT	5	5	
5	O/M MANUAL-DRAFT			3
6	O/M MANUAL-FINAL		3	10
7	TYPE TEST CERTIFICATES	5		

ALL DRAWINGS SHALL BE SUBMITTED IN BOTH PDF AND AUTOCAD (.DWG 2004) FORMATS



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. EPD-TS-CPBG-CPJ005-06

VOLUME NO.

SECTION :

REV NO. : 00

SHEET : Page 1 of 3

LIST OF CODES & STANDARDS.

Annexure M

Notes:

1 Equipment, accessories, components, material and tests shall confirm, to the specifications of latest revision of applicable standards.

2 Equipment, accessories, components, material and tests shall confirm, in general, to the Specifications of

☒ S

☐ BS

☐ IEC

Unless marked otherwise in the list below. Applicable standards are to be ticked ☐

LV Switch gear: –

1	Switchgear General Requirements	☒ IS : 4237	☐ BS : 162	☐ IEC :
2	Factory built assemblies of LV Switchgear control gear	☒ IS : 8623	☐ BS:5486	☐ IEC : 439
3	Selection , installation and maintenance of switchgear and control gear	☒ IS : 10118	☐ :	☐ IEC :
4	Busbar main connections and accessories	☒ IS: 5578	☐ BS : 159	☐ IEC :
5	Rail mounting in switchgear and control gear installation	☒ IS :11039	☐ BS :	☐ IEC : 715
6	Marking and identification of conductor and apparatus terminal	☒ IS:11053	☐ BS :	☐ IEC :
7	Marking of insulated conductors	☒ IS: 5578	☐ BS :	☐ IEC : 391
8	Item designation	☒ IS :8270	☐ BS :	☐ IEC :
9	Climate proofing of electrical equipment	☒ IS: 3202	☐ BS : CP 1014	☐ IEC :
10	Degree of protection (enclosure)	☒ IS:13947	☐ BS :	☐ IEC : 144
11	Wrought aluminium & Al. alloys	☒ IS:5082	☐ BS: 2898	☐ IEC : 114
12	Copper of bus bars	☒ IS :	☐ BS :	☐ IEC : 28
13	LV circuit breakers	☒ IS :2516 Pt. I& II	☐ BS: 4752 ☐ BS:3871 SEC 1	☐ IEC : 157 -1
14	Starters	☒ IS : 8544	☐ BS: 4941	☐ IEC : 292-1
15	Identification of terminals of contractors and associated overload	☒ IS :10705	☐ BS:	☐ IEC : 158-1C
16	Air break switch	☒ IS :4064	☐ BS: 5419	☐ IEC : 408
17	Contactors	☒ IS:2959	☐ BS: 775	☐ IEC : 158-1
18	HRC cartridge fuses	☒ IS:13703	☐ BS: 88	☐ IEC : 269-1



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. EPD-TS-CPBG-CPJ005-06

VOLUME NO.

SECTION :

REV NO. : 00

SHEET : Page 2 of 3

19	Indicating instruments	[v] IS:1248	[] BS: 89	[] IEC : 51
20	Dimensions for panel mounted indicating instruments	[v] IS:2419	[] BS:	[] IEC :
21	AC electricity meters	[v] IS:722	[] BS: 5685	[] IEC : 521
22	Relays	[v] IS:3231	[] BS:142	[] IEC : 255
23	Static protective relays	[v] IS :8686	[] BS:	[] IEC :
24	Current transformers	[v] IS :2705	[] BS: 3938	[] IEC : 185
25	Voltage transformers	[v] IS: 3941	[] BS: 3941	[] IEC :
26	LV Control Transformers	[v] IS: 12021	[] BS :	[] IEC :
27	Miniature circuit breakers	[v] IS: 8828	[] BS : 3871	[] IEC :
28	Control switches & push button	[v] IS: 13947	[] BS:	[] IEC :
29	Thermostatic Bimetals	[v] IS: 8588	[] BS:	[] IEC :
30	Phosphating of iron & steel	[v] IS: 6005	[] BS: 3189	[] IEC :
31	"Colours for ready mixed paints and enamels"	[v] IS: 5	[] BS:	[] IEC :
32	Environmental tests	[v] IS: 2106	[] BS:	[] IEC :
33	Maintenance & field testing of relays	[v] IS:9124	[] BS:	[] IEC :
34	Specification for PVC insulated cables for working voltage upto & including 1100volts	[v] IS: 694	[] BS:	[] IEC :



**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. EPD-TS-CPBG-CPJ005-06

VOLUME NO.

SECTION :

REV NO. : 00

SHEET : Page 3 of 3

LPB & Local Starters:-

1	Factory built assemblies of LV Switchgear and control gear	☒ IS: 8623 PART -II	☐ BS :5486	☐ IEC : 439
2	Degree of protection	☒ IS: 13947	☐ BS :5420	☐ IEC : 144
3	Push button	☒ IS: 13947	☐ BS :	☐ IEC : 337
4	Climatic proofing of electrical equipment	☒ IS: 3202	☐ BS :CP1014	☐ IEC :
5	AC motors starters for voltage not exceeding 1000 V	☒ IS: 8544	☐ BS : 4941	☐ IEC : 292
6	Code of practice for phosphating iron & steel	☒ IS: 6005	☐ BS :3189	☐ IEC :
7	Colour for ready mixed paints & enamels	☒ IS: 5	☐ :	☐ IEC :

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1	BOUGHT OUT ITEMS (ELECTRICAL COMPONENTS)				M	T / C							
1.1	AIR CIRCUIT BREAKER	VERIFICATION OF MAKE, TYPE RATING	MAJOR	VISUAL	100%		IS 13947 , TECH SPEC AND APPROVED DRG	IS 13947 , TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		ROUTINE TEST	CRITICAL	ELECT	100%				SUPPLIER TC	V	V	V	
1.2	MCCB	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH TYPE		IS 13947 , SPEC AND APPROVED DRG	IS 13947 , SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUCHTIONL CHECK		FUCNTIONAL	10% OF EACH TYPE				LOG BOOK	P	V	V	
1.3	ROTARY SWITCHES (CONTROL AND SELECTOR)	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	5 SAMPLE OF EACH TYPE		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK			FUNCTIONAL	10%				P	V	V	
1.4	DOOR , TOGGLE & TNC SWITCH	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH TYPE		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
1.5	SWITCH FUSE UNITS	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10%		IS 13947, TECH SPEC AND	IS 13947 , TECH SPEC AND	LOG BOOK	P	V	V	

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION		
		APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
		CONTINUITY TEST	MAJOR	FUNCTI ONAL	10% OF EACH RATING		APPROVED DRG	APPROVED DRG		P	V	V	
1.6	ETHERNET SWITCH	MAKE, TYPE , RATING MODEL	MAJOR	VISUAL	100%		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	100%				SUPPLIER TC	V	V	V	
1.7	CONTROL TRANSFORMER	MAKE, TYPE, RATING VOLTAGE RATIO & CLASS	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 121021 (81)	IS 121021(87)	LOG BOOK	P	V	V	
		VOLTAGE RATIO			100% OF EACH RATING					LOG BOOK	P	V	V
		ROUTINE TEST		ELEC	100%					SUPPLIER TC	V	V	V
1.8	CURRENT TRANSFORMER CTS	MAKE, TYPE, RATING VOLTAGE RATIO	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 2705 (92)	IS 2705(92)	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%					SUPPLIER TC	V	V	V
1.9	VOLTAGE/ POTENTIAL/ TRANSFORMER PTS	MAKE, TYPE, RATING VOLTAGE RATIO	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 2705 (92) APPROVED DRG/TECH SPEC	IS 2705(92) APPROVED DRG	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%					SUPPLIER TC	V	V	V

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION			
			APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	TRANSDUCCERS CURRENT AND VOLTAGE (CTD & VTD)	MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH RATING		IS 14570 /IEC 16088 APPROVED DRG /TECH SPEC/	IS 14570 /IEC 16088 APPROVED DRG /TECH SPEC	LOG BOOK	P	V	V	
		ROUTINE TEST INCLUDING CALIBRATHION AND ACCURACY TEST		ELECT	100%				SUPPLIER TC	V	V	V	
1.10	HRC FUSE, FUSE BASE,	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		IS 13703 P-2 TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	IS 13703 P-2 TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	LOG BOOK	P	V	V	
		CONTINUITY TEST		ELECT						P	V	V	
1.11	NEUTRAL LINK	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	LOG BOOK	P	V	V	
1.12	NEUMERICAL RELAY	MAKE, TYPE, RATING	MAJOR	VISUAL	100%		APPROVED DRG/ TECH SPEC	APPROVED DRG/TECH SPEC	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%				SUPPLIER TC	V	V	V	
		RELAY TESTING		ELECT	10% OF EACH TYPE		IEC 60255	IEC 60255		P	W	W	
1.13	OVERLOAD RELAY	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		IS 3231(86) / APPROVED DRG/TECH SPEC	IS 3231(86) / APPROVED DRG/TECH SPEC	LOG BOOK	P	V	V	
1.14	INTERPOSING	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MNFR CAT	APPROVED DRG/TECH		P	V	V	
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MANUFACTURER/ SIGNATURE													
									APPROVED BY		APPROVAL SEAL		

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	RELAY	FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE			SPEC/MNFR CAT	LOG BOOK	P	V	V	
1.15	TIMERS	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH	APPROVED DRG/TECH	LOG BOOK	P	V	V	
		CONTACT CONFIGURATION		ELECT	5% OF EACH TYPE		TECH SPEC/ MNFR CAT	TECH SPEC/ MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.16	THERMOSTAT	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MNFR CAT	APPROVED DRG/TECH SPEC/MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.17	SPACE HEATER	MAKE TYPE RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK	MAJOR	ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.18	INDICATING INSTRUMENTS AMMETER,	MAKE, TYPE, RANGE & CLASS	MAJOR	VISUAL	5% OF EACH TYPE		IS 1248(93) APPROVED	IS 1248(93) /APPROVED	LOG BOOK	P	V	V	

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		APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	VOLTMETER	ROUTINE TEST		ELECT	5% OF EACH TYPE				SUPPLIER TC	P	V	V	
	MFM, WATT HOUR METER												
1.19	INDICATING LAMPS	MAKE, TYPE, RATING AND COLOR	MAJOR	VISUAL	5% OF EACH TYPE		IS 1901/APPROVED DRG	IS 1901 /APPROVED DRG	LOG BOOK	P	V	V	
1.20	PUSH BUTTON SWITCHES	MAKE, TYPE, RATING AND COLOR	MAJOR	VISUAL	5% OF EACH TYPE		IS 4794/APPROVED DRG	IS 4794 /APPROVED DRG	LOG BOOK	P	V	V	
1.21	2/3 PIN SOCKET/LAMP HOLDER/ HOOTER	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
1.22	TERMINAL BLOCK FOR POWER AND CONTROL CKT	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
1.23	AC/ DC POWER AND AUX CONTACTORS	MAKE, TYPE, RATING	MAJOR	VISUAL	100%		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		FUCTIONAL		ELECT	5 % OF EACH TYPE				LOG BOOK	P	V	V	
1.24	BUSBAR SUPPORT INSULAOR	MAKE, TYPE, RATING, DIM.	MAJOR	VISUAL AND PHY	5 % OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		IR/ HV TEST	MAJOR	ELECT	-DO-		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	P	V	V	

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MANUFACTURER/ SIGNATURE			
		APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1.25	SHROUDS (FIRE RESISTANT TYPE)	MAKE, TYPE	MAJOR	VISUAL	ONE SAMPLE OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		HV TEST	MAJOR	ELECT	-DO-		2.5 KV FOR 1 MIN WITHSTAND	2.5 KV FOR 1 MIN WITHSTAND	SUPPLIER TC/ LOG BOOK	P	V	V	
		FLAME RESISTANCE TEST	MAJOR	FLAME TEST	SAMPLING AS PER MNFT STD		MNFR STDQ	MNFR STD	SUPPLIER TC	V	V	V	
1.26	POWER AND CONTROL CABLES	MAKE, TYPE, RATING	MAJOR	VISUAL	5 SAMPLES OF EACH TYPE		IS 694(90)	IS 694(90)	LOG BOOK	P	V	V	
1.27	CABLE LUGS	MAKE, TYPE, SIZE	MAJOR	VISUAL/ MEASUR	5% SAMPLES OF EACH TYPE		APPROVED DRG/MANFR CAT	APPROVED DRG/MANFR CAT	LOG BOOK	P	V	V	
1.28	PVC WIRE	SIZE, COLOUR, BIS MARKING	MAJOR	VISUAL	100%		PO SPEC, DRG IS 694	PO SPEC, DRG IS 694	LOG BOOK	P	V	V	
2	BOUGHT OUT ITEMS (MECHANICAL COMPONENTS)												
2.1	ENCLOSURE	SIZE, TYPE	MAJOR	VISUAL/ MEASUR	100%		APPROVED DRG, IS 8623	APPROVED DRG, IS 8623	LOG BOOK	P	V	V	
		COLOUR (PAINT SHADE), SURFACE FINISH	MAJOR	VISUAL	100%		APPROVED DRG/SHADE CARD	APPROVED DRG/IS/SHADE CARD	LOG BOOK	P	V	V	

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MANUFACTURER/ SIGNATURE			
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				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
		PAINT THICKNESS AND ADHESION TEST.	MAJOR	TEST	RANDOM		APPROVED DRG/	IS 6005/ APPROVED DRG.	LOG BOOK	P	V	V	
2.2	ENCLOSURE ANGLES, CHANNELS AND SHEET(CR)/ GLAND PLATE	DIMENSION/THICKNESS	MAJOR	MEASUR	5% OF EACH TYLPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		SURFACE FINISH, CHCEK FOR WAVINESS AND FLATNESS	MAJOR	VISUAL	5% OF EACH TYLPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		TENSILE / BENDING STRENGTH	MAJOR	MECH	AS PER IS		IS 513/ IS 1079/ IS 2062	IS 513/ IS 1079/ IS 2062	SUPPLIER TC	V	V	V	
2.3	BUSBAR: AL & CU	SIZE	MAJOR	MEASUR	1 SAMPLE OF EACH TYPE		IS 5082(FOR AL)/ IS 1897 (FOR CU)/ APPROVED DRG/ TECH SPEC	IS 5082(FOR AL)/ IS 1897 (FOR CU)/ APPROVED DRG/ TECH SPEC	LOG BOOK	P	V	V	
		SURFACE FINISH	MAJOR	VISUAL	-DO-		IS 5082 & IS 1897	IS 5082 & IS 1897	LOG BOOK	P	V	V	
		CONDUCTIVITY	MAJOR	ELECT	AS PER IS		IS 5082 & IS 1897	IS 5082 & IS 1897	SUPPLIER TC	P	V	V	
		CHEMICAL / MECH PROPERTY	MAJOR	CHEM & MECH	AS PER IS		-DO-	-DO-	SUPPLIER TC	P	V	V	
2.4	EARTH BUS BAR	SIZE, MATERIAL	MAJOR	PHYSIC AL/ MEASUR	1 SAMPLE /LOT		IS 3043	IS 4043	LOG BOOK/ SUPPLIER TC	V	V	V	

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		APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)				CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)					
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	M	T	C	
2.5	CABLE GLAND	MAKE, TYPE, SIZE	MAJOR	VISUAL/ MEASUR	5 SAMPLES / LOT		APPROVED DRG/MANFR CAT	APPROVED DRG/MANFR CAT	LOG BOOK	P	V	V	
2.6	GASKET	MATERIAL TYPE	MAJOR	VISUAL	1 SAMPLE OF EACH TYPE AND SIZE		IS 11149 TECH SPEC / APPROVED DRG	IS 11149 TECH SPEC / APPROVED DRG	LOG BOOK	P	V	V	
		DIMENSION, SHORE HARDNESS, FLAME TEST	MAJOR	MEASUR /PHY	-DO-		-DO-	-DO-	LOG BOOK	P	V	V	
		COMPRESSION , ELONGATION AT BREAK AND AGING, TEST,OZONE RESISTANCE	MAJOR	TEST	-DO-		-DO-	-DO-	SUPPLIER TC	V	V	V	
3.0	IN-PROCESS										V	V	
3.1	PRE TREATMENT AND PAINTING (POWDER COATING)	1. CHEMICAL CONCETRATIOIN CHECK OF ALL TANIKS FOR PRE TREATMENT OF SHEET STEEL (7 TANK PROCESS)	MAJOR	CHEMIC AL	MANFR STD		MANFR STD/ IS 6005	MANFR STD/ IS 6005	SUPPLIER TC	V	V	V	
		2. PAINT SHADE	MAJOR	VISUAL	1 SAMPLE PER LOT		TECH. SPEC./ APPROVED DRAWING	TECH. SPEC./ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
		3. PAINT THICKNESS AND ADHESION	MAJOR	MEASUR / TEST	MANUF. PRACTICE		TECH. SPEC./ APPROVED DRAWING	TECH. SPEC./ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
3.2		SIZE/ TYPE	MAJOR	MEASUR	1 NO OF EACH TYPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC/ LOG BOOK	V	V	V	

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION			
			APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	DRAWOUTS	TYPE OF COATING FOR BASE AND FRAME	MAJOR	VISUAL	1 NO OF EACH TYPE		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	V	V	V	
		COATING THICKNESS	MAJOR	MEASUR	-DO-		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	V	V	V	
3.3	ASSEMBLY OF ELECTRICAL COMPONENTS	LOCATION OF COMPONENTS, ACCESSIBILITY FOR ATTENDING / WIRE TIGHTENING	MAJOR	VISUAL	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	
		CLEARANCE OF BUS BARS OF DIFFERENT PHASES AND EARTH	MAJOR	MESH	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	
		SHROUDING OF POWER TERMINALS	CRITIC AL	VISUAL	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	
4.0 FINAL INSPECTION													
4.1	VERIFICATION OF DEMENSION OF VERTICALS, SHEET. VISUAL CHECK FOR VERTICALITY, ALIGNMENT OF PANELS.		MAJOR	VISUAL & MEASUR	100%		AS PER APPROVED DRG.GA	AS PER APPROVED GA DRG.	LOG BOOK	P	W	W	

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								APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	M	T	C	
4.2	VERIFICATION OF PAINT FINISH, SHADE, THICKNESS & ADHESIION TEST		MAJOR	VISUAL AND MEASUR	100% FOR SHADE AND FINISH 2-3 SAMPLES FOR THICKNESS AND ADHESION 2-3 SAMPLES/ BOARD		AS PER IS/ APPROVED DRG GN	AS PER IS/ APPROVED DRG GN	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.3	VERIFICATION OF BUSBAR (MAIN, CONTROL AND AUX). MATERIAL, COLOR CODING, PHASE SEQUENCE IDENTIFICATION, PROVISION OF COLOR (R-Y-B)/ BLACK HEAT SHRINKING SLEEVE. & EARTH BUSBAR		CRITICAL	VISUAL AND MEASUR	10%		APPROVED DRG GA	APPROVED DRG GA	INSPECTIO N REPORT	P	W	W	
4.4	MEASUREMENT OF TIGHTENING TORQUE OF BUSBAR JOINTS BY TROQUE WRENTCH		CRITICAL	MECH	10%		M6 = 0.30- 0.7KGFM M8 = 1.25- 2.5KGFM M10= 2.50- 4.0KGFM M12= 4.30- 7.0KGFM	M6 = 0.30- 0.7KGFM M8 = 1.25- 2.5KGFM M10= 2.50- 4.0KGFM M12= 4.30- 7.0KGFM	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.5	BUS BAR SUPPORT ARRANGEMENT, CENTRE TO CENTRE DISTANCE (CREEPAGE DISTANCE)		MAJOR	VISUAL AND MEASUR	10%		APPROVED DRG GA	APPROVED DRG GA	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION			
			APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN (TENTATIVE)			CUSTOMER:NTPC PROJECT: TELANGANA SUPER THERMAL POWER PROJECT PHASE-I (2X800 MW)						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.6	MOUNTING ARRANGEMENT OF COMPONENTS AND COMPONENT IDENTIFICATION FOR MAKE, TYPE, RATING AND LAYOUT		MAJOR	VISUAL	100% FOR EACH TYPE OF MODULE		APPROVED DRG/MANFR STD	APPROVED DRG/MANFR STD	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.7	VERIFICATION OF CONTROL WIRING, TERMINAL ARRANGEMENT AND FERRULING		MAJOR	VISUAL	100%		APPROVED DRG/MANFR STD	APPROVED DRG/MANFR STD	INSPECTION REPORT	P	W	W	
4.8	VERIFICATION OF SINGLE LINE DIAGRAM COMPONENTS AND LEGENDS		MAJOR	VISUAL	100%		APPROVED DRG SLD	APPROVED DRG SLD	INSPECTION REPORT	P	W	W	
4.9	VERIFICATION OF MOUNTING ARRANGEMENT OF COMPONENT , IDENTIFICATION OF COMPONENT AND VERIFICATION OF MAKE, TYPE & RATING (AS PER BOM)		MAJOR	VISUAL	100%		AS PER APPROVED DRG(SCHEME) AND APPROVED BOM	AS PER APPROVED DRG(SCHEME) AND APPROVED BOM	INSPECTION REPORT	P	W	W	
4.10	VERIFICATION OF DOOR INTERLOCK AND DEFEAT INTERLOCK		MAJOR	PHYSICAL	100%		APPROVED GN	APPROVED GN	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.11	VERIFICATION OF DEGREE OF PROTECTION AND FIXING OF GASKETS		MAJOR	PHYSICAL	2-5 SAMPLES AT GASKETED JOINTS PER BOARD		APPROVED GN	NO INSERTION POSSIBLE FROM OPENINGS AND GASKETTED JOINTS	INSPECTION REPORT	P	W	W	PAPER INSERTION METHOD FOR IP5X COMPARTMENT AND WIRE INSERTION METHOD FOR IP 4X COMPARTMENT RANDOM CHECK

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				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.12	ACB OPERATION TEST AT SERVICE, TEST AND ISOLATION POSITION & CHECK OF MECHANICAL INTERLOCK AND ANTI PUNPING AND TRIP FREE FEATURE		CRITICAL	ELECT	100%		APPROVED DRG/TECH SPEC	APPROVED DRG/TECH SPEC	INSPECTION REPORT	P	W	W	10% RANDOM SAMPLE BY CUSTOMER
4.13	VERIFICATION OF INTER CHANGEABILITY OF SIMILAR MODULES AND CHECK FOR ALIGNMENT OF POWER AND CONTROL CONTACTS.		MAJOR	VISUAL & MECH	RANDOM		APPROVED TECH SPEC	APPROVED TECH SPEC	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER
4.14	FUNCTIONAL CHECK / LOGIC CHECK (1. Operation of Instrument & Relays 2. Functional Check of Control Function & Interlock in test & service Position. 3. Relay calibration Tests.)		MAJOR	ELECT	100%		AS PER APPROVED SCHEME	AS PER APPROVED SCHEME	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.15	IR TEST BEFORE HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%		IS 8623	IS 8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.16	HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELCECT	100%		IS 8623	IS8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.17	IR TEST AFTER HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%		IS 8623	IS 8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.18	TYPE TEST		CRITICAL	ELECT	1/ ITEM		PO SPEC, DRG IS 60529 IS 8623	PO SPEC, DRG IS 60529 IS 8623	INSPECTION REPORT	P	V	V	AS PER BELOW NOTE

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				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY MTC			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.19	CHECK SHROUDING OF ACCECABLE LIVE PARTS		MAJOR	VISUAL	10%		AS PER TECH SPEC	AS PER TECH SPECH	INSPECTIO N REPORT	P	W	W	
4.20	PROVISION OF ADDITIONAL TAPPED HOLES AND FASTENERS FOR EARTH CONNECTION AND EARTH SYMBOL		MAJOR	VISUAL	100%		AS PER TECH SPEC	AS PER TECH SPECH	INSPECTIO N REPORT	P	V	V	

NOTE:

- A. ONLY APPROVED MAKE OF COMPONENTS USED.
- B. TYPE TESTS WILL INCLUDE
1. DEGREE OF ENCLOSURE PROTECTION (AS PER IEC 60529)
 2. TEMPERATURE RISE TEST (AS PER IS 8623)
 3. SHORT CIRCUIT TEST (AS PER IS 8623)
- C. FUNCTIONAL/ PERFORMANCE CHECKS TO BE CONDUCTED ON ENTIRE BOARD WHILE ALL POWER SUPPLIES SWITCHED ON.

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**TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW)**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. : EPD-TS-CPBG-
CPJ005-06

VOLUME II-B

SECTION -

REVISION
0

DATE: 25/05/2018

SHEET 1 OF 1

MAKE OF COMPONENT

COMPONENT	MAKE
ACB	C&S ELECTRIC, NOIDA
	L&T, MUMBAI
	GE, BANGALORE
	SIEMENS, GERMANY
	SCHNEIDER, FRANCE
	ABB, BANGALORE
IEC 61850 COMPLIANT NUMERICAL RELAY	SEL, PULLMAN USA
	ALSTOM T&D, STAFFORD-UK (P14X, P34X, P44X, P64X, P74X MODELS ONLY)
	ALSTOM T&D, CHENNAI (P14X, P34X, P44X, P64X, P74X MODELS ONLY)
	GE MULTILIN, ZAMUDIO/VIZEAYA (SPAIN)/ MARKHAM/ONTARIO(CANADA) (F650 ONLY)
	SCHNEIDER, STONE(UK) (PX30 & PX40 MODELS ONLY)
	ABB, FINLAND
	ABB, BARODA (FOR 6XX SERIES)
	SIEMENS, GOA (7SR2X SERIES ONLY)
	SIEMENS GERMANY (7SX SERIES ONLY)
BOI'S	WITH VDE/CE/UL/CSA MARKED OR BIS APPROVED WITH VALID CML NO.