

TD-201 Rev No. 00	Form No.	 	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION, HYDERABAD	ANNEXURE-2C to PY55223
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. PROJECT 40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT CUSTOMER M/S TATA STEEL LIMITED, JAMSHEDPUR CONSULTANT TATA CONSULTING ENGINEERS, KOLKATA				

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED			CHECKED
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ELECTRICAL CONTROL PHILOSOPHY

CONSULTANT:



TATA CONSULTING ENGINEERS LIMITED
MUMBAI



BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE
DRN.	K SRINIVASA RAO		29.06.16
CHD.	A V SURESH		29.06.16
APPD.	J K PATTANAIK		29.06.16

DEPT. PE&SD	UNTOL. DIMS. GR. G/M/F		SCALE NTS	WEIGHT (KG) -N.A.-	REF. TO ASSY. DRG. -N.A.-	ITEM NO. -N.A.-	-N.A.-
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TITLE
SIZING CRITERIA FOR
6.6/0.433kV SERVICE TRANSFORMER

CARD
CODE
BHEL DRAWING NO.
PY-SE-4-M085-0000-01
REV.
00



TATA STEEL LTD
JAMSHEDPUR

DEPT	40MW CDQ WASTE HEAT RECOVERY CO-GENERATION POWER PLANT	CODE	
AREA	JAMSHEDPUR	CODE	
SUBJECT	ELECTRICAL CONTROL PHILOSOPHY	CODE	

TATA DRG. NO.

REV

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. <u>INDEX</u> 1. <u>OBJECTIVE</u> 2. <u>REFERENCE DOCUMENTS</u> 3. <u>GENERAL</u> 4. <u>33kV GIS BREAKER, GENERATOR, GENERATOR TRANSFORMERS & UAT</u> 4.1 Control and Operation Philosophy 5. <u>ON LOAD TAP CHANGER (OLTC) CONTROL PHILOSOPHY FOR GENERATOR TRANSFORMER & UAT</u> 6. <u>6.6kV SWITCHBOARD</u> 6.1 Control scheme 6.2 Control and Operation Philosophy 7. <u>6.6kV/0.433KV SERVICE TRANSFORMERS (ST) AND 415V PMCC</u> 8. <u>Emergency Systems/Equipments (i.e. DC System, UPS System & Emergency DG set)</u> 8.1 Emergency DG Set 8.2 DC System 8.3 UPS System: 9. <u>415V MCC AND DBs</u> 10. <u>OPERATING PHILOSOPHY IN VARIOUS CONDITIONS</u> 10.1 Normal operation 10.2 Emergency condition 11. <u>DG OPERATING PHILOSOPHY</u> 11.1 Emergency Black Out Operation 11.2 Restoration Of Normal Supply To PMCC <u>ANNEXURE -1</u>			
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		1. OBJECTIVE The document provides guidelines for Operation and Control philosophy of Plant electrical systems. It also covers annunciation, metering, control and indication of plant electrical systems.		
		2. REFERENCE DOCUMENTS 1. TCE Specification:: Electrical Design Requirements (TCE.7742B-C-540-001) 2. Key Single Line Diagram(PY-DL-1-M085-0000-01, Rev-00) 3. 6.6kV Switchboard SLD(PY-DL-1-M085-8801-01, Rev-00) 4. PMCC-Switchboard SLD (PY-DL-1-M085-8809-01, Rev-00)		
		3. GENERAL The electrical network of power evacuation and auxiliary electrical distribution system is designed to meet the auxiliary power requirements of captive power plant (i.e CDQ 10&11) and to export the power to 33kV GIS switchboard. The power plant consists of 1 no. of STG having a capacity of 40MW with complete aux.electrical distribution network to meet the power requirements of the captive power plant. Generated power from STG at 11kV is evacuated through 11/34.5kV Generator Transformer (GT) to 33kV GIS (Customer's Scope). Synchronization of STG is envisaged at 33kV GIS breaker located in control room. Further, auxiliary distribution network consists of 11/6.9kV Unit Auxiliary Transformer, 6.6kV unit cum station switchboard, 6.6/0.433kV Station Transformer 415V PMCC, 415V TG MCC, 220V DC System, 240V UPS System, etc. 6.6kV unit cum station switchboard is powered up through tap off bus duct fed 11/6.9kV Unit Auxiliary Transformer (UAT) and tie line from 6.6kV existing switchgear of CDQ-11. (Located at ECR-11). Emergency power for safe shutdown of Power plant is envisaged from 415V DG set (Customer's scope).		
		4. 33kV GIS BREAKER, GENERATOR, GENERATOR TRANSFORMER & UAT The control and monitoring for Generators and 33kV GIS breaker is envisaged from Generator Control Panel/Generator Relay Panel (GCP/GRP) located in power plant control room. Generator synchronization, essential metering, indications and annunciations pertaining to generator, generator transformer and UAT will be provided in hard-wired Generator Control Panel/ Generator Relay Panel. Synchronization of the generator will be done at the 33kV GIS Breaker located within the power plant area through GCP.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		4.1 Control and Operation Philosophy 33kV GIS Breaker Panel is provided with local/remote selector switch. (Local-33kV GIS, Remote-GCP). i. When selector switch is selected in local mode, controls will be done from 33kV GIS Breaker Panel. Following operations are possible from GIS when selector switch is in local mode. • Close of 33kV GIS breakers in feeder earthing mode. • Open of 33kV GIS breaker. • Close & Open of isolators. ii. When selector switch is selected in remote mode, all the controls will be transferred to GCP. Further, based on selector switch at GCP, control of generator will be possible from DCS. Hard wired GCP is provided with the following major selector switch for operation of Generators. SW-1: 3 position selector switch (GCP/OFF/DCS) for STG. SW-2: 4 position synchronizing selector switch (OFF/Dead bus/Manual Synchronizing/Auto synchronizing) for 33kV GIS Breaker. When selector switch SW-1 in GCP, is selected in GCP mode, following operations are envisaged from GCP: • Close of 33kV GIS breaker on dead bus condition in service mode (Breakers dead bus closing to be checked on either side). • Auto and Manual Synchronization for STG Generator. • Open of 33kV GIS breaker. When selector switch SW-1 in GCP is selected in DCS mode, control of 33kV Generator breaker is transferred DCS. Following operations are possible from DCS: • Close of 33kV GIS breaker on dead bus condition in service mode (Breakers dead bus closing to be checked on either side). • Open of 33kV Generator breakers. The control, monitoring, measurement, annunciation, and sequential event logging for generator and its sub system shall be done at plant DCS through HMI. A. Monitoring functions The following monitoring functions are provided in DCS: a) Indication (Status) of the upstream 33kV GIS breaker i.e. (Breaker close & open). b) Generator stator core, windings and bearing temperatures.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.			c) Tap positions of generator transformer. d) Monitoring of winding temperatures, oil temperatures, and oil level of generator transformer and unit auxiliary transformer. B. Alarms The following alarms are provided in DCS: a) Operation of each of the protective relay (alarm & trip) conditions of generator, excitation system and generator transformer. b) All alarm and trip conditions of transformers including OLTC alarms and cooler control alarms. c) Trip circuit unhealthy of 33kV GIS circuit breaker, protection relay unhealthy of each equipment (i.e. Generator, Generator Transformer & UAT), trip relay unhealthy of each equipment, CT/VT circuit unhealthy of each CT/VT, LBB operation of breaker, DC supply failure of each protection/control scheme as appropriate. C. Metering The following metering is provided in DCS: a) Generator • Voltage (All phases) • Current (All phases) • MW • MVA • MVAR • Frequency • Power Factor • MWH • Field Voltage • Field Current • Pulse output from TVM/Meters Digital multifunction meters with communication facility over MODBUS to interface with plant DCS shall be provided in GCP. b) Generator transformer • Current(All phases) • MW • MVAR 5. <u>ON LOAD TAP CHANGER (OLTC) CONTROL PHILOSOPHY FOR GENERATOR TRANSFORMER & UAT</u>	
	Ref. Doc		Tap changer control (Raise/Lower) of transformers (GT & UAT) will be done from Transformer Local or from RTCC panel located in control room or from DCS.	

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		Local/Remote selection is located on OLTC (Transformer local), when the selection is made in Local, tap changer control of Transformers is possible from OLTC. When the selection is made in Remote, controls are transferred to RTCC panel. Further, based on selection made at RTCC (i.e. RTCC/DCS selector switch as part of RTCC), the tap changer controls are possible either from RTCC or DCS. 6. 6.6kV UNIT CUM STATION SWITCHBOARD 6.6kV Switchgear has following sources of supply: (i) Incomer-1, which is connected to STG through 11/6.9 kV UAT (Unit Auxiliary Transformer). (ii) Incomer-2, which is connected to existing CDQ-11 6.6kV HT Switchboard (located at ECR-11). ➤ All metering (Multifunction meter), control and indication of all feeders (Incomer, Bus coupler & outgoing feeders) will be provided on the switchgear panel. ➤ All metering, control and indication of all feeders (Incomer, Bus coupler & outgoing feeders) will be provided ECP. ➤ Control, indication & metering (through MFM located at 6.6kV Switchgear) of all feeders (Incomer, Bus coupler & outgoing feeders) will be provided on DCS. The control scheme is described in brief as follows. 6.1 Control scheme <u>Normal operating condition</u> a) Incomer no. 1, 2 connected to bus-A & bus-B are NC. And bus coupler connected between bus-A and bus-B is NO. b) Auto/Manual/Paralleling (Momentary) Selector Switch is provided on the switchboard & normally kept in Auto Position for Auto Changeover. <u>Auto changeover</u> • When Incomer 1 or 2 fails, the respective unhealthy incomer is tripped through under voltage and a timer. • Bus coupler will close automatically by sensing healthy voltage of healthy incomer. • Auto changeover is blocked if any incomer trips due to fault or both the incomers simultaneously experience under-voltage. • Necessary protection interlocks will also be realized in the switchboard. <u>Manual operation</u> In manual mode either of incomer 1 or incomer 2 or bus coupler can be closed in dead bus condition after ensuring relevant bus under voltage. <u>Paralleling (Momentary) operation</u>		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		It is possible to take either of incomer1/incomer2/bus coupler for maintenance and bring it back to the normal operating condition by momentary paralleling. In momentary paralleling mode, synchronization of incomer1 or incomer2 or bus coupler is done through contacts of check synchronization relay. Momentary paralleling facility is provided for Incomer-1, 2 & bus coupler. In case of Prolonged Paralleling, alarm shall be generated and last closed breaker shall be tripped. PT selection & Trip selector switch shall be provided on the switchboard. 6.2 Control and Operation Philosophy i) 6.6kV Switchboard has one local/remote control selector switch. a) When selector switch is selected in local mode, controls are transferred to 6.6kV Switchboard. Following operations are possible from 6.6kV Switchboard: • Close of all incomers, bus couplers and outgoing breakers in test position. • Close of incomer1, 2 on manual and momentary paralleling mode in service position • Close of bus coupler breaker on auto, manual and momentary paralleling mode in service position. • Close of all outgoing breakers in service position. • Open of all breakers. b) When selector switch is selected in remote mode, controls are transferred to hard-wired Electrical Control Panel (ECP). Electrical Control Panel (ECP) is provided with the following major selector switch for operation and control: SW-1 3 position selector switch (ECP/OFF/DCS) SW-2 3 position selector switch (OFF/Dead bus/Manual synchronizing) for DG synchronizing breakers When selector switch SW-1 is selected in ECP mode, controls are transferred to ECP. Following operations are possible from ECP: • Close of all incomers and bus couplers breakers on dead bus condition in service mode (bus coupler breaker dead bus closing to be checked on either side). • Close of all outgoing breakers in service mode. • Open of all breakers.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		c) When selector switch SW-1 is selected in DCS mode, controls are transferred to Distributed Control system (DCS). Following operations are possible from DCS: • Close of all incomers and bus couplers breakers on dead bus condition in service mode (bus coupler dead bus closing to be checked on either side). • Close of all outgoing breakers in service mode. • Open of all breakers. a. Monitoring functions It will be possible to monitor the following through DCS: a) Indication (Status) of all 6.6kV breakers i.e. (Breaker close & open). b. Alarms Alarms will be considered in DCS for the following abnormal conditions in HT switchgear: (i) Breaker lockout relay operated (Auto trip) (ii) Individual protective relay operated (iii) Trip relay/circuit unhealthy (iv) Bus under voltage lockout relay operated (v) Bus PT fuse failed (vi) DC supply - 1 failed (vii) DC supply - 2 failed (viii) Bus PT not in service (ix) Overload alarm and individual protective relay operation of motor feeders ➤ All possible alarms in the above list shall be interfaced with DCS by using IEC-61850 communication protocol through Numerical relays via Ethernet switches (located in switchboard). c. Metering The following metering is provided in DCS: <u>6.6kV Incomers, Bus coupler, Outgoings feeders:</u> Digital multifunction meters with communication facility over MODBUS to interface with plant DCS shall be provided in switchboard. 7. <u>6.6kV/0.433KV SERVICE TRANSFORMERS (ST) AND 415V PMCC</u> 415V PMCC Switchgear has following sources of supply: (i) Incomer-1, which is connected to 6.6kV Switchgear through 6.6/0.433 kV ST-1 (ii) Incomer-2, which is connected to 415V DG set (Supplied by TSL/TCE). (iii) Incomer-3, which is connected to 6.6kV Switchgear through 6.6/0.433 kV ST-2. <u>415V PMCC</u>		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.			➤ All metering, control and indication of all feeders (Incomer, Bus coupler & outgoing feeders) will be provided on the switchgear panel. ➤ All metering, control and indication of Incomer, Bus coupler feeders will be provided ECP. ➤ Control, indication & metering of all breaker feeders will be provided on DCS. a. Control scheme Normal operating condition a) Incomer no. 1, 3 breakers connected to Bus-A & C, Bus coupler-2 (connected between Bus-B and C) are NC. Incomer. 2 and Bus coupler-1 (connected between Bus-A and B) are NO. b) Auto/Manual (Dead bus closing)/Paralleling (Momentary) Selector Switch is provided on the switchboard & normally kept in Auto Position for Auto Changeover. Auto changeover • When Incomer 1 or 3 fails, the respective unhealthy incomer is tripped through under voltage and a timer. • Bus coupler-1 will close automatically by sensing healthy voltage of healthy incomer. • Auto changeover is blocked if any incomer trips due to fault or both the incomers simultaneously experience under-voltage. • Necessary protection interlocks will also be realized in the switchboard. Manual operation In manual mode, either of incomer 1, incomer 2, incomer 3 or bus couplers can be closed in dead bus condition after ensuring relevant bus under voltage. Paralleling (Momentary) operation It is possible to take either of incomer1/incomer3/bus coupler1 for maintenance and bring it back to the normal operating condition by momentary paralleling. In momentary paralleling mode, check synchronization of incomer1 or incomer3 or bus coupler1 is done through contacts of check synchronization relay. In case of Prolonged Paralleling, alarm shall be generated and last closed breaker shall be tripped. PT selection switch & Trip selector switch shall be provided on the switchboard. b. Controls Each 415 V PMCC Switchgear has one local/remote control selector switch.		
			Ref. Doc		

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		i. a) When selector switch is selected in local mode, controls are transferred to 415 V PMCC Switchgear. Following operations are possible from Switchgear: • Close of all incomers, bus couplers and outgoing breakers in test position. • Close of incomer1, 3 on manual and paralleling(momentary) mode in service position • Close of DG incomer on manual and synchronization mode in service position. • Close of bus coupler breaker1 on auto, manual, paralleling (momentary) & synchronization mode in service position. • Close of bus coupler breaker2 on manual, paralleling (momentary) & synchronization mode in service position. • Close of all outgoing breakers in service position. • Open of all breakers. i. b) When selector switch is selected in remote mode, controls are transferred from Switchgear to ECP. When selector switch SW-1 at ECP is selected in ECP mode, controls are possible to ECP. Following operations are possible from ECP: • Close of all incomers and bus couplers breakers on dead bus condition in service mode (bus coupler breaker dead bus closing to be checked on either side). • Open of all incomers and bus couplers breakers. When selector switch SW-1 at ECP, is selected in DCS mode, controls are transferred to Distributed Control system (DCS). Following operations are possible from DCS: • Close of all incomers and bus couplers breakers on dead bus condition in service mode (bus coupler dead bus closing to be checked on either side). • Close of all outgoing breakers in service mode. • Open of all breakers. ii. Monitoring functions It will be possible to monitor the following through DCS: i. Indication (Status) of all 415V breakers i.e. (Breaker close & open). iii. Alarms Alarms will be considered in DCS for the following abnormal conditions in LT switchgear: (i) Breaker lockout relay operated (Auto trip) (ii) Individual protective relay operated		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		(iii) Trip relay failure (iv) Bus under voltage (v) Incoming 220V DC control supply failed (vi) Bus PT fuse failed (vii) Bus PT not in service ➤ All possible alarms in the above list shall be interfaced with DCS by using IEC-61850 communication protocol through Numerical relays via Ethernet switches (located in switchboard). iv. Metering The following metering is provided in DCS: <u>415V Incomers, Bus coupler feeders:</u> Digital multifunction meters with communication facility over MODBUS to interface with plant DCS shall be provided in switchboard. 8. <u>Emergency Systems/Equipments (i.e. DC System, UPS System & Emergency DG set)</u> 8.1 Emergency DG Set: i. Alarms: Alarms will be considered in DCS for the following abnormal conditions in DG system: • DG alarm and trip conditions ii. Metering Measurement and display of the following parameters from AMF panel will be provided in DCS. Transducers wherever required will be included. (i) Current (All phases) (ii) Voltage (All phases) (iii) MW (iv) MVAR (v) PF (vi) Frequency 8.2 DC System: i. Alarms: Alarms will be considered in DCS for the following abnormal conditions in DC system: • Bus under voltage (from DCDB) • Bus earth fault (from DCDB) • Battery earth fault (from Battery Charger) • Battery Charger under voltage (from Battery Charger) • Battery Charger faulty (group trouble alarm) (from Battery Charger)		
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		Ref. Doc		



S.No.	EQUIPMENT	BREAKER	GENERATOR CONTROL PANEL/ GENERATOR RELAY PANEL (GCP/GRP)						ELCTRICAL CONTROL PANEL (ECP)						SWITCHBOARD						DCS					
			Location : Power Plant Control room						Location : Power Plant Control room						Location : Power Plant Control room						Location : Power Plant Control room					
			Synchronisation	Control	Metering	Annunciation	Indication	Remarks	Synchronisation	Control	Metering	Annunciation	Indication	Remarks	Sync	BKR	Metering	Protections	Indication	Remarks	Sync	Control	Metering	Annunciation	Indication	Remarks
1	STG	33kV GIS Breaker	Synch facilities are provided on GCP. Sync is done at 33kV GIS breaker located within the power plant areaA (Refer Note-1).	Voltage control	V, A,F,PF, MW,MVA, MVAR	Fault status of trips & alarms of STG	PF/MVAR ON/OFF	33kV CB ON, OFF indications are to be provided on GCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33kV GIS Bkr Close in Independent (Dead bus) mode	V, A,F,PF, MW,MVA, MVAR	Fault status of trips & alarms of GTG	PF/MVAR ON/OFF		
				Speed control	Exciter V,A	Group Alarm for Generator temperatures	AVR Ch-1/2 in service															Field Voltage, Field Voltage	AVR Ch-1/2 in service			
				Exciter Field breaker control	Null voltmeter		AVR in local,reset															MW trending, MVAR trending, MWH		AVR in local,reset		
				PF, MVAR Regulation	Trivector meter		Temperature Scanner															Pulse output from TVM/Meters		Exciter CB ON,OFF		
				AVR Auto/Manual SS			Exciter CB ON,OFF																			
2	EMG DG	NA	NA	NA	NA	NA	NA	Manual synch facilities are provided on ECP. Synch is done at DG incomer CB of 415V swbd. (Refer Note-2, 8)	Voltage control	V, A,F,PF, MW,MVA, MVAR	DG Tripped on fault	DG ON	NA	NA	NA	NA	NA	NA	NA	NA	NA	DG ON	V, A,F,PF, MW, MVAR	DG alarm and trip conditions	DG ON	
									Speed control		DG failed to start	DG OFF										DG OFF				
									DG Start													DG in Local Mode				
									DG Stop													DG in Remote Mode				
																						DG in Auto Mode				
3	GENERATOR TRANSFORMER (GT)	NA	NA	NA	NA	Transformer Protections (covered in GRP)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
4	UNIT AUXILIARY TRANSFORMER (UAT)	NA	NA	NA	NA	Transformer Protections (covered in GRP)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
5	SERVICE TRANSFORMER (ST)	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	Transformer incipient faults (As per respective switchboard SLD)	NA	NA	NA	NA	NA	NA	NA			
6	6.6kV SWBD	I/C	NA	NA	NA	NA	NA	NA	CB Close in Independent (Dead bus) mode	V, A,MW	CB Tripped on fault	CB ON		Manual close through check sync relay	CB Close in test position	As per respective switchboard SLD	Refer Note-3	NA	CB Close in Independent (Dead bus) mode	V, A,MW (Refer Note-9)	CB Tripped on fault	CB ON				
											Trip circuit unhealthy	CB OFF			CB Independent (Dead bus) Close in Service position						Trip circuit unhealthy	CB OFF				
												CB RTC										CB RTC				
											CB Open				CB Open											
		O/G	NA	NA	NA	NA	NA	NA	CB Close in Service position	NA	CB Tripped on fault	CB ON		NA	CB Close in test & service position	As per respective switchboard SLD	Refer Note-4	NA	CB Close in Service position	NA	CB Tripped on fault	CB ON				
											Trip circuit unhealthy	CB OFF										CB OFF				
												CB RTC										CB RTC				
											CB Open				CB Open											
		B/C	NA	NA	NA	NA	NA	NA	CB Close in Independent (Dead bus) mode	NA	CB Tripped on fault	CB ON		Manual close through check sync relay	CB Close in test position	As per respective switchboard SLD	Refer Note-5	NA	CB Close in Independent (Dead bus) mode	NA	CB Tripped on fault	CB ON				
											Trip circuit unhealthy	CB OFF			CB Independent Close in Service position						Trip circuit unhealthy	CB OFF				
												CB RTC			CB Close in Auto mode							CB RTC				
											CB Open				Open						CB Open					
		BUS & BUS PT	NA	NA	NA	NA	NA	NA		NA	V	DC FAIL			NA	NA	As per respective switchboard SLD	Refer Note-3	NA	NA	V	DC FAIL				
											NA	Bus-A under voltage									NA	Bus-A under voltage		NA		
												Bus-B under vlotage										Bus-B under vlotage				

S.No.	EQUIPMENT	BREAKER	GENERATOR CONTROL PANEL/ GENERATOR RELAY PANEL (GCP/GRP)						ELCTRICAL CONTROL PANEL (ECP)						SWITCHBOARD						DCS					
			Location : Power Plant Control room						Location : Power Plant Control room						Location : Power Plant Control room						Location : Power Plant Control room					
			Synchronisation	Control	Metering	Annunciation	Indication	Remarks	Synchronisation	Control	Metering	Annunciation	Indication	Remarks	Sync	BKR	Metering	Protections	Indication	Remarks	Sync	Control	Metering	Annunciation	Indication	Remarks
7	415V PMCC LT SWGR (Refer Note-4)	I/C	NA	NA	NA	NA	NA	NA	CB Close in Independent (Dead bus) mode CB Open	A.V, MW	CB Tripped on fault	CB ON	Manual close through check sync relay	CB Close in test position	As per respective switchboard SLD	Refer Note 3			NA	CB Close in Independent (Dead bus) mode CB Open	A.V, MW (Refer Note-9)	CB Tripped on fault	CB ON			
											Trip circuit unhealthy	CB OFF		CB Independent Close in Service position									Trip circuit unhealthy		CB OFF	
												CB RTC													CB RTC	
		DG I/C	NA	NA	NA	NA	NA	NA	CB Close in Independent (Dead bus) mode CB Open	NA	CB Tripped on fault	CB ON	Refer Note-8	NA	CB Close in test position	As per respective switchboard SLD	Refer Note 3	Auto/Ind/Manu al SS Provided at B/C (Common SS for SWBD)	NA	CB Close in Independent (Dead bus) mode CB Open	A.V, MW (Refer Note-9)	CB Tripped on fault	CB ON			
											Trip circuit unhealthy	CB OFF			CB Independent Close in Service position								Trip circuit unhealthy		CB OFF	
												CB RTC													CB RTC	
		B/C1	NA	NA	NA	NA	NA	NA	CB Close in Independent (Dead bus) mode CB Open	NA	CB Tripped on fault	CB ON		NA	CB Close in test position	As per respective switchboard SLD	Refer Note 3	Auto/Ind/Manu al SS Provided at B/C (Common SS for SWBD)	NA	CB Close in Independent (Dead bus) mode CB Open	NA	CB Tripped on fault	CB ON			
											Trip circuit unhealthy	CB OFF			CB Independent Close in Service position								Trip circuit unhealthy		CB OFF	
												CB RTC													CB RTC	
		B/C2	NA	NA	NA	NA	NA	NA	CB Close in Independent (Dead bus) mode CB Open	NA	CB Tripped on fault	CB ON		NA	CB Close in test position	As per respective switchboard SLD	Refer Note 3	Auto/Ind/Manu al SS Provided at B/C (Common SS for SWBD)	NA	CB Close in Independent (Dead bus) mode CB Open	NA	CB Tripped on fault	CB ON			
											Trip circuit unhealthy	CB OFF			CB Independent Close in Service position								Trip circuit unhealthy		CB OFF	
												CB RTC													CB RTC	
		O/G	NA	NA	NA	NA	NA	NA	CB Close CB Open	NA	CB Tripped on fault	CB ON		NA	CB Close in test & service position	As per respective switchboard SLD	Refer Note 3			NA	CB Close CB Open	NA	CB Tripped on fault	CB ON	NA	
												CB OFF														CB OFF
												CB RTC														CB RTC
		BUS & BUS PT	NA	NA	NA	NA	NA		NA		V		NA		NA	NA	As per respective switchboard SLD			NA		V		NA		
NOTES 1Auto/Manual Synchronisation purpose of STG; Dual voltmeter, Dual Freq.meter, Synchroscope, Synchroscope on/off switch, Checksync. relay, Gaurd relay, SS, etc. are provided on GCP. 2Manual Synchronisation purpose of EMG DG; Dual voltmeter, Dual Freq.meter, Synchroscope, Synchroscope on/off switch, Checksync. relay, Gaurd relay, SS, etc. are provided on ECP. 3Open, Close, Trip, Trip Circuit healthy, DC Fail(buscoupler), Spring charged LED type indicating lamps provided on switchboard. 4Only Breaker feeders are covered. 5TNC Switch is discrepancy type. 6Electrical signals (except for drives) are not envisaged at DCS. 733kV CB ON, OFF signals are to be provided in DCS for Mimic generator. 8Dead Bus/Manual synch selector switch part of ECP panel. Based on selection of this switch sync/dead bus closing shall be decided. 9Digital multifunction meters with communication facility over MODBUS to interface with plant DCS shall be provided in switchboard. LEGEND: A - AMMETER V - VOLT METER MW - MEGAWATT METER MWH - ENERGY METER MVA - MEGAVOLTAMP METER MVAR - MEGAVAR METER F - FREQUENCY METER PF - POWER FACTOR METER TPI - TAP POSITION INDICATOR 2- TIMER 25 - CHECK SYNC RELAY 27 - UNDER VOLTAGE RELAY 50 - INSTANTANEOUS OVER CURRENT RELAY 50N - INSTANTANEOUS EARTH FAULT RELAY 51 - IDMT OVRERCURRENT RELAY 51N - IDMT EARTH FAULT RELAY 67 - DIRECTIONAL PHASE O/C RELAY 67N - DIRECTIONAL EARTHFAULT RELAY 64R - RESTRICTED EARTH FAULT RELAY 51G - STANDBY EARTHFAULT RELAY 87GT - OVERALL DIFFERENTIAL RELAY 80 - CONTROL SUPPLY SUPERVISION RELAY 81 - U/F RELAY WITH DF/DT 86 - LOCK RELAY 87B - BUS DIFFERENTIAL RELAY 87F - FEEDER DIFFERENTIAL RELAY 87T - TRAFO DIFFERENTIAL RELAY 95 - TRIP CKT SUPERVISION RELAY 95B - BUS DIFFERENTIAL SUPERVISION RELAY 97 - FUSE FAILURE RELAY 98 - DEAD BUS RELAY I/C - INCOMER B/C - BUSCOUPLER B/S - BUS SECTIONISER SWBD - SWITCHBOARD CB - CIRCUIT BREAKER SS - SELECTOR SWITCH ACO - AUTOCHANGEOVER IND/DB - DEAD BUS MAN/MP - MOMENTARY PARALLING PTSS - PT SELECTOR SWITCH TSS - TRIP SELECTOR SWITCH BKR - BREAKER ISO- ISOLATOR DIST - DISTRIBUTION O/G - OUTGOING SYNC - SYNCHRONISATION CR - CONTROL ROOM NA - NOT APPLICABLE/ NOT ENVISAGED																										