

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

TECHNICAL SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR

BHEL DOCUMENT NO. : EPD-TS-CPBG-14063, REV-0



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



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NCTPS
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SPECIFICATION NO. : EPD-TS-CPBG-14063

VOLUME

SECTION -

REVISION
0

DATE: 06/10/2017

SHEET 1 OF 1

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>
1.	TITLE SHEET
2.	CONTENTS
3.	INSTRUCTIONS FOR BIDDERS
4.	SCOPE OF ENQUIRY
5.	PROJECT INFORMATION
6.	TECHNICAL SPECIFICATION FOR LV SWITCHGEAR
7.	SINGLE LINE DIAGRAM
8.	BLOCK LOGIC
9.	DRIVE CONTROL PHILOSOPHY
10.	BOARDWISE BOM_ ANNEXURE-A
11.	MODULE WISE BOM_ANNEXURE-B
12.	PRICE SCHEDULE _ANNEXURE-C
13.	SITE MODIFICATION_ANNEXURE -D
14.	E&C SPARE LIST_ANNEXURE-E
15.	MANDATORY SPARE_ANNEXURE-F
16.	TOOLS & TACKLES_ANNEXURE- G
17.	UNIT PRICE SCHEDULE _ANNEXURE-H
18.	DRGS AND DISTBTN SCHDLE _ANNEXURE-I
19.	MANUFACTURING QUALITY PLAN FOR LV SWGR
20.	LIST OF CODES AND STANDARDS_ANNEXURE-M
21.	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: 06-10-2017
SHEET :

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) Un-priced copy of TECHNICAL SPECIFICATION, Annexure-A, B, C, D, E, F, G, and H duly stamped and signed by the bidder.
 - b) 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.
 - c) **No. of Verticals considered by vendor for each board are to be compulsory given along with offer.**
 - d) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - e) A copy of sheet "List of Contents" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) 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.
7. In case bidder is having any queries regarding technical parameters same shall get clarified before quoting, in case if any technical deviations are observed during scrutiny wrt to NIT, bidder shall meet the technical requirements without any price implication.
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 clearly deviations if any in the deviation sheet.
10. Vendor to complete the panel in all respect and dispatch to BHEL. Numerical relay is in BHEL scope and same shall be fitted by BHEL in BHEL Premises. Vendor to do the relay wiring up to relay with proper ferruling and lugs terminals.



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SECTION :
REV NO. : 00 DATE: 06-10-2017
SHEET : 1 OF 1

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 2X660 MW ENNORE SEZ Supercritical Thermal Power Project.
- 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 equipment's/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.

PROJECT
INFORMATION

**SPECIFICATION
FOR
EPC CUM DEBT FINANCING CONTRACT
VOLUME II – GENERAL & SCHEDULES**

CHAPTER 1

PROJECT SYNOPSIS

1.0 GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1320 MW (2 units of 660 MW each) Coal Based Thermal Power Station at Katupalli. This is an expansion of North Chennai Thermal Power Station (NCTPS) and located on some portion of the ashdyke of NCTPS.

1.2 Location

The proposed site for main power plant is located near Ennore port (approx 5 kms).

The nearest Railway station is at Athipattu Pudunagar (approx 5 kms)

All weather road from Pattamandri on the Thiruvottiyur-Ponneri district highway is the nearest road access.

The nearest airport is at Chennai at a distance of 60 km.

1.3 Type of Plant

The proposed 2x660 MW Super-Critical Power Project consists of coal fired steam generator connected to a reheat type steam turbine generator along with all the required auxiliaries. Circulating cooling water system is envisaged for condenser cooling.

The description and salient technical data of the Steam Generator, Steam Turbine Generator, Auxiliary systems, Electrical, Control & Instrumentation, Civil etc. are explained elsewhere in the specification:

1.4 PROJECT INFORMATION

Project Title : **2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS**



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14

Vol. II: 1



Owner : TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

LOCATION

The site is located near Vayalur Village, Ennore

Latitude : 13°17' N to 13°18' N

Longitude : 80°18' E to 80°19' E

Distance from Chennai City : 35 km

Nearest Airport is at Chennai at a

Distance of : 60 km

Nearest Seaport is : Ennore

Nearest Railway Station is : Athipattu Pudunagar (approx 5 kms)

Meteorological Condition

Climate : Tropical ,very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind.

Climatological data :

Ambient temp. (°C)	
Annual Maximum Mean Temp	41.5(°C)
Annual Minimum Mean Temp	24(°C)
Design Ambient temperature	35(°C)

Relative Humidity

Maximum 100%

Minimum 36%

Design 75%

Annual Rainfall

Maximum 2540 mm

Average 1600 mm

Minimum 1175 mm

Prevailing Wind Direction

Nov to Jan – From NW & NE



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



Feb to Mar – From East & SE
 Apr to May – From South & SE
 June – From SW
 July to Aug – From NW
 Sept to Oct – From SE & SW
 Wind Speed 11.8 kmph (avg)
 50 kmph (max)
 Seismic Zone III as per
 IS:1893-2002

1.5 Access to Site

Site is well connected to all weather road from Pattamandri on the Thiruvottiyur – Ponneri district highway. Site is located adjacent to the Chennai – Howrah broad gauge line and thus well connected by rail also.

1.6 Plant Rating, Capacity, Availability, PLF

Each of the two units shall have a Turbine maximum continuous rating (TMCR) of 660 MW at generator terminals based on the following site conditions.

- Ambient air temperature
- Condenser cooling water inlet temperature of 33°C and 9°C temperature rise across the condenser.
- Generator power factor of 0.85.
- Fuel specification as given elsewhere.
- Design temperature for electrical equipment is 50°C.

The VVO capacity of the steam turbine shall not be less than 105% of TMCR flow at rated parameters. Boiler maximum Continuous Rating (BMCR) will be established to match the steam flow at VVO conditions, but BMCR flow shall not less than 108% of TMCR flow.

The capacity of the unit is selected so as to deliver the rated output even after ageing that will occur between overhauls, as a result of deposition of salts in turbine blades, wear and tear etc.

The plant load factor (PLF) being considered is 85%.

1.7 Power Evacuation

Power will be evacuated from the proposed thermal power station at 400 KV voltage level through 400 KV transmission lines. The power evacuation lines would be double circuit 400 KV lines which will act as Line in & Line out circuit.



2 x 660 MW Ennore SEZ Supercritical Thermal Power
 Project at Ash Dyke of NCTPS
 Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



1.8 Site Selection

The following factors which influence the project site selection have been found very favourable to establish and operate the project.

- a. Availability of fuel.
- b. Existing power plant
- c. Availability of adequate cooling water.
- d. Availability of adequate land for locating the power plant with approach roads.
- e. Suitability of land from topographical and geological aspects
- f. Proximity of National Highways, Ports & Transport of fuel & heavy equipment.
- g. Facility for interconnection with transmission and distribution system for evacuation of power.
- h. Environmental aspects.

Total land required for the project is 500 acres which is under the possession of TANGEDCO.

1.9 Fuel

1.9.1 Source of Fuel

Domestic coal requirement for the power plant will be sourced from Kalinga block of Talcher coal fields, Mahanadi and IB valley coal fields in the state of Orissa. Coal will be transported by sea. The port of dispatch and port of receipt for domestic coal would be Paradip port and Ennore port respectively. Imported coal shall be sourced from foreign countries through sea to Ennore port.

Coal can be transported from coal mines to Ennore port by sea and unloaded at proposed coal berth-III. Further the coal can be transported to the proposed power plant through pipe conveyor which shall have a system capacity of 2 x 2000TPH.

The steam generator shall be designed for the following conditions :

- **Best Coal** – 100% Imported Coal
- **Design Coal** – 70% Imported & 30% Domestic Coal
- **Worst Coal** – 50% Imported & 50% Domestic Coal

The analysis of fuel is given below :

1.9.2 Coal Analysis:

Coal Quality Parameters

SL.NO	DESCRIPTION	DOMESTIC COAL	IMPORTED COAL
1.	HIGHER HEATING	2800 (GCV as	6250 (GCV Air



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



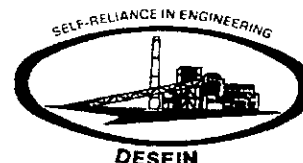
	VALUE -As Fired basis given Kcal/kg	received basis)	dried basis) 5642 (as received basis)
2.	TOTAL MOISTURE %	During rainy season 20% (inherent + surface)	16.5%
3.	HGI Abrasiveness expected YGP Shale and sand stone content Feed coal size	45 to 55 Average 52 50 to 70 mg/kg 20% max. upto 50 mm.	51

DOMESTIC COAL

Sr. No.	Particulars	Units	Parameters
A.	Proximate Analysis		
1.	Moisture	%	16.00
2.	Volatile Matter	%	19.00
3.	Ash	%	45.00
4.	Fixed carbon	%	20.00
	Total	%	100
B.	ULTIMATE ANALYSIS, % (As received)		
1.	Carbon	%	27.70
2.	Hydrogen	%	2.60
3.	Nitrogen	%	0.52
4.	Oxygen	%	7.26
5.	Sulphur	%	0.50
6.	Ash	%	45.00
7.	Moisture	%	16.00
8.	Carbonates	%	0.38
9.	Phosphorous	%	0.04
10.	Others	%	-
	Total	%	100.00
C.	Ash fusion temperature	deg C	
1.	Initial deformation, IT	deg C	1100
2.	Spherical, ST	deg C	1200
3.	Hemispherical, HT	deg C	1300
4.	Fluid, FT	deg C	-
D.	Ash Analysis, %		
1.	SiO ₂	%	59.54
2.	Al ₂ O ₃	%	29.00
3.	Fe ₂ O ₃	%	6.42
4.	CaO	%	1.50
5.	Na ₂ O	%	0.08



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



Sr. No.	Particulars	Units	Parameters
6.	K ₂ O	%	-
7.	TiO ₂	%	1.60
8.	SO ₃	%	0.25
9.	P ₂ O ₅	%	0.51
10.	MgO	%	0.50
11.	Others	%	0.60
12.	Total		100.00
E	Resistivity of fly ash	Ohm - cm	1.73x 10 ¹²

IMPORTED COAL

Sr. No.	Particulars	Units	Parameters
A.	Proximate Analysis (As received)		
1.	Moisture	%	16.50
2.	Volatile Matter	%	36.45
3.	Ash	%	6.62
4.	Fixed carbon	%	40.43
5.	Total	%	100.00
B.	ULTIMATE ANALYSIS, % (As received)		
1.	Carbon	%	60.12
2.	Hydrogen	%	4.38
3.	Nitrogen	%	1.48
4.	Oxygen	%	10.37
5.	Sulphur	%	0.53
6.	Ash	%	6.62
7.	Moisture	%	16.5
8.	Carbonates	%	-
9.	Phosphorous	%	-
10.	Others	%	-
	Total	%	100.00
C.	Ash fusion temperature	deg C	
1.	Initial deformation, IT	deg C	1230
2.	Spherical, ST	deg C	1270
3.	Hemispherical, HT	deg C	1320
4.	Fluid, FT	deg C	-
D.	Ash Analysis, %		
1.	SiO ₂	%	36.00
2.	Al ₂ O ₃	%	13.90
3.	Fe ₂ O ₃	%	14.80
4.	CaO	%	12.70
5.	Na ₂ O	%	0.70
6.	K ₂ O	%	1.70
7.	TiO ₂	%	0.80



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



Sr. No.	Particulars	Units	Parameters
8.	SO ₃	%	10.60
9.	P ₂ O ₅	%	0.20
10.	MgO	%	8.60
11.	Others	%	-
12.	Total	%	100.00

The plant should be suitable to accept imported coal sourced from any country. The limiting parameters of imported coal are furnished below :

S. No.	Particulars	Unit	Parameter
1	Total Moisture (ARB)	%	Up to 23 (Max)
2	Ash (ADB)	%	Up to 20 (Max)
3	Gross Calorific Value (ADB)	Kcal / Kg	5800 - 6500
4	Sulphur (ADB)	%	Up to 1 (Max)
5	Fixed Carbon (ADB)	%	30-50
6	Volatile Matter (ADB)	%	25-45
7	HGI		45-60
8	IDT (Under Reducing Atmosphere)	Deg C	1100-1250
9	Size	mm	< 50

Note: ADB stands for "As dried Basis" and ARB for "As Received Basis"

1.9.3 Specification of LDO

Specific gravity @ 15° C	0.8348
Gross calorific value, Kcal/kg	10400
Pour point "°C" max.	12
Flash point "°C" min.	66
Sulphur % "T" max.	0.5
K. Viscosity in Centistokes @ 50° C max.	7.5
Ash by wt. %	0.01
Water & sediment Vol. Max. %	0.25

1.9.4 Specification of HFO

Flash point "°C" min.	66
K. Viscosity in Centistokes @ 50° C max.	370



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



Ash by wt. %	0.1
Water content by volume % max	1
Sediment by weight % max	0.25
Total Sulphur by weight % max	4.5
Gross calorific value, Kcal/kg	10800

1.9.5 Fuel Linkage

TANGEDCO has approached Ministry of Coal through Ministry of Power for the long term linkage of Coal from the coal sources of Talcher or Mahanadi in Orissa.

The coal requirement has been worked as under:-

Coal required at MCR per hr. (Blended) 872 tonnes

Per day 20928 tonnes.

Annual 6.5 MTPA for 85% PLF

1.9.6 Fuel Transportation

The coal shall be received at Ennore port. The coal will be transported by pipe conveyor from coal berth 3 in Ennore Port and then through 2 x 2000 TPH pipe conveyor to the bunker directly or to stockyard.

1.10 Source Of Water

1.10.1 Source

The raw water intake shall be from the existing cooling water forebay of NCTPS PHASE-II.

1.10.2 Chemical analysis of Sea Water:

As given in Annexure-1, Volume III, Chapter- 3.

1.10.3 Requirement

The requirement of water for the plant will be for meeting the requirement of make up for the re-circulating cooling water system, dust suppression system in coal handling plants, ash disposal system and the RO/ D.M. water plant which will be supplying the power cycle make up requirements, etc. In addition the water requirements will be for drinking and service purposes. Water requirement is estimated as approx. 15523 m³/hr.



1.11 Source of Equipment

The proposed plant will be supplied, erected and commissioned on Single EPC basis.

1.12 Power Evacuation Plan

Power will be evacuated from the proposed thermal power station at 400 KV voltage level through 400 KV transmission lines. The power evacuation lines would be double circuit 400 KV lines.

1.13 400 KV GIS Switchyard

The 400 KV Switchyard is proposed to have one and a half bus arrangement and will comprise following bays/circuits :

- ◆ 2 – Generator transformer bays
- ◆ 1– Start up transformer bay
- ◆ 4 – Line Bays
- ◆ 2 – Bus VT's
- ◆ 2 – Bus Reactor Bays
- ◆ 2 – Spare bay (Equipped)
- ◆ 1 – Equipped bay for future GT
- ◆ 2 – Equipped bays for future lines

The switchyard will be complete with galvanized steel structures, lightning surge arrestors, OPGW Equipment, CTs, PTs of suitable VA burden and accuracy class as required for measurement protection and communication, insulators, bus-bars clamps & hard wares etc. The switchyard will be controlled by computerized control and data acquisition (SCADA) system.

1.14 Average Yearly Generation

The average yearly generation is calculated considering the following.

- The expected plant load factor is 85 %. With this PLF the average yearly generation will be around 11914 Million units.

1.15 INFORMATION FOR ENVIRONMENTAL APPRAISAL**1.0 GENERAL INFORMATION ABOUT THE PROJECT**

- | | | | |
|-----|-----------------------------|---|---|
| 1.1 | Name / Title of the Project | : | 2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS |
| 1.2 | Name of Owner | : | Tamilnadu Generation and Distribution Corporation (TANGEDCO) |



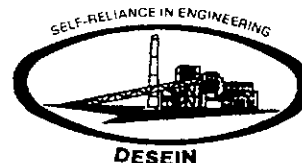
2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



- 1.3 Location of the Project : Near Vayalur Village, Ennore, Tamil Nadu
- 1.4 Site where proposed plant is to be located : Ash dyke of NCTPS
- 1.5 Capacity of the project under consideration : 2x 660MW
- 1.5.1 Govt. land / Private land / others : TANGEDCO land
- 1.5.2 Topographical feature, demographic profile & physiography : Site has differential levels and require filling to maintain the desired grade level of +10.00 meter above MSL
- 1.5.3 Nature of soil : Clayey soil
- 1.5.4 Distance from the nearest town / city / major human settlements : Chennai -35 km
- 1.5.5 Population to be displaced : Nil
- 1.5.6 Distance from water source : Approx. 5 km (from Cooling Water Forebay of NCTPS Stage II)
- 1.5.7 Area of forest land, if involved : Nil
- 1.5.8 Distance of forest from the site : N.A
- 1.6 Is this an extension? : No
If so indicate capacity of existing plant
- 1.7 What is the ultimate capacity envisaged : 2x660 MW
- 2.0 GENERAL ENVIRONMENTAL INFORMATION**
- 2.1 Area of the land proposed to be acquired : Refer Plot Plan Land already acquired
- i. Area required for plant : 500 Acres
- ii. Ash disposal : 100 % dry fly ash disposal and



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14



- 100% wet bottom ash disposal is envisaged to existing ash pond.
- iii. Plant facilities : The area is adequate for locating all the required systems for 2x660 MW.
- 2.2 Area proposed to be built-up or developed : Power station will be built-up in the proposed site as indicated in the plot plan.
- 2.3 Specify site characteristics River basin/ estuarine / coastal / others : Site is close to Buckingham Canal
- 2.4 Is the site situated in the forest area? Give following details : No
- 2.4.1 Area : N.A
- 2.4.2 Type of forests : N.A
- 2.5 Is site situated near to the forests? Give the distance from the site. : N.A.
- 2.6 Give a description of the flora within 25 km of your plant site under the following heads :
- a. Crops :
 - b. Forest :
 - c. Grass land :
 - d. Endangered species :
 - e. Others (Specify) :
- } Refer details in the specification elsewhere.
- 2.6.2 Give details of the following features, if they exist, within a radius of 25 km of the proposed site? :
- i. Fisheries :
 - ii. Sanctuary / natural park biosphere reserve :
 - iii. Lakes / ponds / reservoir :
 - iv. Stream / river : Buckingham canal is close to the site
 - v. Estuary / sea : Bay of Bengal is 5 km from site



- vi. Hills / mountains :
 - vii. Historic / cultural /
tourist /
archaeological scenic
sites / defence
installations :
- 2.7 Human settlement :
- 2.7.1 Total number of persons :
proposed to be employed
- i. During construction : 2500
450(0.75person/MW) TANGEDCO
 - ii. During operation : direct employees



2 x 660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT.No.03 /2013-14

Vol. II: 12



CHAPTER - 11

LV SWITCHGEAR

1.00.00 CODES AND STANDARDS

IEC: 60947 - Low-Voltage Switchgear and Control gear

IS: 13947 (parts 1 TO 5) - General Requirements of Switchgear and Control gear For Voltage Not Exceeding 1000 V AC.

2.00.00 DESIGN CRITERIA

2.01.00 Power from Unit / Station LV service transformers will be supplied to 415 V switchgears. Power from 415 switchgears to the various PMCCs, ACBDs, MCCs, Emergency MCCs, etc. shall be supplied from redundant incomers. These switchgears will distribute power to LV auxiliary motors and also to other auxiliary loads viz. MCCs / ACBDs, etc. LV switchgears will be of metal enclosed indoor type. Incomers / bus-couplers, outgoing tie feeders rated above 400 amps and motor feeders rated 90 kW and higher, will be equipped with air circuit breakers of fault interrupting capacity of 50 KA rms. Lower rated feeders will be equipped with fully-rated MCCBs.

2.02.00 System Parameters

1)	Nominal system voltage	415 V AC	220 V DC
2)	Highest system Voltage	433 V	240 V DC
3)	Voltage variation	±10%	190 - 240
4)	Rated frequency	50 HZ	-
5)	Frequency variation	+3% to (-)5%	-
6)	One minute Power frequency withstand voltage		
	Main circuit	2.5 kV	2.5 kV
	Auxiliary Circuit	2.0 KV	2.0 KV
6)	System Earthing	Solidly Grounded	Unearthed



7)	Maximum system fault level	50 KA for 3 secs	25 KA for 1 sec
4.	Molded Case Circuit Breaker		
a)	No. of poles	TPN/TP	
b)	Short time current for 1 sec.	50 kA rms	
c)	Rated short circuit breaking current	50 kA rms	
d)	Rated short circuit making current	105 kA peak	
e)	Overload release setting	Yes	
f)	Short circuit release setting	Yes	
g)	Undervoltage release	Yes	
h)	Shunt trip	Yes	

2.03.00

Type

Circuit Breakers	Shall be air break, three pole, spring charged, and horizontal draw out type, suitable for electrical operation.
Switchgear	Fully draw out type single front
MCC	Fully draw out type single front/Double front.
ACDB/DCDB	Fixed type single front

2.04.00

List of minimum required LV switchgears**S.No Name of LV Switchboard**

1. UNIT PMCC
2. WT PMCC
3. P.H. ACDB
4. BUNKER FLOOR MCC
5. P.H.B. MLDB
6. VENTILATION MCC
7. AC MCC



8. BOILER MCC
9. SOOT BLOWER MCC
10. BOILER VALVE DAMPER MCC
11. MILL SYSTEM MCC
12. TURBINE AUX. MCC
13. TURBINE VALVE DB
14. BOILER ACDB
15. ESP # 1A PMCC
16. ESP # 1B PMCC
17. ESP # 1C PMCC
18. ESP # 1D PMCC
19. ESP ACDB
20. ASH SILO PMCC
21. HYDROGEN GEN PLANT MCC
22. SEA WATER PUMP HOUSE PMCC
23. WATER TREATMENT MCC
24. SWPH MLDB
25. SERVICE BLDG MCC
26. WORKSHOP ACDB
27. AIR CDM MCC
28. CHLORINATION MCC
29. CHP MCC
30. MLDB CHP
31. AHP PMCC
32. ASH SLURRY MCC
33. AHP WATER SYSTEM MCC
34. AHP MLDB
35. FIRE WATER PMCC
36. MLDB RFWF PHASE
37. DG SWGR1 AMF PANEL
38. UNIT NORMAL EMERGENCY PMCC
39. 415 AC ELDB
40. 415MLDB AWR PMCC
41. ADMIN BLDG. PMCC
42. MLDB ADMIN BLDG AREA
43. FUEL OIL UNLOADING PH PMCC
44. MLDB FOHS AREA



45. WATER SERVICE PMCC
46. DM PLANT MCC
47. ETP MCC
48. PRETREATMENT PLANT MCC
49. MLDB WATER SERVICE S/S
50. INTAKE RAW WATER MCC
51. CLARIFIED WATER PUMP HOUSE MCC
52. FD PRESSURISING AREA MCC
53. ESP STANDBY PMCC
54. RO Plant SWGR
55. ICHS Stage I SWGR
56. PIPE CONVEYOR END SWGR
57. Any other LV Switchgear not mentioned herein but required for safe and reliable functioning of the plant.
- 58.

3.00.00 TEMPERATURE RISE

The temperature rise of the horizontal and vertical busbars and main bus link including all power draw out 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 and busbars over an ambient of 50 deg C.

4.00.00 OPERATIONAL REQUIREMENTS**4.01.00 Automatic Reverse Closure**

Automatic Reverse Closure (ARC) to the reserve supply source shall be provided for 415V unit essential service and other critical switchgears.

4.02.00 Breakers

4.02.01 Breakers shall have anti-pumping feature.

4.02.02 The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.

4.02.03 Breakers shall have inherent fault making and breaking capacities. They shall have shunt trip coils. In case releases are offered, the same shall have contact for energization of lockout relay. All breakers shall have built in interlocks for equipment and personnel safety.



- 4.02.04 Paralleling of two supplies shall be avoided by interlocking except for switchgear where auto-changeover is provided. Breaker contact multiplication, if required, shall be through latch relay.
- 4.02.05 Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.
- 4.02.06 Provision of mechanical closing of breaker only in 'Test' and 'Withdrawn' position shall be made. Alternatively, mechanical closing facility should be normally inaccessible, accessibility rendered only after deliberate removal of shrouds. It shall be possible to close the door with breaker in test position.
- 4.02.07 Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.
- 4.02.08 Supervision relay shall be provided for trip coil monitoring.
- 4.02.09 All air circuit breakers (ACBs) and moulded case circuit breakers shall be of short circuit performance category as per IS: 13947.
- 4.02.10 The MCCBs shall be of current limiting type. When MCCBs are used as short circuit protection devices for motor modules they shall provide type 2 coordination with associated contactor and thermal overload relay as per IS: 8544 under all operating conditions for the all currents up to the design fault current. The MCCBs on upstream and downstream shall be coordinated. Test reports to prove the requirements of type-2 coordination shall be obtained.
- 4.02.11 The local start push button shall be connected to the DCS so that the drive can be started on checking the process permissive through DCS.
- First contact of STOP PB shall be hardwired directly to switch gear for tripping the drive. Another contact of local push button (Stop) shall be connected to DCS for alarming LPB latched condition in DCS.
- 4.03.00 Switches and Contactors**
- 4.03.01 Motor starter contactors shall be of air break, electromagnetic type suitable for DOL starting of motor, and shall be of utilisation category AC-3 for ordinary and AC-4 for reversing starters. DC contactor shall be of DC-3 utilization category.
- 4.03.02 MCCBs shall be provided for short circuit protection. Isolating switches shall be of AC 23A category when used in motor circuit, and AC 22A category for other applications.
- 4.03.03 Isolating switches and MCCBs shall have door interlocks and padlocking facility.



4.03.04 Moulded case Circuit Breakers (MCCB) / Motor Protection Circuit Breakers (MPCB)

MCCBs shall be of three / four pole construction for panel mounting. The MCCBs shall be provided with front operating handles and mechanical ON / OFF indicators.

MCCB shall be provided with spring assisted quick-make, quick-break, current limiting type manually operated trip free mechanism, mechanical ON/OFF/TRIP position indicators, thermal tripping devices of inverse characteristics, instantaneous short circuit tripping devices and necessary auxiliary and alarm contacts. The MCCB module shall be provided with service, test and isolated position. The thermal and short circuit tripping device shall be adjustable type.

The MPCB's shall be in general similar to that of MCCB's in all the features mentioned above.

MCCBs/MPCBs shall be provided with overload thermal release setting range of 50% to 100% of rated current and adjustable short circuit magnetic release of 5 to 10 times rated current.

MCCBs/MPCBs shall be capable of withstanding the thermal stresses caused by overloads and locked rotor currents of values associated with protective relay settings of the motor starting equipment and the mechanical stress caused by the peak short circuit current of value associated with the switchgear rating. The maximum tripping time under short circuit shall not exceed 20 m.second. When used for motor circuit, shunt trip devices shall be provided and the let through power of controlling MCCB/MPCB shall be lower than the respective contactor, Contactor and overload relays shall be selected so as to withstand the let-through energy of the connected MCCB/MPCB in the feeder and consequent thermal and dynamic effects. All power feeder module MCCBs shall be equipped with earth fault release.

The DC circuits shall be provided with DC rated MCCB / MCBs.

MCCBs/MPCBs shall have following accessories and features:

- a) Shunt trip release
- b) Under voltage release
- c) Auxiliary contact for ON/OFF/ trip position
- d) Fault signaling contact
- e) Insulation shields to isolate the connection between each pole
- f) Finger protection plate to prevent accidental contact



g) The compartment door shall be interlocked with handle of MCCB/MPCB.

4.04.00 Panels

4.04.01 All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved identification plates.

4.04.02 Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall be of Degree of Protection IP55. Push buttons shall be of latch type with mushroom knobs.

4.04.03 Operating height of the panels shall be maximum 1800 mm and minimum 300 mm from finished floor level.

4.04.04 Wherever breaker/starter module front serves as compartment cover, suitable blanking covers, one for each size of modules per switchboard shall be supplied for use when carriage is withdrawn.

4.04.05 All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galvanized steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.

4.04.06 Suitable trolley arrangement shall be provided for breaker/starter modules. Two trolleys per switchgear room shall be provided so that top most breaker module of all types, sizes and rating can be withdrawn on trolley and lowered for maintenance purpose.

4.04.07 The incoming connection to transformer of more than 1000 KVA and inter-connecting sections between switchboards shall be of busducts. The busduct enclosure shall be made of minimum 3mm thick aluminium alloy. The section of the busduct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor busduct enclosure joints to provide additional protection against water ingress. The busduct top shall be sloped to prevent retention of water. The bus duct shall have DOP of IP55.

4.04.08 It should be possible to carryout maintenance on a feeder with adjacent feeders alive.

4.05.00 Control, Protection & Metering Requirements



- 4.05.01 Control circuits shall operate at suitable voltage of 110V AC. Necessary control supply transformers of 415/110 volts shall be provided for each module of MCC, with its connection after MCCB. However the breakers shall operate on 220V DC.
- 4.05.02 Contractor shall fully co-ordinate overload and short circuit tripping of breaker with upstream and downstream breakers//MCCBs motor starters. Various equipments shall meet requirement of Type-II class of coordination as per relevant IEC.
- 4.05.03 All relays shall be numerical and timers shall operate on available DC supply and not have any inbuilt batteries. They shall be provided with hand-reset operation indicator (flags) or LEDs with pushbuttons for resetting.

The relays shall have provision of both current and voltage inputs. The current operated relay shall have provision for 5 sets of CT inputs, 3 nos. for phase fault and 1 CT input for earth fault & 1 CT input for CBCT. Relay shall be suitable for both residually connected CT input as well as CBCT input. Relays shall be suitable for CT secondary current of 1 A / 5 A selectable at site. The voltage-operated relay shall have provision for 3 PT inputs. Relays shall be rated for operation on 110 V, VT secondary voltage. Relays used in Incomers and bus couplers shall have provision of two sets of voltage signal inputs for the purpose of synchronization.

All CT and 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.

All numerical relays 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. Relays shall have suitable output contact for breaker failure protection.

Relays shall have self-diagnostic feature with self-check for power failure, programmable routines, memory and main CPU failures.

The numerical relay shall be able to provide supervisory functions such as, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis



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 backup for real time clock in the event of power supply failure shall be provided.

Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping.

Numerical relays shall be capable of storing Minimum of 150 time tagged events/ records with time stamping. The numerical relays shall be able to store last 5 faults including the indication, waveforms, protection operated, fault location relay and operating time, currents, voltage and time. All Setting parameters, Fault data, waveforms & event logs shall be stored in Non-volatile memory only.

Sequence of events shall have 1 ms resolution at device level.

Measurement accuracy shall be 1 % for RMS Current and voltage.

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 IOs shall have optical isolation. Analog inputs shall be protected against switching surges, harmonics etc.

The alarm/status of each individual protection function and trip operation shall be communicated to DCS/Respective control system. The numerical relay system shall have built-in features/hardware interface to provide such inputs to Respective control system for analog/digital values.

Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC/ ANSI programmable characteristics.

Numerical relays shall have two level pass word protections, one for read only and other for authorization for modifying the setting etc.

Timer functions shall be programmable for on/off delays.



The protective relays shall have at least 10 nos. potential free contacts (Programmable) Auxiliary relays shall have contacts as required. Relay output contacts shall be suitable for directly wiring in the breaker closing and trip circuit operating from 220 V DC control voltage.

Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Interrogation voltage for the binary inputs shall be suitably selected to ensure avoidance of mal operation due to stray voltages.

No separate earth bus shall be required for the relays. It shall be possible to connect the relay earth to the common earth bus in the switchgear panel which shall be connected to the plant earth mat.

All protective relays shall be latest numerical type, having following features/functions:

- Protection functions as required
- IEC IDMT characteristics
- Measurements
- Event/fault/disturbance recording
- Binary input/output relays as required
- LEDs to indicate status of the relay
- LCD display for measurements, settings, faults etc.
- Key pad on the front of the relay
- Communication ports for transmitting settings, measurements, alarms, faults, events, disturbance records to DCS/Respective control system/SAS (Substation Automation System)
- Communication port for software setting/access measurements/maintenance/fault analysis
- Self-monitoring

All protective relays shall be latest numerical type with one USB port at the front for connecting to Laptop and one port (RJ45/FO port) at rear suitable for communication on IEC 61850 protocols.

The Numerical relays shall be networked through Ethernet switch, Gateway/Data Concentrators and shall be further integrated with SCADA based electrical monitoring system (for monitoring, measuring, fault data analysis & relay parameterization).



All necessary hardware including Managed Ethernet switches, accessories and licensed software shall be supplied by the vendor.

Ethernet switches shall be 'substation hardened' and shall comply with IEC61850-3 for communications and environment requirements. The Ethernet switches shall be of managed type with two (2) no. of fibre optic cable ports for ring network and Fourteen/Sixteen of Copper ports to achieve the LAN configuration. These switches shall be mounted inside the switchgear Panel.

The switchgear shall be provided with DC fail relay and DC fail indication lamp.

Breaker auxiliary contacts used for interlocking purposes shall be multiplied using electrically latched relay.

4.05.04

All equipments shall have necessary protections. However, following minimum protections shall be provided:

- 1) MCCB controlled motor feeders (all motors up to 90 kW)
 - a) Instantaneous short circuit protection on all phases through MCCBs rated for 80 kA rms (prospective breaking capacity at 415V).
 - b) Thermal overload relay in all the three phases with inbuilt protection against single phasing.
 - c) Instantaneous over current protection on all outgoing feeders.
- 2) ACB controlled motors feeders (motors rated above 90 kW) (protection relays shall be of numerical type)
 - a) Instantaneous short circuit protection on all phases
 - b) Overload protection on two phases
 - c) Over load alarm on third phase
 - d) Earth fault protection (sensitive earth fault detectors shall be provided in DC system to annunciator earth fault)
 - e) Under voltage protection
 - f) hand reset lockout relay
- 3) Incomers/bus coupler/outgoing breaker feeders other than motor feeders.
 - a) Definite time delay short circuit protection
 - b) Hand reset lockout relay



- 4) Incomer From DG Set.
- a) Differential Protection (87) - Three Pole
 - b) Reverse Power Protection.
 - c) Overload Alarm on one phase
 - d) Earth Fault Detection Relay (64) definite time delayed earth fault protection connected to transformer LV neutral CT (for Transformer Incomer feeder).
 - e) Voltage controlled over current relay
 - f) Generator under/over voltage Protection
 - g) Hand Reset Lockout Relay
 - h) 3-phase Digital Multifunction meter.

4.06.00 Meters / instruments

Plant electrical parameters shall be metered to the extent required for proper operation and monitoring of plant conditions. Current, voltage and watt-hours measured on each incomer and for each bus. Currents measured on each feeder. Voltage measured on each bus

All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. size with 240 degree scales and accuracy class of 1.0. It shall have cramped scale above 2 times to 8 times the rated current for indicating the starting current.

- 4.06.01 All motors of 15 kW and above shall have an Ammeter. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. Ammeters shall also be provided for all critical drives such as AOP, jack oil pump, seal oil pumps etc., irrespective of ratings and can be decided during detailed engineering. Adequate control and selector switches, push buttons and indicating lamps shall be provided. Thermostatically controlled space heaters with switches shall be provided to prevent condensation.

- 4.06.02 Breaker controlled panel shall also be of remote controlled with following features:

Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test position whereas closing from remote shall be possible in either service or test position. Tripping from local shall be possible only when local/remote selector switch is in local position. Tripping from remote shall be either breaker in service position or selector switch being in remote position.

- 4.06.03 Meters and Transducers for 415 Volts MCCs



For incomers feeders following Meters and transducers shall be provided:

- Current transducer on 'Y' phase
- Voltage transducer on 'Y-B' phase
- 1.0 class digital multi-function Meter.

For Bus Coupler following Meters and transducers shall be provided:

- Current transducer on 'Y' phase
- 1.0 class digital multi-function Meter.

For Bus PT following Meters and transducers shall be provided:

- Digital Voltmeter measuring all three phases
- Voltage transducer on three phases

For contactor motor feeders 15 kW & above following Meters and transducers shall be provided:

- Current transducer on 'Y' phase
- 1.0 class Analog meter on 'Y' phase
- Electronic overload relay with current display in switchgear.

For contactor motor feeders less than 15 kW following Meters and transducers shall be provided:

- Electronic overload relay with current display in switchgear.

Meters and Transducers for 415 Volts DBs

For incomers feeders following Meters shall be provided:

- Digital voltmeter measuring all three phases
- Digital ammeter measuring all three phases

For Bus PT following Meters shall be provided:

- Digital Voltmeter measuring all three phases

Energy accounting and audit meters shall meet CEA regulation. For details refer cl.7.00.00, chapter 1.

Transducers shall be of dual output type, class 0.5, 4-20 mA DC linear output & 750 ohm load.

Transducers shall be provided in all the buses so that algebraic summation in electrical system shall be Zero.

4.07.00

Control from Remote



2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT. No. 03/2013-14
Vol. IV: Electrical Works:345



Closing/ opening of the incomer and bus coupler breakers and starting/ Stopping of all motors/ outgoing feeders shall be from DCS/EDMS based control system through interposing relays only. The status (ON/OFF/TRIP), voltage and current of incomers & bus couplers shall be indicated in DCS/PLC. The required transducers shall be provided.

Necessary hardware shall be provided in the switchgear panel like coupling relays (24V DC, with max. burden of 2.5VA), auxiliary relays, current/voltage transducers (4-20 mA, dual output) etc. to effect interlocks, exchange information / status and exercise control from remote.

4.08.00 Normal/ Emergency (N/E) Switchgear

4.08.01 During auto changeover of the supply, the contactors in the affected bus would have dropped off. The services, which shall be restarted immediately and automatically without time lapse to keep unit running, are considered essential service. (For e.g. seal oil pumps, lube oil pumps, auxiliary cooling water pumps etc.). Such auxiliaries shall restart automatically after an auto changeover. These modules shall have additional hardware like timer, auxiliary contactors & associative circuitry in the module. Such essential services shall be identified during the detailed engineering stage & suitable module/Scheme shall be provided.

The modules of some of the critical application motors like baring gear motor, air heater motor, lube oil pump, jacking oil pump etc irrespective of their KW rating shall be provided with a CT, ammeter & a current transducer with remote metering in DCS.

Normal / emergency switchgear (N/E) shall be normally fed by 415V unit service switchgear & incomer from DG set will remain open. A bus coupler shall be provided in the N/E bus so that either DG set can feed the emergency loads.

The N/E switchgear shall be located adjacent to CCR.

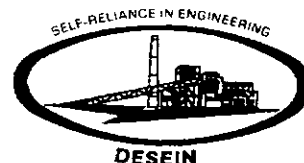
5.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

5.01.00 All 415V switchgear motor control centers (MCCs), ACDB, etc shall have following features:

- 1) Shall be of metal enclosed, fully draw out, indoor, floor mounted and free standing type.
- 2) Incomer modules and bus coupler modules of all the switchgear shall be fully draw out air circuit breaker type, controlled from local/ DCS/EDMS.



- 3) All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2 mm.
- 4) Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels.
- 5) All switchboards/panels shall be of dust and vermin proof. All cutouts shall have synthetic rubber gaskets.
- 6) For motors above 90 kW, remote controlled electrical circuit breakers (ACB), and for smaller motors and all other feeders, MCCBs shall be provided.
- 7) All switchboards, MCCs and DBs shall have following distinct vertical sections.
 - a) Completely enclosed bus bar compartment for horizontal and vertical bus bars.
 - b) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or MCCB feeders).
 - c) Compartment for cable alley or cable box for power and control cables. In case of cable box, they shall be segregated with complete shrouding for individual feeders at the rear for direct termination of cables.
 - d) For cable connection to circuit breaker, a separately enclosed cable compartment shall also be acceptable.
 - e) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary.
 - f) All 415 V switchgears, MCC's, AC & DC distribution boards etc. shall be painted by powder coating process. Paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards.
- 8) Busbars shall be of high conductivity aluminium alloy suitable for required current ratings with maximum temperature rise of 40°C over design ambient



temperature for plain joints and 55°C for silver plated joints. The Busbars shall be provided with Double decker Lyra type contacts for better connection.

- 9) Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances shall be at least 10mm. Wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/ sleeved.
- 10) Busbar insulators shall be of track-resistant high strength non-hydro- scopic, non-combustible type and suitable to withstand stresses due to over-voltages and short circuit current. Insulators and barrier of inflammable material such as Hylam shall not be accepted.
- 11) All numerical relays and timer shall be subject to Owner's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, draw out construction for easy replacement and testing facility. The auxiliary relays and timer may be provided in fixed cases.
- 12) Maxi terminal /cage clamp type terminal blocks shall be provided for signals to be interfaced with DDCMIS. The details of interfacing with DCS/EDMS shall be referred in Annexure B, Volume V (C&I).
- 13) The switchgears/MCC shall be designed to offer adequate level of safety to operating/ maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Contractor shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switchgear/MCC room describing various safe operating procedure/safety precautions for safe operation and maintenance of switchgear/MCC.
- 14) All current and voltage transformers as required for metering & protection specified shall be completely encapsulated cast resin insulated type. Incomers from transformers shall have CTs for transformer REF protection. All current and voltage transformers as required for metering and protection specified shall



be completely encapsulated cast resin insulated type. Incomers from transformers shall have CTs for transformer restricted earth fault protection.

The accuracy shall be as follows:

	CTs	PTs
Protection	5P20	3P
Metering	1.0	1.0
REF	PS	

- 15) Indicating lamps shall be cluster LED type.
- 16) 20% spare feeders of each type used in the MCC with a minimum one (1) number on each bus section shall be provided.

5.02.00 DC Distribution Board (DCDB)

For feeding the DC loads, following DC switchboards shall be provided.

- a) 220VDC Main plant and Station Switch Board (one for each unit)
- b) 220VDC Coal Handling Plant Switch Board
- c) 220V DC 400 kV Switchyard Switch Board
- d) 220VDC Ash Handling Plant Switch Board
- e) 220VDC Raw water plant and RO Plant Switch Board
- f) 220VDC ECHS Switch Board

The switch board shall be provided with suitably rated incomers & bus couplers, required quantity and type of outgoing feeders for the auxiliaries, control supply to various panels / systems in accordance with the number of 220 VDC supplies enumerated in the respective equipment specification. For Each load and auxiliaries separate feeders shall be provided. In addition, the following feeders shall be provided in each switchboard.

- (a) Minimum of two nos. feeders of each type and rating as spare and the same is the minimum quantity at the time of handing over the plant. Any additional quantity required for increase/adjustment during detailed



engineering stage shall also be duly considered.

- (b) 1 No. switchboard for 230V single phase space heating modules.
- (c) 1 No. alarm module for common alarm of outgoing feeder fault.

05.02.01 Current Rating

The short circuit current rating of the switchboard shall be arrived considering the contribution from charger and battery with 5% margin, with minimum 25 kA

The continuous current rating of the bus bars, incomers, ties for 220V DC switchboards shall be the maximum DC load (excluding the momentary load) on the bus due to any operating condition, when unit system additionally feeds station system or vice-versa plus 20% margin rounded off to the next higher standard rating.

5.02.02 Specific Requirements

The constructional features of all DC switchboards shall comply with the requirements of 415V AC switchgear as applicable. DCDB shall be sectionalized and loads are to be distributed for easy maintenance and isolation during earth leakages.

Positive and negative bus bars in the DC switchgear shall be completely segregated from each other by sheet steel partitions.

5.02.03 Module details

- (a) Incomer

The incomer modules shall be breaker controlled. Each incomer shall be provided with:

- Ammeter & voltmeter
- Earth fault relay with contact for remote indication (only for 220V DC switchboards)
- Under voltage relay with timer
- Indicating lamps for ON, OFF, earth fault, under voltage conditions
- One no. each of current and voltage transducers for remote indication
- Necessary hardware and circuitry for fault alarm, lamp test and reset.



(b) Outgoing feeders and tie Feeders/bus coupler

These feeders shall be provided with suitably rated DC MCBs with feeder on and fault indicating lamps.

The feeders rated 200 Amps and above shall be provided with a shunt and ammeter.

(c) Motor modules

(i) The motor starters shall be housed within DC switch boards. Separate DC starter panels are to be provided near the Motors. The starting current of the motor shall be limited to 200 % of full load current.

(ii) The motor modules shall be provided with:

- Switch, fuses, air break contactors
- Thermal overload relays
- Starting resistors with associated timers
- ON, OFF, FAULT indicating lamps.
- Necessary auxiliary contactors for fault alarm circuit
- 230V space heating circuit
- ON, OFF PBs for testing purposes
- One shunt with ammeter and one shunt for remote indication (if required)
- Appropriate circuitry for receiving the ON, OFF commands from remote panels/systems, interlocks, etc.
- MCB for space heating circuit

(d) Space Heating Module

230V, 1 space heating module shall be provided with incoming side switch fuse, suitably rated 415/230V cast resin type transformer (expected heating loads of the switchgear and the connected motors + 30% margin), secondary fuse, supply indicating lamp and connection to space heating buses. The 415V power supply for these modules shall be obtained from the unit service switchgear.

5.02.04

Technical Requirements Table

(a) DCDB Details



2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
Spec. No. CE/C/P&E/EE/E/OT. No. 03/2013-14
Vol. IV: Electrical Works:351



- (i) Ref ambient temperature : 50 deg C
- (ii) Degree of protection for enclosure IP54 enclosure
- (iii) Type of construction Indoor, single/ double front, non draw out type

(b) Alarm module

- (i) Alarm module for outgoing feeder faults shall be provided with switch fuse, alarm accept, reset PBs, 'supply ON' lamp, 'fault detected' lamp, hooter, necessary auxiliary contactors, control circuit for detecting, annunciating, accepting, resetting the fault in any module of the particular bus section. Contacts from this module for common feeder fault and its own module supply failure shall be provided and used for annunciation in control desk.
- (ii) Alarm module for incomers/bus coupler faults shall be similar to the above except that it shall work on 230V AC supply.

5.02.05 Control room alarms/indications/SER points

(a) Following indications /alarms shall be available in the control room OWSs.

- Incomer, bus coupler, ties – ON & OFF
- Incomer current
- Alarm module supply failed
- Outgoing feeder fault
- Incomer alarm supply fail
- Bus under voltage
- Bus earth fault
- Bus voltage

- (b) For the annunciation in control desk, alarms of a particular bus shall be grouped as one window. The requirement of contacts to SER shall be duly considered and provided.



5.02.06 Metering

1. All meters / shunts / transducers in DC system shall be class 1.00 only
2. Ammeters shall be provided on all incomer to DCDB with remote indication at UCR / DCS
3. Center Zero Voltmeters with Earth fault detection relay shall be provided in Bus PT of DCDB with remote indication at UCR / DCS.
4. Center zero ammeters shall be provided on bus coupler and ties
5. Charger DC output ammeter and voltmeter shall be provided with remote indication at UCR /DCS.

6.00.00 INSTALLATION

6.01.00 This shall be applicable to all LV switchgear panels, MCCs and other power & lighting distribution boards, DCDB, etc.

6.02.00 Manufacturer's instructions, drawings and instructions of the Site Engineer shall be strictly followed during handling, erection, testing and commissioning of the switchgear. The switchgear shall be handled with care, avoiding impact to the equipment by using experienced riggers under the guidance of a competent supervisor. Dragging of the panels shall be avoided and use of a crane and trailer shall be made for handling purposes while transporting to various sites. The switchboard shall be properly supported on the truck or trailer by means of ropes to avoid any chances of damage or tilting due to heavy vibration. The switchboards should be lifted by making use of lifting eyebolts only, fully tightened after ensuring that panel supports, nuts and bolts are all intact and tightened. When panels are to be lifted in packed conditions, utmost care shall be taken to avoid any damage to insulators, bushings, metering and protective equipment. The panels shall preferably be kept inside the packing cases till foundations are ready.

6.03.00 Base channels shall be grouted, leveled, in cement concrete pad for 415 V switchgear panels and other cubicle panels. Pedestal type panels and MCCs shall be erected by grouting base channels by bolts. A proper bonding surface should be made by chipping the floor while making cement concreting. All foundations, grouted bolts shall be cured for a minimum period of 48 hours.

6.04.00 The switchboard panels should be taken out from the packed cases and moved one by one to a proper place. All the panels should be assembled aligned leveled and it



7.00.00 LIST OF TESTS TO BE CONDUCTED**7.01.00 ROUTINE TESTS**

The switchgear panel shall be subjected to routine tests in accordance with the relevant IS/IEC standards. The tests shall include the following:

- Power frequency voltage dry test on the main circuit
- Voltage test on control and auxiliary circuits
- Measurement of resistance of the main circuit
- Mechanical operating tests

The circuit breakers, contactors, switches, local push buttons, local motor starters, VTs, CTs and control transformers shall be subjected to routine tests in accordance with the relevant IS/IEC standards. Routine test reports shall be furnished by the Vendor for Owner's review.

For circuit breaker, the list of routine tests shall include the following:

- Dielectric tests on the main circuit
- Dielectric tests on the control circuit & auxiliary circuit
- Measurement of the resistance of the main circuit
- Mechanical operating tests
- Design and visual checks

7.02.00 TYPE TESTS

The following type test certificates on each type & rating of L.V. switchgear, MCC panel and distribution boards shall be submitted.

- (a.) Short time withstand test with circuit breaker mounted inside the switchgear panel.
- (b.) Temperature rise test.
- (c.) Type II - Short circuit co-ordination test for any three ratings of MCC module as selected by the Purchaser.
- (d.) Test sequence -1 & combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel.



7.03.00

(e.) Degree of protection tests

Site Tests

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out.

a) General

- Check name plate details according to specification
- Check for physical damage
- Check tightness of all bolts, clamps and connecting terminals
- Check earth connections
- Check cleanliness of insulators and bushings
- Check heaters are provided
- HV test on complete switchgear with CT and breaker/ contactor in position
- Check all moving parts are properly lubricated
- Check for alignment of busbar with the insulators to ensure alignment and fitness of insulators
- Check for interchange ability of breakers/ contactors
- Check continuity and IR value of space heater
- Check earth continuity for the complete switchgear board

b) Circuit Breaker/ Contactors

- Check alignment of trucks for free movement
- Check correct operation of shutters
- Check slow closing operation (if provided)
- Check control wiring for correctness of connections, continuity and IR values
- Manual operation of breakers completely assembled
- Power closing/ opening operation, manually and electrically at extreme condition of control supply voltage
- Closing and tripping time
- Trip free and anti-pumping operation
- IR values, resistance and minimum pick up voltage of coils
- Simultaneous closing of all the three phases
- Check electrical and mechanical interlocks provided



- Checks on spring charging motor, correct operation of limit switches and time of charging
- Check SF6 pressure/ vacuum (as applicable)
- All functional checks

c) Current Transformers

- Insulation resistance between windings and winding terminals to body
- Polarity tests
- Ratio identification checking of all ratios on all cores by primary
- Injection of current
- Magnetisation characteristics and secondary winding resistance
- Spare CT cores, if any to be shorted and earthed

d) Voltage Transformers

- Insulation resistance test
- Ratio test on all cores
- Polarity test
- Line connections as per connection diagram

e) Cubicle Wiring

- Check all switch developments
- It should be made sure that the wiring is as per relevant drawings. All interconnections between panels shall similarly be checked
- Insulation resistance of all wires with respect to earth
- Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component/ equipment
- Check terminations and connections
- Wire ducting
- Gap sealing and cable bunching



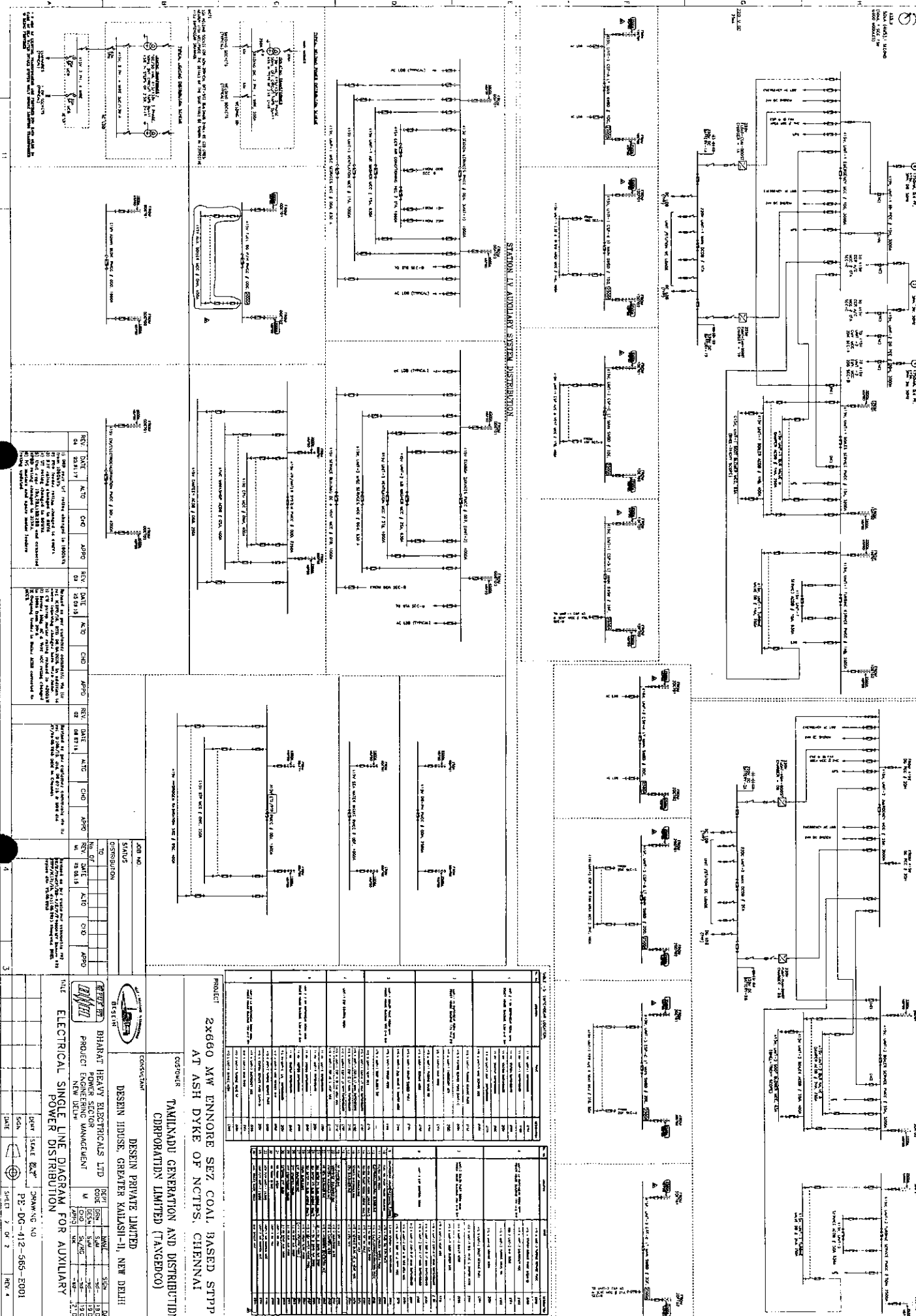
f) Relays

- Check internal wiring
- Insulation resistance between all terminals and body
- Insulation resistance between AC and DC terminals
- Check operating characteristics by secondary injection
- Check minimum pick up voltage of DC coils
- Check operation of electrical/ mechanical targets
- Check CT connections with particular reference to their polarities for differential type relays
- Relay settings

g) Meters

- Insulation resistance of all insulated portions
- Check CT and VT connections with particular reference to their polarities for power type meter





ELECTRICAL SINGLE LINE DIAGRAM FOR AUXILIARY POWER DISTRIBUTION

PROJECT: 2x660 MW ENMORE SERZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI

DESIGNER: BHARAT HEAVY ELECTRICALS LTD

PROJECT ENGINEERING MANAGEMENT: DESHN HOUSE, GREATER KAILASH-II, NEW DELHI

CONSULTANT: DESHN PRIVATE LIMITED

DATE: 10/01/15

REV: 1

REV: 2

REV: 3

REV: 4

REV: 5

REV: 6

REV: 7

REV: 8

REV: 9

REV: 10

REV: 11

REV: 12

REV: 13

REV: 14

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REV: 92

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REV: 95

REV: 96

REV: 97

REV: 98

REV: 99

REV: 100

DRAWING NO. PE-DG-412-506-E004

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

CONTROL LOGIC FOR 415V PCC/MCC INCOMER, BUSCOUPLER & OUTGOING FEEDERS

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											27/07/15					
STATUS CONTRACT																
DISTRIBUTION																
TO																
NO																



TAMILNADU GENERATION AND DISTRIBUTION
CORPORATION LIMITED (TANGEDCO)

CONSULTANT

DESEIN PRIVATE LIMITED



DESEIN HOUSE, GREATER KAILASH-II, NEW DELHI

PROJECT

2x660 MW ENNORE SEZ COAL BASED STPP
AT ASH DYKE OF NCTPS, CHENNAI



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT	NAME	SIGN	DATE
CHD	SSR	-sd-	31.03.15
APPD	SL	-sd-	31.03.15
CHD	SL	-sd-	31.03.15

TITLE CONTROL LOGIC FOR 415V PCC/MCC INCOMER,

BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO.

PE-DG-412-506-E004

SHEET 1 OF 22 REV. 01

CONTENTS

S. NO.	CONTENTS	SHEET NO.
01	KEY DIAGRAM	03-06
02	NOTES AND REFERENCES	07-08
03	LOGIC DIAGRAM FOR PMCC/MCC INCOMER	09-10
04	LOGIC DIAGRAM FOR PMCC/MCC BUS COUPLER	11-12
05	LOGIC DIAGRAM FOR EMERGENCY INCOMER FROM DG-1/2 TO DG PCC 1DH/2DH	13-14
07	LOGIC DIAGRAM FOR NORMAL INCOMER OF EMERGENCY BOARD 1DG/2DG.	15-16
08	LOGIC DIAGRAM FOR EMERGENCY MCC BUS COUPLER	17-18
09	LOGIC DIAGRAM FOR OUTGOING FEEDER FROM PMCC/PCC	19-20
10	LOGIC DIAGRAM FOR INCOMER TO EMERGENCY MCC 1DG/2DG FROM DG PCC 1DH/2DH	21-22

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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

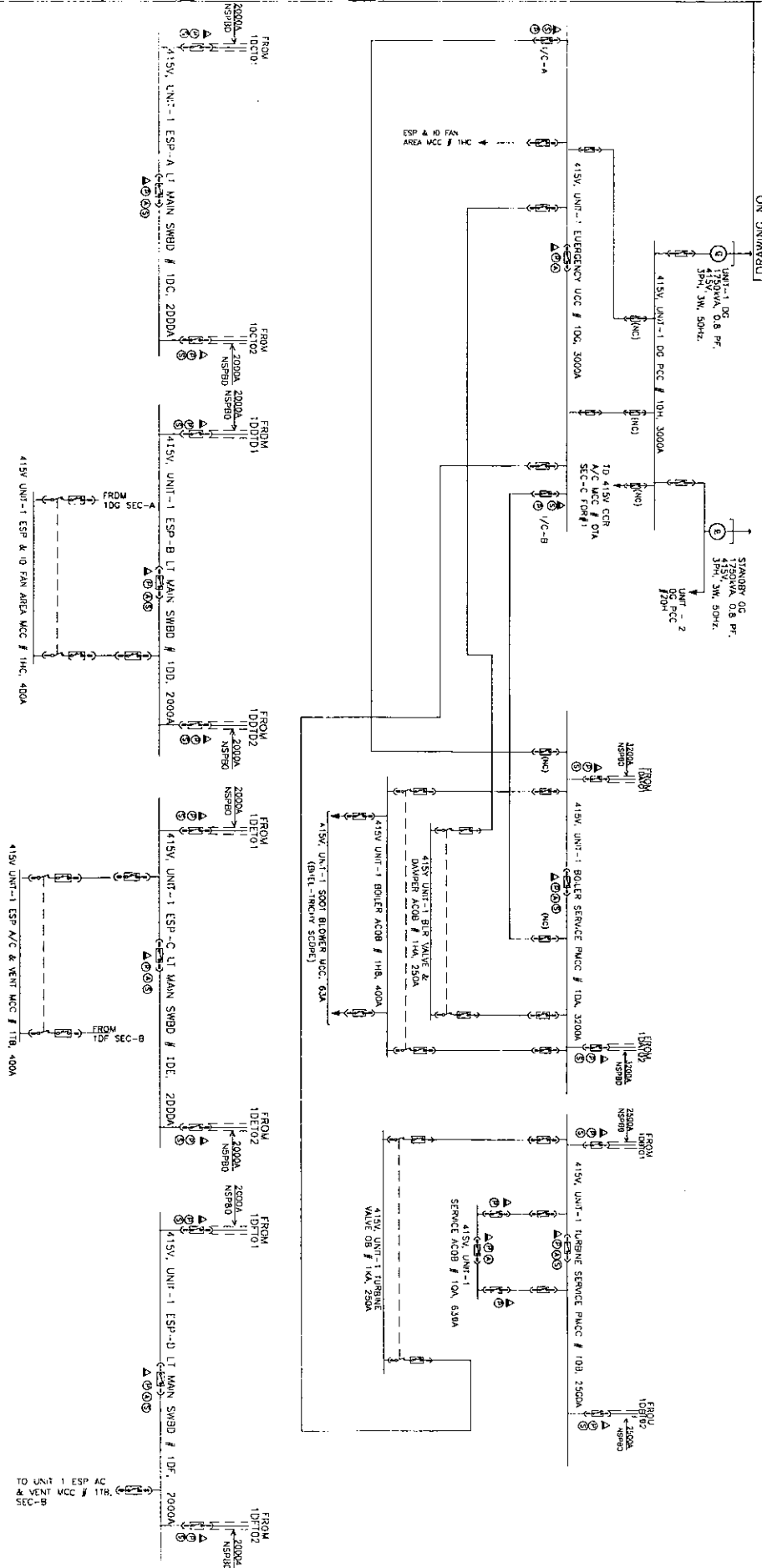
TITLE
CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO.
PE-DG-412-506-E004
SHEET 2 OF 22
REV. 01

DRAWING NO. PE-DG-412-506-E004

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



KEY DIAGRAM

LEGENDS:

- △ TWO OUT OF THREE CAN BE CLOSED (ELECTRICAL INTERLOCK)
- ① SYNCHRONISING FACILITY
- ② PLANNED CHANGEOVER FACILITY
- ③ AUTO-CHANGEOVER FACILITY WITHOUT PARALLELING (SLOW)
- △ AUTO-CLOSE FACILITY



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NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

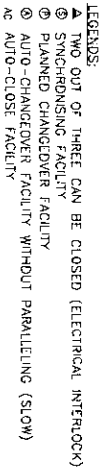
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CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO.
PE-DG-412-506-E004

SHEET
3 OF 22

REV.
01

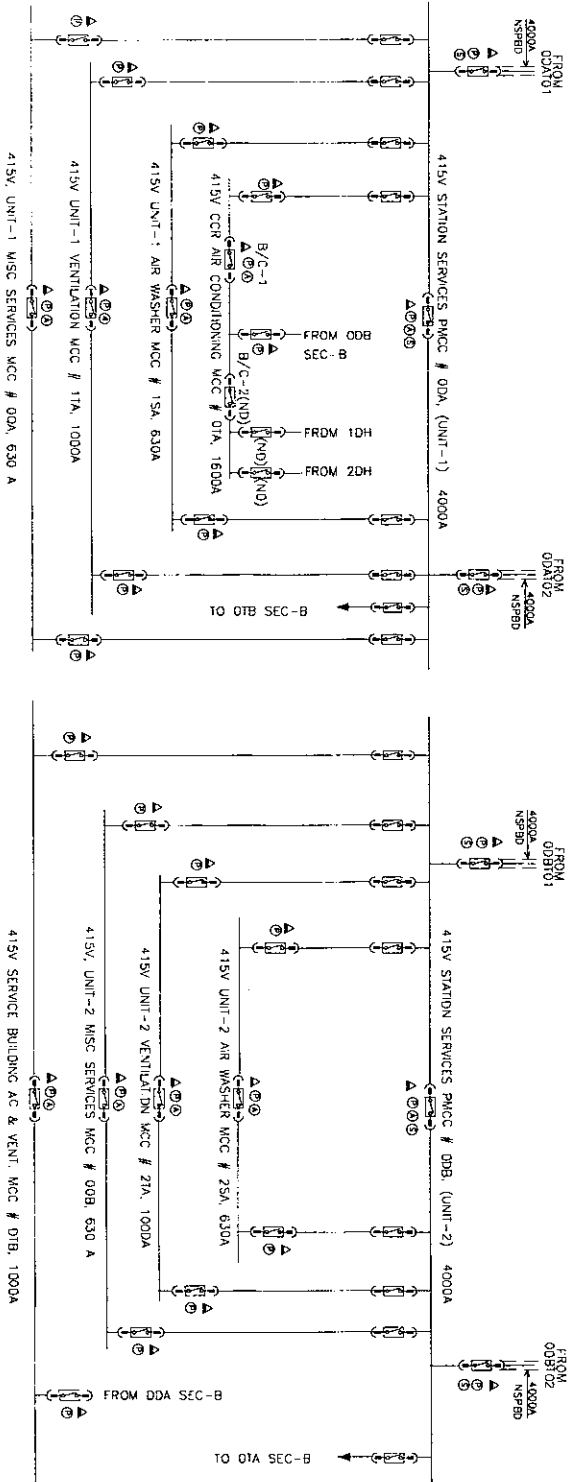
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2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

PE-DG-412-506-E004

SHEET	4	OF	22	REV.	01
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NOTES:

1. MECHANICAL INTERLOCK SHALL BE PROVIDED BETWEEN INCOMERS TO CCR AIR CONDITIONING MCC # 01A FROM DG PCC # 1DH AND 2DH SO THAT ONLY ONE INCOMER CAN BE CLOSED AT A TIME. ANY ONE OF THE EMERGENCY INCOMERS CAN BE CLOSED ONLY WHEN B/C-2 IS CLOSED.
2. MECHANICAL INTERLOCK SHALL ALSO BE PROVIDED BETWEEN B/C-2 AND NORMAL INCOMERS OF CCR AIR CONDITIONING MCC SO THAT B/C-2 CAN BE CLOSED ONLY WHEN NORMAL INCOMERS ARE OPEN

KEY DIAGRAM

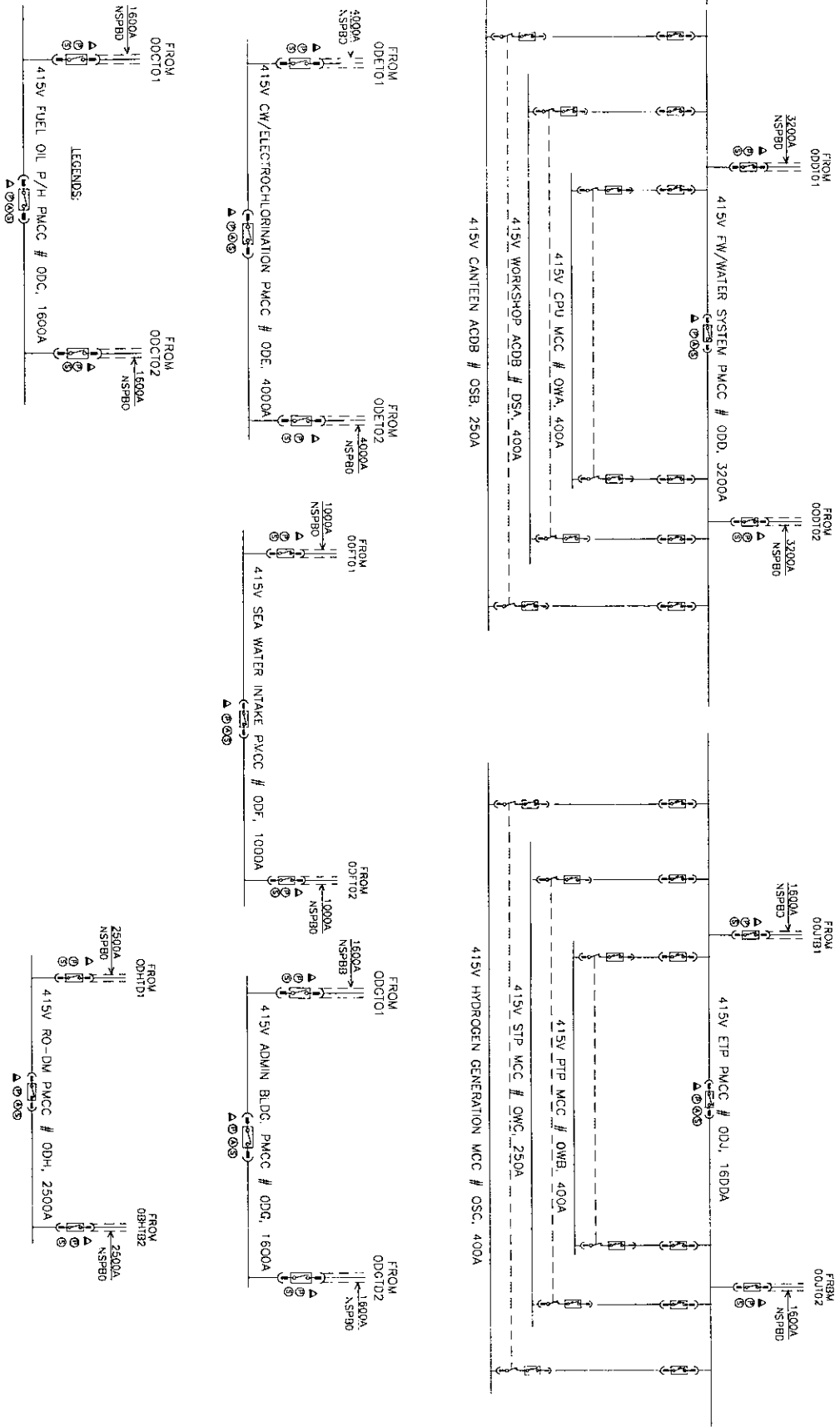
LEGENDS:

- ▲ TWO DUTY OF THREE CAN BE CLOSED (ELECTRICAL INTERLOCK)
- ⊙ SYNCHRONISING FACILITY
- ⊙ PLANNED CHANGEOVER FACILITY
- ⊙ AUTO-CHANGEOVER FACILITY WITHOUT PARALLELING (SLDW)

	BHARAT HEAVY ELECTRICALS LTD. POWER SECTION PROJECT ENGINEERING MANAGEMENT MADRAS, INDIA	2X60MW ENNORE, NCTPS (UNIT 1 & 2)
TITLE CONTROL LOGIC FOR 415V PCC/MCC INCOMER BUSCOUPLER & OUTGOING FEEDERS	DRAWING NO. PE-DG-412-506-F004 SHEET 5 OF 22 REV. 01	

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- LEGENDS:
- ▲ TWO OUT OF THREE CAN BE CLOSED (ELECTRICAL INTERLOCK)
 - ⊗ SYNCHRONISING FACILITY
 - ⊕ PLANNED CHANGEOVER FACILITY
 - ⊙ AUTO-CHANGEOVER FACILITY WITHOUT PARALLELING (SLDW)

LEGENDS:



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

**2X60MW ENNORE,
NCTPS (UNIT 1 & 2)**

TITLE
CONTROL LOGIC FOR 415V MCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO. PE-DG-412-506-E004
SHEET 6 OF 22 REV. 01

NOTES

- 1 ALL NON-MOTOR BREAKER FEEDERS PERTAINING TO BTG AREA INDICATED IN TABLE-1 SHALL BE CONTROLLED FROM EDMS. OUT OF THESE, SELECTED BREAKERS SHALL BE CONTROLLED FROM ECP ALSO.
- 2 FOR BOP AREAS, ALL NON-MOTOR BREAKER FEEDERS LISTED IN TABLE-2 SHALL BE CONTROLLED FROM DDCMS/PLC ONLY (DDCMS/PLC OF RESPECTIVE AREA). EXCEPT INCOMER AND BUS-COUPLER OF UNIT SERVICE ACDB WHICH SHALL BE CONTROLLED FROM EDMS.
- 3 IN CASE OF INCOMER AND BUS COUPLER, IF OVER CURRENT PROTECTION 50/51 OR 51N RELAY OPERATES, IT WILL OPERATE THE LOCKOUT RELAY (86). IN CASE OF, OUTGOING BREAKER FEEDERS, IF OVER CURRENT PROTECTION 50/51 OR 51N RELAY OPERATES, IT WILL OPERATE THE LOCKOUT RELAY (86).
- 4 CONTACTOR BASED CHANGE OVER ARRANGEMENT SHALL BE PROVIDED FOR MCCB INCOMER AND BUSCOUPLER. THE CHANGEOVER ARRANGEMENT IS PART OF SWITCHGEAR HARDWARE AND IS NOT SHOWN IN THIS DOCUMENT. SAME SHALL BE SHOWN IN SWITCHGEAR MANUFACTURER'S DOCUMENTS.

TABLE - 2

S. NO	DESCRIPTION	BOARD NO.
1	UNIT SERVICE ACDB	1QA & 2QA
2	FUEL OIL P/H PMCC	ODC
3	SEA WATER INTAKE PMCC (LOCAL DCS)	ODF
4	RO-DW PMCC	ODH
5	ESP LTMSBs	1DC,1DD,1DE,1DF,2DC, 2DD,2DE & 2DF
6	ETP PMCC	ODJ
7	MISC SERVICES MCC	0QA & 0QB
8	CW/ELECTROCHLORINATION PMCC	ODE
9	CCR AIR CONDITIONING MCC	OTA
10	VENTILATION MCC	1TA & 2TA
11	ADMIN BLDG. PMCC	ODG
12	FW/WATER SYSTEM PMCC	ODD
13	AIR WASHER MCC	1SA & 2SA
14	SERVICE BUILDING AC & VENT. MCC	OTB

SYNC. CHECK RELAY PROVIDED IN BUS-COUPLER OF RESPECTIVE PMCC SHALL BE USED FOR SYNC. CHECK FACILITY, WHEREVER APPLICABLE.

TABLE - 1

S. NO	DESCRIPTION	BOARD NO.
1	BOILER SERV. PMCCs	1DA & 2DA
2	TURBINE SERV. PMCCs	1DB & 2DB
3	STATION PMCCs	0DA & 0DB
4	EMERGENCY MCCs	1DG & 2DG
5	DG PCC	1DH & 2DH

COMMON SYNC. CHECK RELAY LOCATED IN ECP SHALL BE USED FOR SYNCHRONISING FACILITY

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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NODRA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

TITLE
CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO.
PE-DG-412-506-EO04
SHEET 7 OF 22
REV. 01

4003-905-214-DG-3d
ON 31/04/2019

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

1 THE OPERATIONAL LOGIC FOR DIFFERENT TYPE OF FEEDERS REALISED IN ECP/EDMS ARE DESCRIBED BELOW FEEDER WISE:

- A) INCOMER BREAKER AT PMCC/PCC/MCC.
- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
 - b) MANUAL PLANNED CLOSING IN MOMENTARY PARALLELING MODE FROM REMOTE.
 - c) MANUAL TRIPPING FROM REMOTE.
 - d) INTER TRIPPING WHEN UPSTREAM BREAKER IS OPEN.
- B) BUS COUPLER BREAKER AT PMCC/PCC/MCC (EXCEPT EMERGENCY MCC).
- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
 - b) MANUAL PLANNED CLOSING IN MOMENTARY PARALLELING MODE FROM REMOTE.
 - c) AUTO CLOSING OF THE BUS COUPLER BREAKER CONSEQUENT UPON LOSS OF ONE OF THE TWO INCOMING SOURCES.
 - d) MANUAL TRIPPING FROM REMOTE.
 - e) TRIPPING OF BREAKER WHEN BOTH INCOMER BREAKERS ARE OPEN.
- C) EMERGENCY INCOMER BREAKER FROM MAIN DG TO DG PCC.
- a) MANUAL DEAD BUS CLOSING FROM REMOTE (THROUGH DG AMF).
 - b) AUTO DEAD BUS CLOSING (THROUGH DG AMF) ON DG ATTAINING NORMAL RUNNING CONDITION (TO RESTORE SUPPLY TO EMERGENCY MCC)
 - c) MANUAL TRIPPING FROM REMOTE (THROUGH AMF).
 - d) INTER TRIPPING WHEN EMERGENCY MCC INCOMER FROM DG PCC FAILS TO TRIP (ON RESTORATION OF NORMAL POWER SUPPLY AT EMERGENCY MCC)
 - e) EMERGENCY INCOMER BREAKER FROM STANDBY DG TO DG PCC.
- a) MANUAL DEAD BUS CLOSING FROM REMOTE (THROUGH DG AMF).
 - b) MANUAL TRIPPING FROM REMOTE (THROUGH DG AMF).
 - c) INTER TRIPPING WHEN EMERGENCY INCOMER FROM DG PCC FAILS TO TRIP (ON RESTORATION OF NORMAL POWER SUPPLY AT EMERGENCY MCC)
- E) INCOMER BREAKER AT EMERGENCY SWITCHBOARD FROM DG PCC.
- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
 - b) AUTO DEAD BUS CLOSING (ON CLOSING OF MAIN DG INCOMER TO DG PCC)
 - c) MANUAL SYNC. CLOSING (WITH NORMAL SUPPLY ON EMERGENCY MCC)
 - d) MANUAL TRIPPING FROM REMOTE
 - e) INTER TRIPPING WHEN NORMAL SUPPLY IS RESTORED.
- F) INCOMER BREAKER AT EMERGENCY SWITCHBOARD FROM BOILER PMCC.
- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
 - b) MANUAL PLANNED CLOSING IN MOMENTARY PARALLELING MODE FROM REMOTE.
 - c) MANUAL SYNC. CLOSING (WITH SUPPLY FROM DG PCC)
 - d) MANUAL TRIPPING FROM REMOTE.
 - e) INTER TRIPPING WHEN UPSTREAM BREAKER IN OPENED (TRIPPED).
- G) BUS COUPLER BREAKER AT EMERGENCY MCC.
- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
 - b) AUTO CLOSING OF THE BUS COUPLER BREAKER CONSEQUENT UPON LOSS OF [INCOMER-1 FROM DG PCC AND INCOMER FROM SEC-A BOILER PMCC] OR [INCOMER-2 FROM DG PCC AND INCOMER FROM SEC-B BOILER PMCC]
- H) OUTGOING FEEDER FROM PMCC/PCC.
- a) MANUAL CLOSING FROM REMOTE.
 - b) MANUAL TRIPPING FROM REMOTE.
- I) OUTGOING FEEDER TO MOTOR AS PER DRIVE CONTROL PHILOSOPHY UNLESS OTHERWISE INDICATED. ALL COMPONENTS REQUIRED TO MEET THE FUNCTIONAL REQUIREMENTS AS PER THE LOGIC DIAGRAMS ARE LOCATED IN RESPECTIVE SWITCHGEAR.
- 2 THE INTERPOSING RELAYS FOR ON/OFF COMMAND (K12/K11) SHALL BE LOCATED IN RESPECTIVE SWITCHGEAR.
- 3 ALL THE LOGIC PERTAINING TO ISSUE OF CLOSING/TRIPPING COMMAND FROM EDMS WILL BE BUILT IN THE EDMS.
- 4 ALL THE LOGIC PERTAINING TO ISSUE OF CLOSING/TRIPPING COMMAND TO BREAKERS OF OFFSITE AREA SHALL BE BUILT IN THE RESPECTIVE OFFSITE AREA DDCMS/PLC.
- 5

REFERENCES:

- 1 PE-DG-412-565-E001 ELECTRICAL SINGLE LINE DIAGRAM FOR AUXILIARY POWER DISTRIBUTION

	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT MUMBAI, INDIA	2X660MW ENNORE, NCTPS (UNIT 1 & 2)
TITLE CONTROL LOGIC FOR 415V PCC/MCC INCOMER BUSCOUPLER & OUTGOING FEEDERS		
DRAWING NO. PE-DG-412-506-E004		SHEET 8 OF 22
		REV. 01

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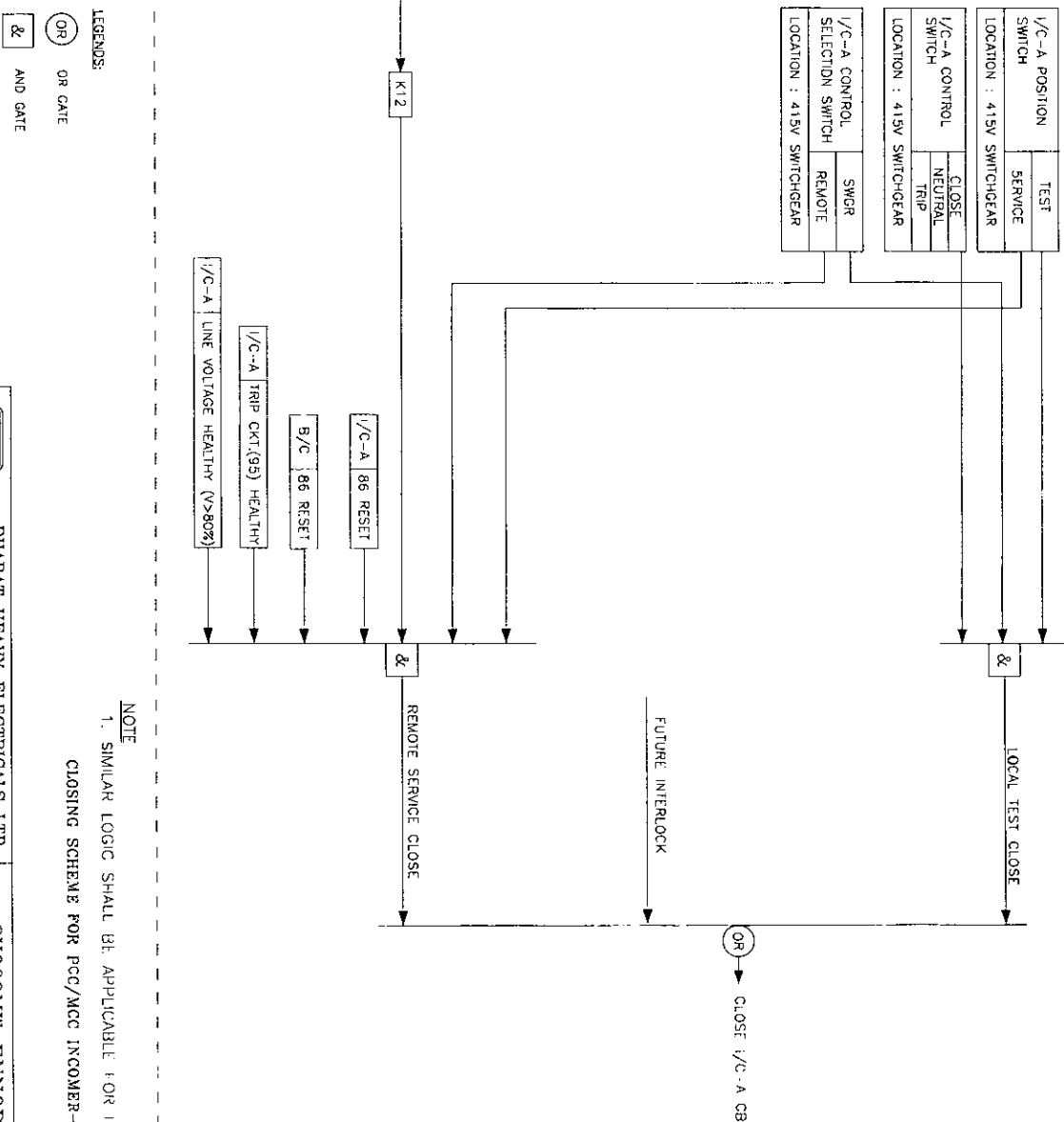
S.NO	DESCRIPTION	BOARD NO.
1	TURBINE SERVICE PMCC	1DB & 2DB
2	BOILER SERVICE PMCC	1DA & 2DA
3	ESP LT MSB	1DC,1DD,1DE,1DF, 2DC,2DD,2DE,2DF
4	STATION SERV. PMCC	ODA & ODB
5	FW/WATER SYS. PMCC	ODD
6	ETP PMCC	ODJ
7	CW/ELEC. CHL PMCC	ODE
8	SFA WATER INTAKE PMCC	ODF
9	ADMIN BLDG PMCC	ODG
10	FUEL OIL P/H PMCC	ODC
11	RO-DM PMCC	ODH
12	UNIT SERV. ACDB	1QA & 2QA
13	CCR AC MCC	OTA
14	VENTILATION MCC	1TA & 2TA
15	MISC. SERVICES MCC	00A & 00B
16	AIR WASHER MCC	1SA & 2SA
17	SERV. BLDG. AC & VENT. MCC	OTB

APPLICABLE SWITCHBOARD

CLOSING COMMAND

EDMS/DDCMS/PLC

415V SWITCHGEAR



NOTE
1. SIMILAR LOGIC SHALL BE APPLICABLE FOR I/C-B
CLOSING SCHEME FOR PCC/MCC INCOMER-A

BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA, INDIA		2X660MW ENNORE, NCTPS (UNIT 1 & 2)	
TITLE CONTROL LOGIC FOR 415V PCC/MCC INCOMER BUSCOUPLER & OUTGOING FEEDERS		DRAWING NO. PE-DG-412-506-E004	
SHEET 9 OF 22		REV. 01	

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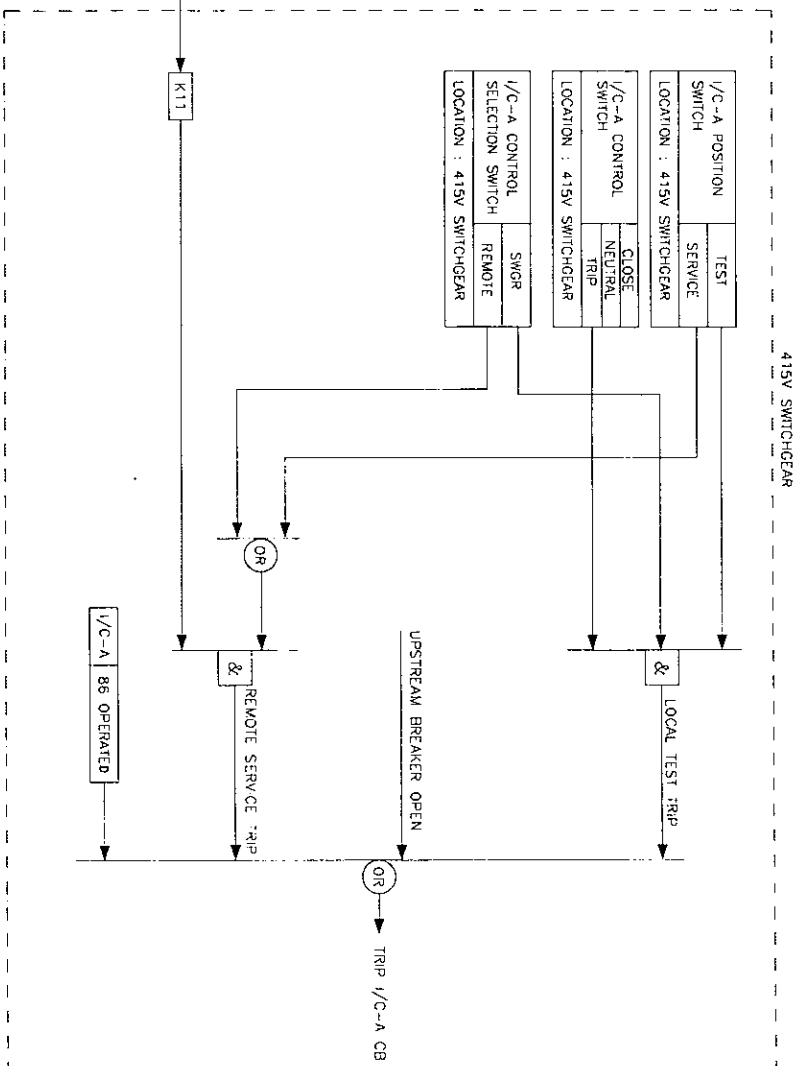
CUSTOMER'S DRAWING NO.

S.NO	DESCRIPTION	BOARD NO.
1	TURBINE SERVICE PMCC	1DB & 2DB
2	BOILER SERVICE PMCC	1DA & 2DA
3	ESP LT MSB	1DC,1DD,1DE,1DF, 2DC,2DD,2DE,2DF
4	STATION SERV. PMCC	ODA & ODB
5	FW/WATER SYS. PMCC	ODD
6	ETP PMCC	ODJ
7	CW/ELEC CHL PMCC	ODE
8	SEA WATER INTAKE PMCC	ODF
9	ADMIN BLDG PMCC	ODG
10	FUEL OIL P/H PMCC	ODC
11	RO-DM PMCC	ODH
12	UNIT SERV. ACDB	1QA & 2QA
13	CCR AC MCC	OTA
14	VENTILATION MCC	1TA & 2TA
15	MISC. SERVICES MCC	ODA & ODB
16	AIR WASHER MCC	1SA & 2SA
17	SERV. BLDG. AC & VENT.MCC	OTB

APPLICABLE SWITCHBOARD

TRIPPING COMMAND

EDMS/DDCMIS/PLC



NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR I/C-B

LEGENDS

OR
OR GATE

AND GATE

TRIPPING SCHEME FOR PCC/MCC INCOMER-A



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PROJECT ENGINEERING MANAGEMENT
NOLDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

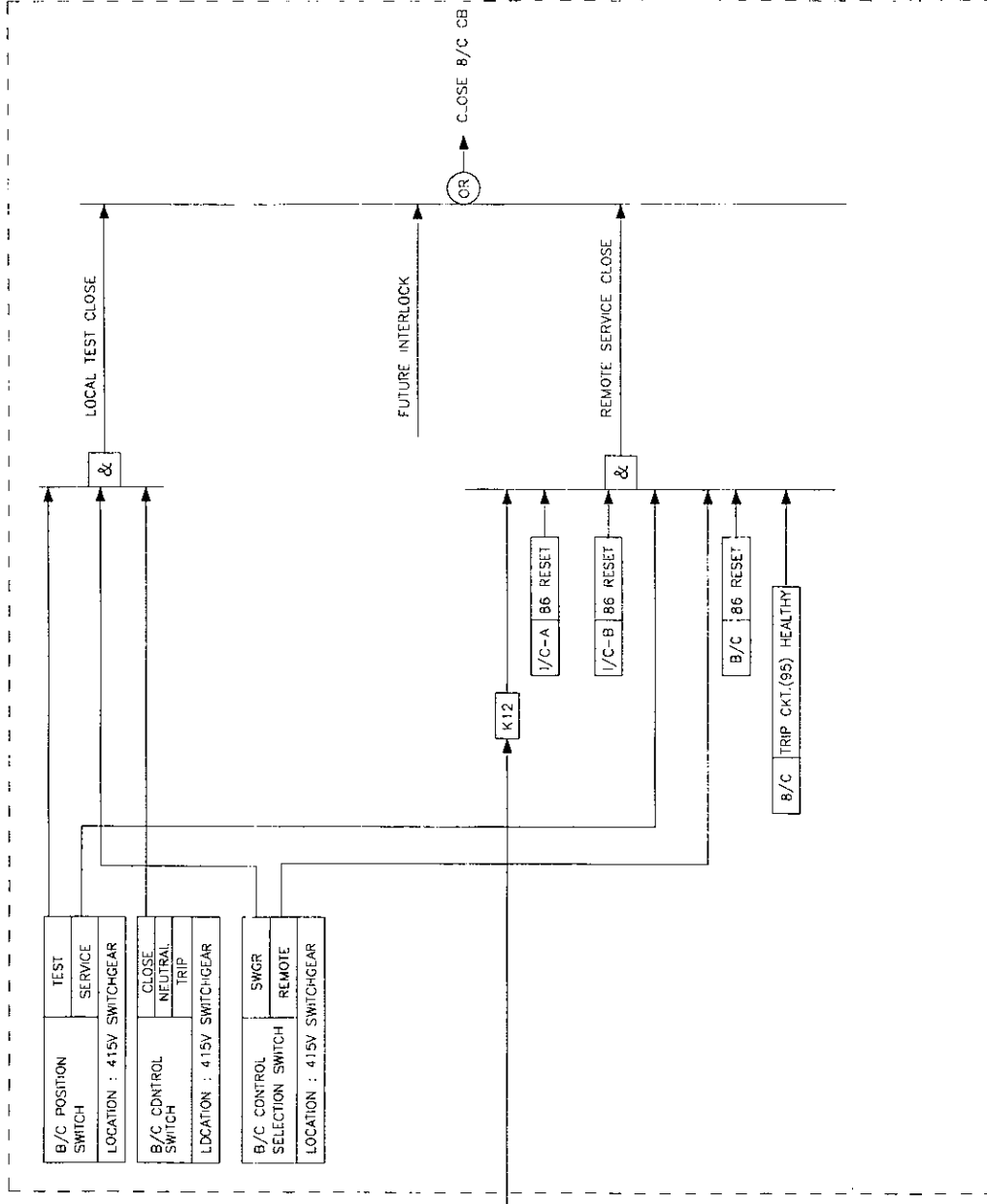
PE-DG-412-506-E004

SHEET 10 OF 22	REV. D1
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DRAWING NO.
PE-DG-412-506-E004

EDMS/DDCMS/PLC

415V SWITCHGEAR



CLOSING SCHEME FOR BUS COUPLER OF PCC/MCC

LEGENDS:

OR OR GATE
& AND GATE

CLOSING COMMAND

APPLICABLE SWITCHBOARD

S.NO	DESCRIPTION	BOARD NO.
1	TURBINE SERVICE PMCC	1DB & 2DB
2	BOILER SERVICE PMCC	1DA & 2DA
3	ESP LT MSB	1DC,1DD,1DE,1DF, 2DC,2DD,2DE,2DF
4	STATION SERV. PMCC	QDA & ODB
5	FW/WATER SYS. PMCC	ODD
6	ETP PMCC	ODJ
7	CW/ELEC CHL PMCC	ODE
8	SEA WATER INTAKE PMCC	ODF
9	ADMIN BLDG PMCC	ODG
10	FUEL OIL P/H PMCC	ODC
11	R0-DM PMCC	ODH
12	UNIT SERV. ACDB	1QA & 2QA
13	CCR AC MCC	OTA
14	VENTILATION MCC	1TA & 2TA
15	MISC. SERVICES MCC	QQA & OQB
16	AIR WASHER MCC	1SA & 2SA
17	SERV. BLDG. AC & VENT. MCC	OTB

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

DRAWING NO. PE-DG-412-506-E004
SHEET 11 OF 22 REV. 01

TITLE
CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

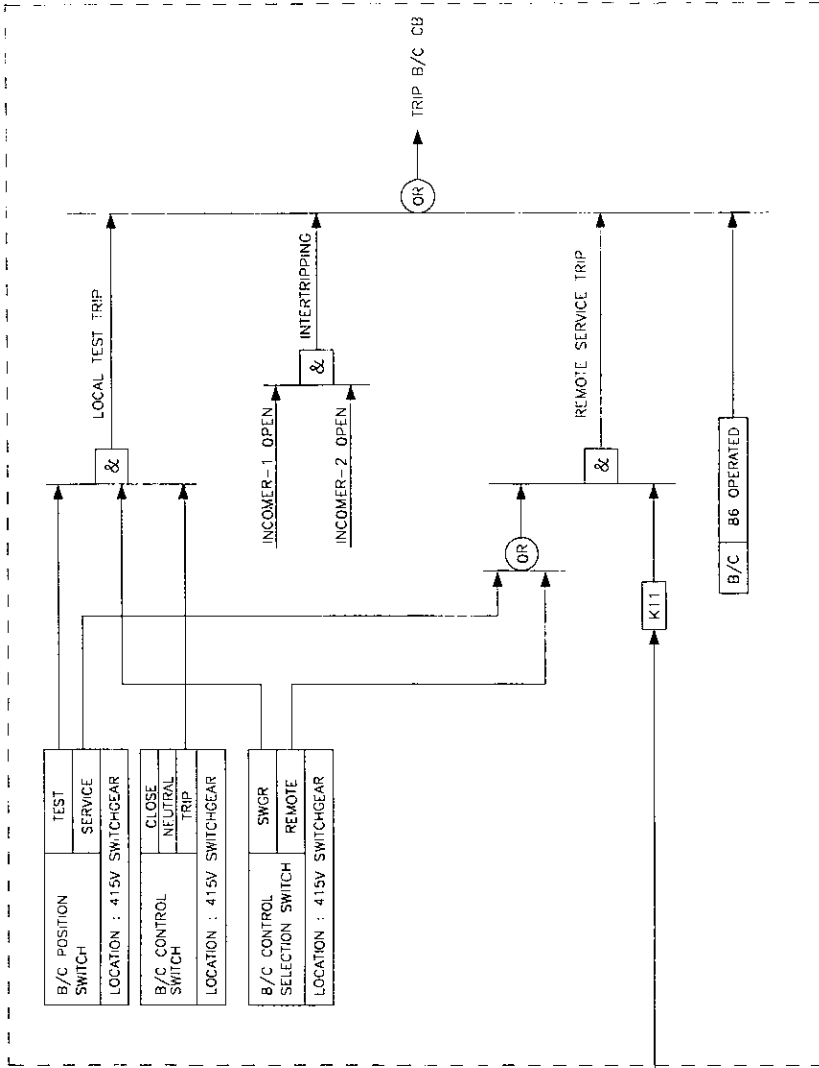
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

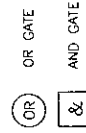
DRAWING NO.
PE-DG-412-506-E004

EDMS/DDCM/PLC

415V SWITCHGEAR



LEGENDS:



TRIPPING SCHEME FOR BUS COUPLER OF POC/MCC

S.NO	DESCRIPTION	BOARD NO.
1	TURBINE SERVICE PMCC	1DB & 2DB
2	BOILER SERVICE PMCC	1DA & 2DA
3	ESP LT MSB	1DC,1DD,1DE,1DF, 2DC,2DD,2DE,2DF
4	STATION SERV. PMCC	ODA & ODB
5	FW/WATER SYS. PMCC	ODD
6	ETP PMCC	ODJ
7	CW/ELEC CHL PMCC	ODE
8	SEA WATER INTAKE PMCC	ODF
9	ADMIN BLDG PMCC	ODG
10	FUEL OIL P/H PMCC	ODC
11	RO-DM PMCC	ODH
12	UNIT SERV. ACDB	1QA & 2QA
13	CCR AC MCC	OTA
14	VENTILATION MCC	1TA & 2TA
15	MISC. SERVICES MCC	0QA & 0QB
16	AIR WASHER MCC	1SA & 2SA
17	SERV. BLDG. AC & VENT.MCC	0TB



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

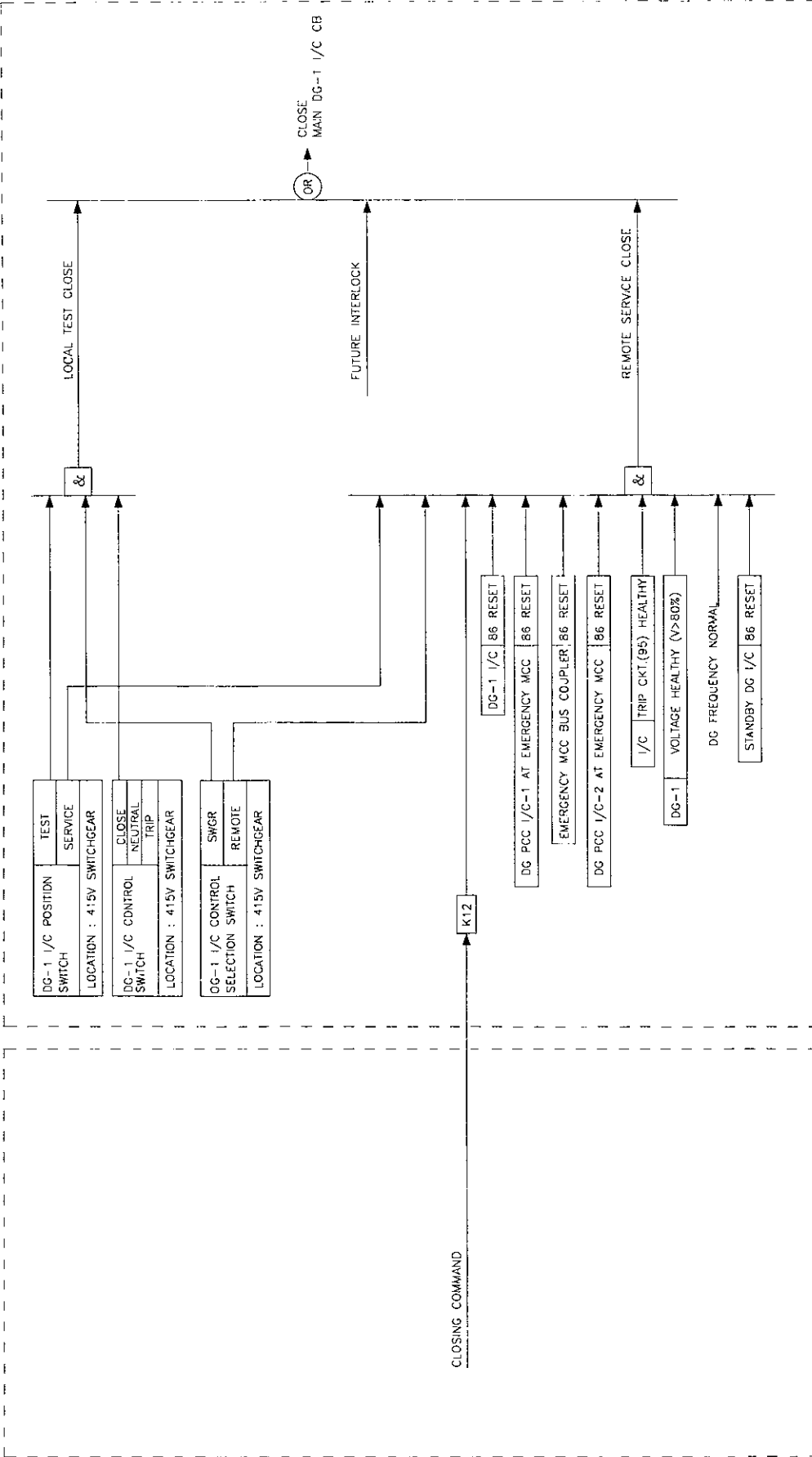
TITLE		CONTROL LOGIC FOR 415V PCC/MCC INCOMER BUSCOUPLER & OUTGOING FEEDERS		DRAWING NO.	
				PE-DG-412-506-E004	
				SHEET	12 OF 22
				REV.	01

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CUSTOMER'S DRAWING NO.

EDMS

415V SWITCHGEAR



NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR MAIN DG-2 INCOMER AT #2DH
2. SIMILAR LOGIC SHALL BE APPLICABLE FOR STANDBY DG INCOMER AT 1DH AND 2DH

LEGENDS:

OR GATE

AND GATE



BIHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

**2X660MW ENNORE,
NCTPS (UNIT 1 & 2)**

DRAWING NO.

PE-DG-412-506-E004

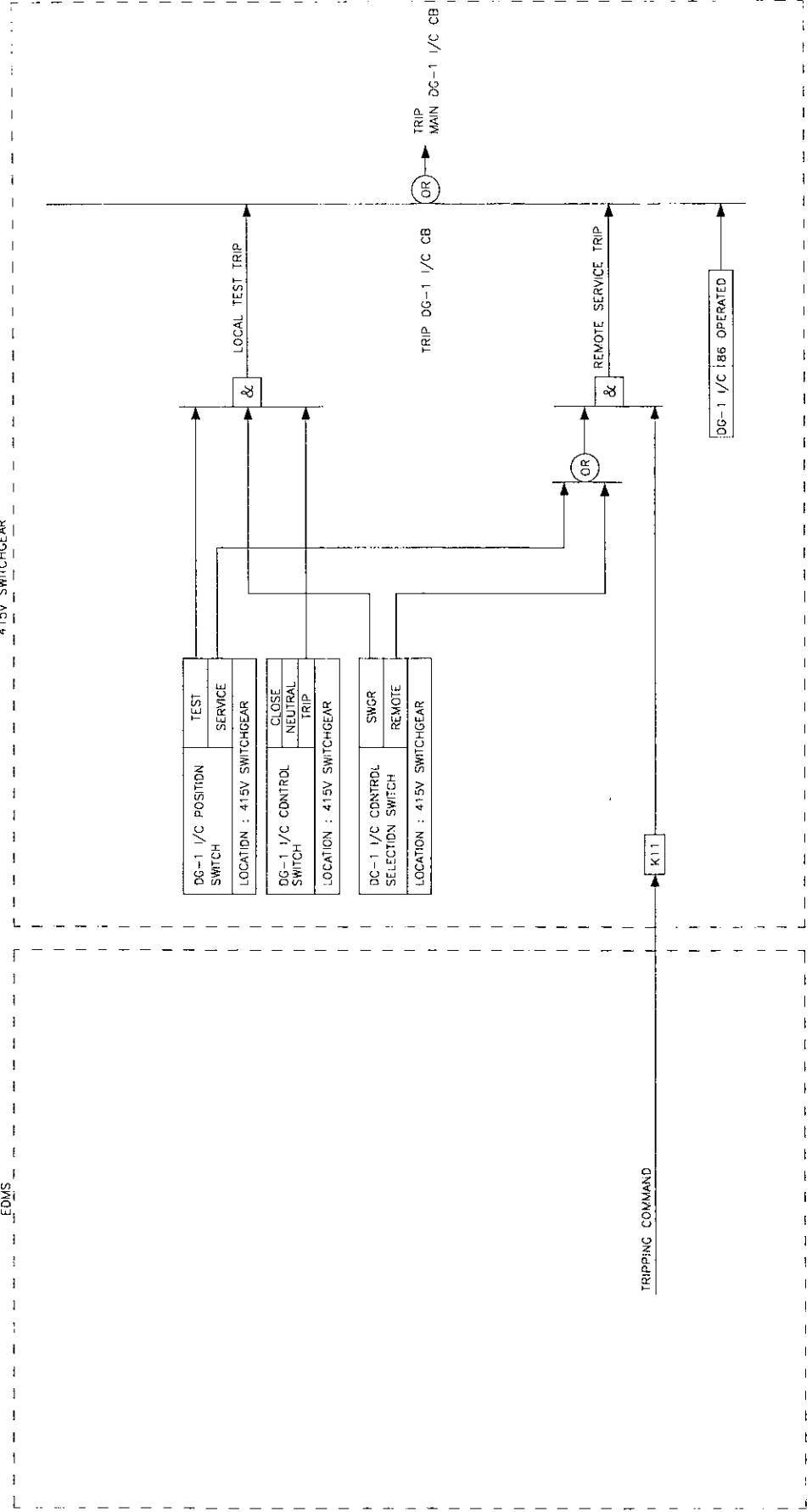
TITLE
CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEDERS

SHEET 13 OF 22 REV. 01

DRAWING NO.
PE-DG-412-506-E004

EDMS

415V SWITCHGEAR



- NOTE
1. SIMILAR LOGIC SHALL BE APPLICABLE FOR #2DF
 2. SIMILAR LOGIC SHALL BE APPLICABLE FOR STANDBY DG INCOMER AT 1DF AND 2DF

LEGENDS:

OR

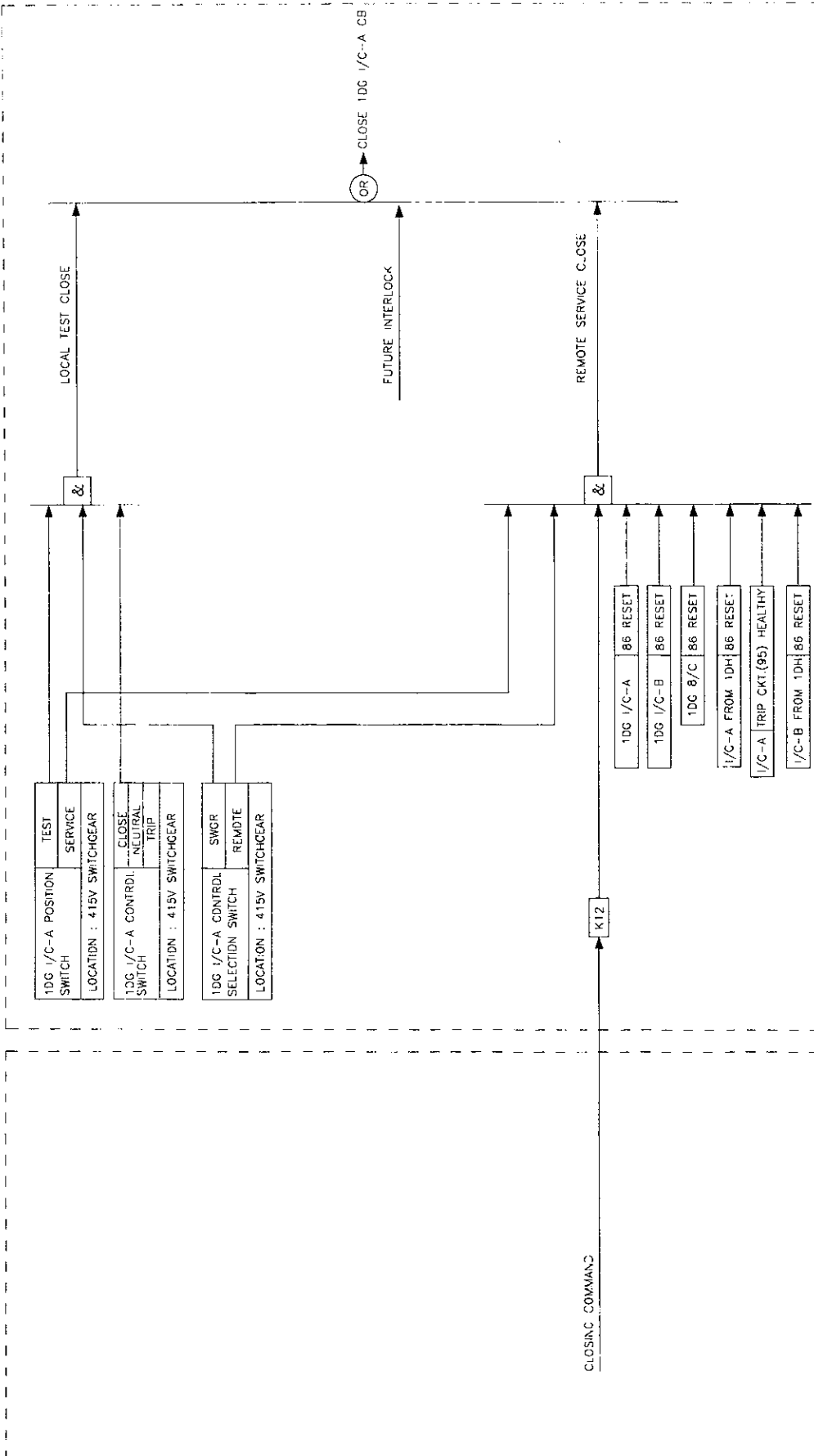
AND GATE

TRIPPING SCHEME FOR EMERGENCY I/C TO DG PCC #1DH

	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT Noida, India	2X660MW ENNVORE, NCTPS (UNIT 1 & 2)
	DRAWING NO. PE-DG-412-506-E004	
TITLE CONTROL LOGIC FOR 415V PCC/MCC INCOMER BUSCOUPLER & OUTGOING FEEDERS		SHEET 14 OF 22 REV. 01

DRAWING NO. PE-DG-412-506-E004

415V SWITCHGEAR



1. SIMILAR LOGIC SHALL BE APPLICABLE FOR #20G
2. SIMILAR LOGIC SHALL BE APPLICABLE FOR 1/C B

& AND GATE

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

DRAWING NO.	PE-DG-412-506-E004
SHEET	15 OF 22
REV	01

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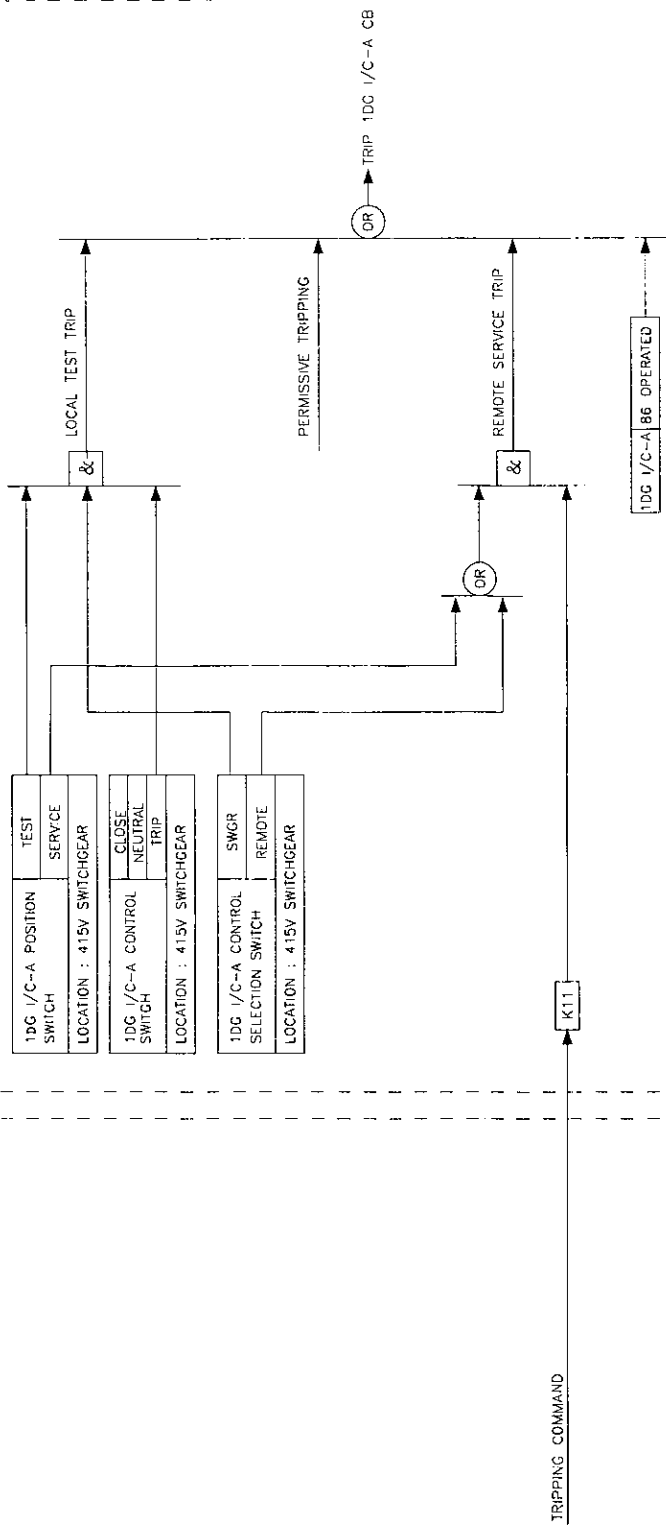
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO.
PE-DG-412-506-E004

EDWS

415V SWITCHGEAR



NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR I/C-A AND I/C-B ON SWBD #2DG
2. SIMILAR LOGIC SHALL BE APPLICABLE FOR I/C B ON SWBD #1DG

LEGENDS:

(OR) OR GATE
& AND GATE

TRIPPING SCHEME FOR NORMAL I/C-A EMERGENCY BOARD #1DG


BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NDIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

TITLE CONTROL LOGIC FOR 415V FCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS
DRAWING NO. PE-DG-412-506-E004
SHEET 16 OF 22 REV. 01

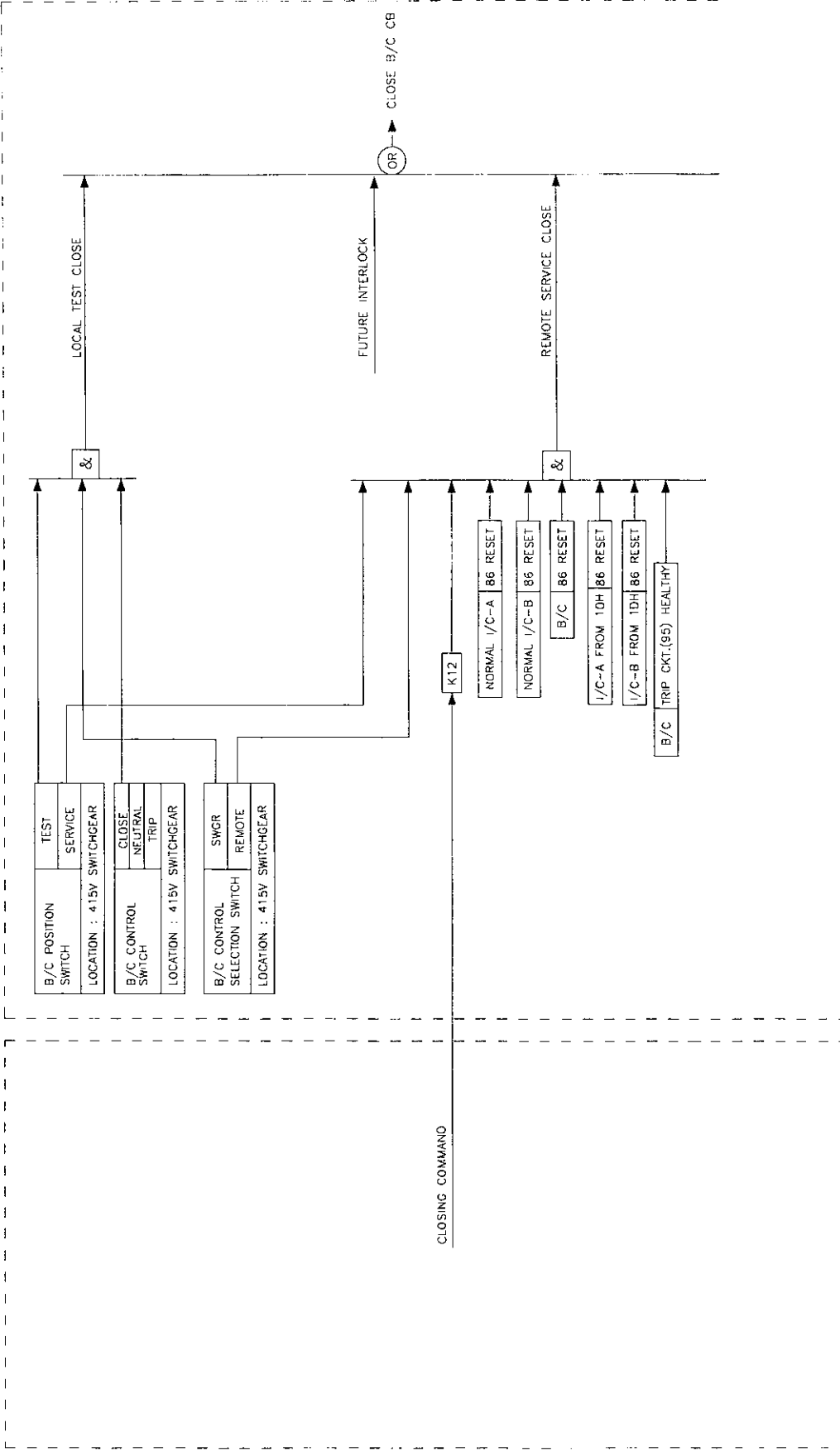
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO.
PE-DG-412-506-E004

EDMS

415V SWITCHGEAR



NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR #2DG

LEGENDS:

OR GATE

AND GATE

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

DRAWING NO.
PE-DG-412-506-E004

TITLE
CONTROL LOGIC FOR 415V MCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

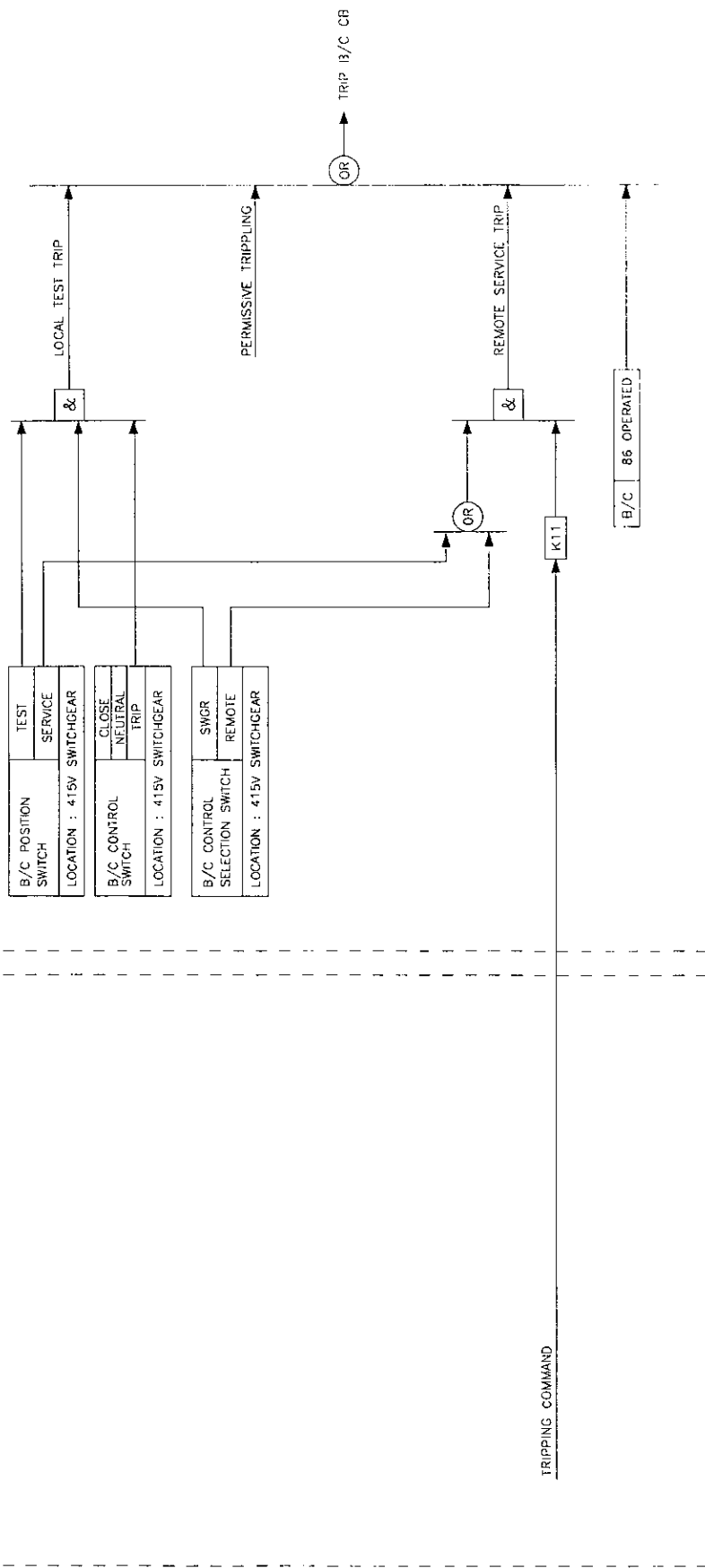
SHEET 17 OF 22 REV. 01

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CUSTOMER'S DRAWING NO.

EDMS

415V SWITCHGEAR



TRIPPING SCHEME FOR BUS COUPLER BF EMERGENCY BOARD #1DG

NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR #2DG

LEGENDS:

OR GATE
& AND GATE



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

TITLE
CONTROL LOGIC FOR 415V FCC/MCC INCDMER
BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO.
PE-DG-412-506-E004
SHEET 18 OF 22
REV. 0

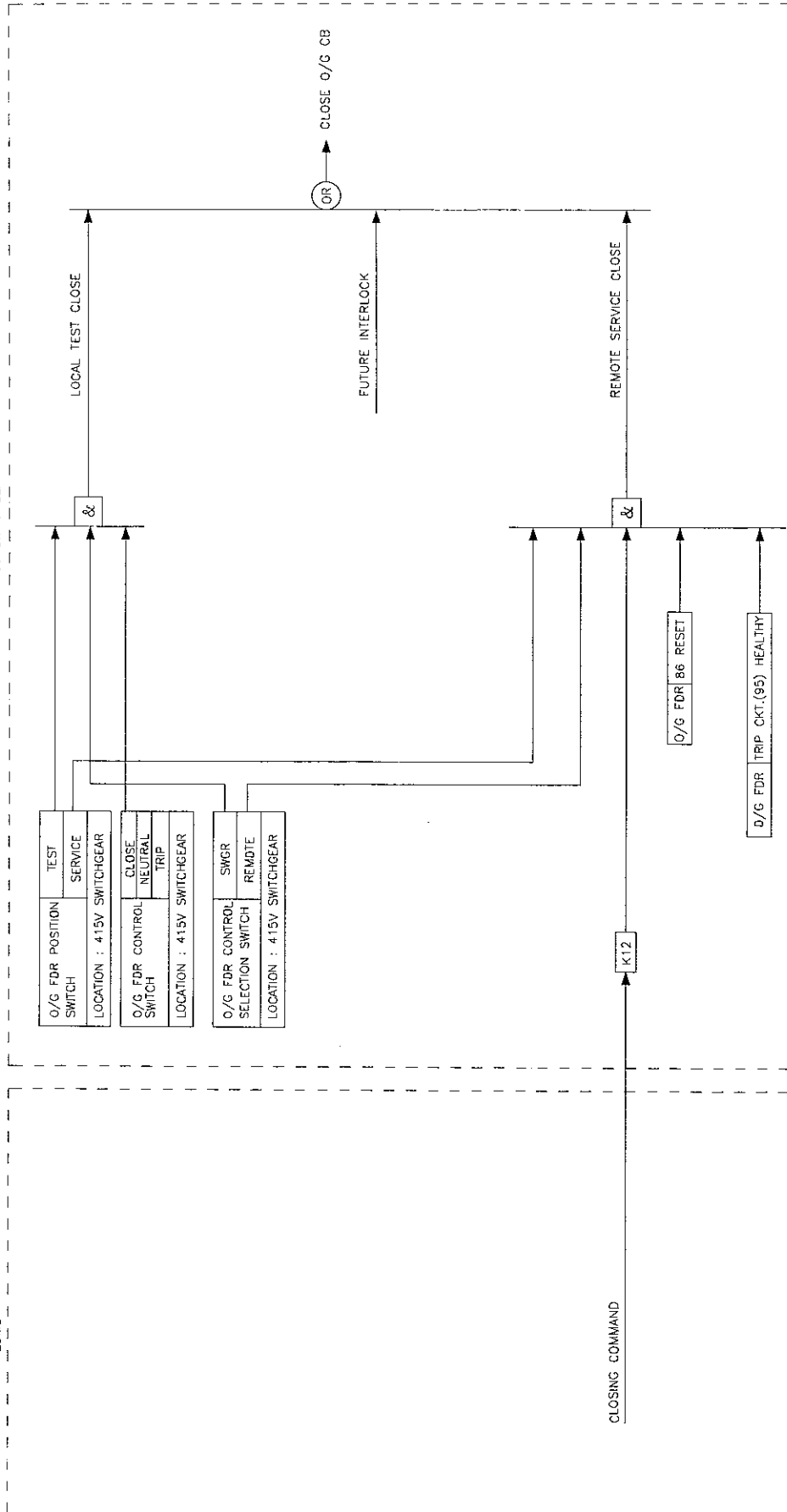
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO.
PE-DG-412-506-E004

EDMS

415V SWITCHGEAR



APPLICABLE SWITCHBOARD

LEGENDS:

OR GATE
& AND GATE

CLOSING SCHEME FOR OUTGOING FEEDER FROM PMCC TO MCC



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

DRAWING NO.

TITLE
CONTROL LOGIC FOR 415V FCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

PE-DG-412-506-E004
SHEET 19 OF 22
REV. 01

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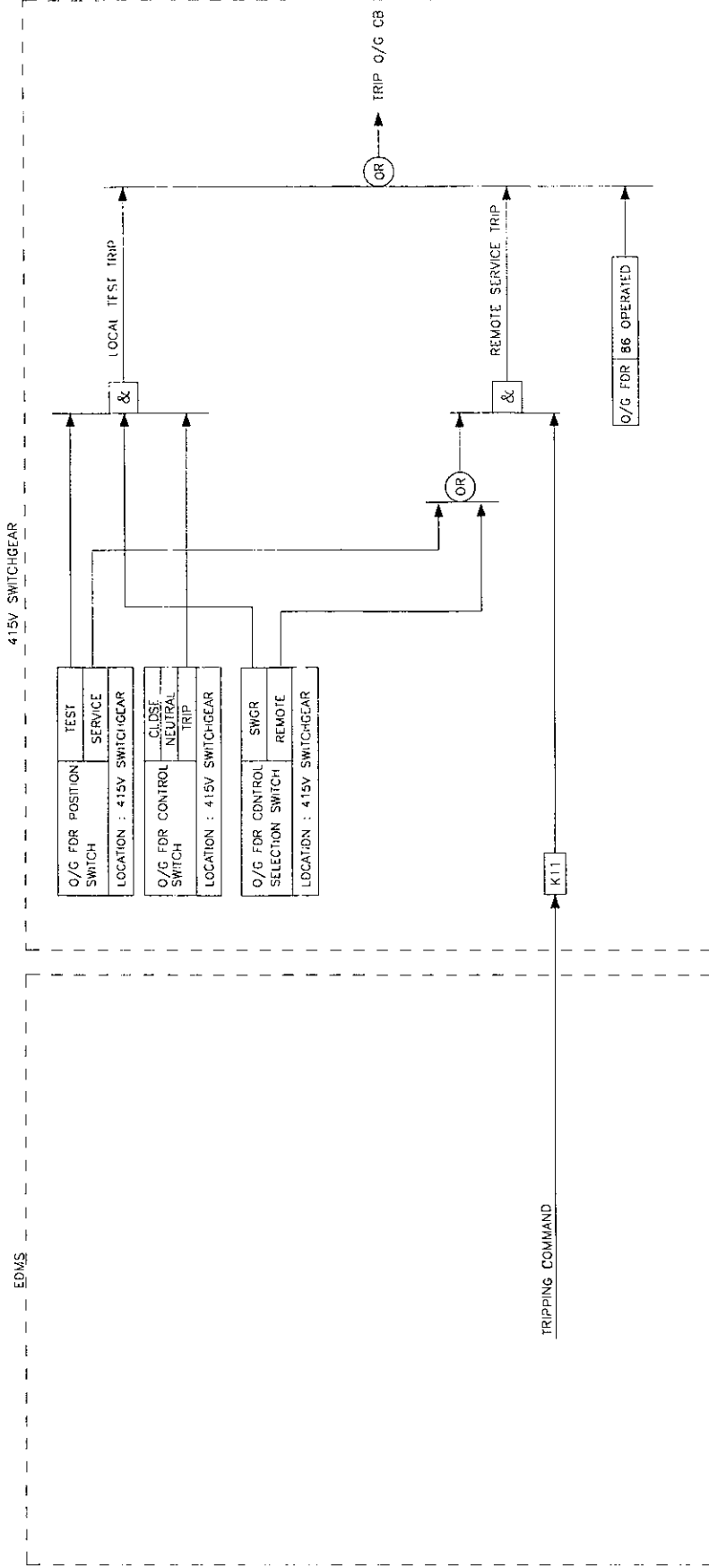
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ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO.
PE-DG-412-506-E004

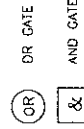
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APPLICABLE SWITCHBOARD

S. NO	DESCRIPTION	BOARD NO.
1	BLR SERV. PMCC	1DA & 2DA
2	TURBINE SERV. PMCC	1DB & 2DB
3	STATION SERV. PMCC	ODA & ODB

LEGENDS:



TRIPPING SCHEME FOR OUTGOING FEEDER FROM PMCC TO MCC

	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT INDIA, INDIA	2X660MW ENNORE, NCTPS (UNIT 1 & 2)
TITLE	CONTROL LOGIC FOR 415V PCC/MCC INCOMER BUSCOUPLER & OUTGOING FEEDERS	DRAWING NO. PE-DG-412-506-E004
		SHEET 20 OF 22 REV. 01

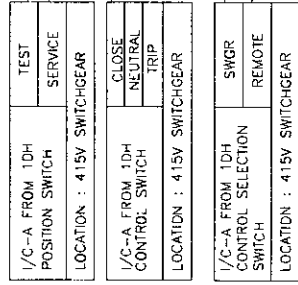
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

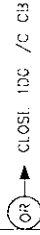
DRAWING NO.
PE-DG-412-506-E004

EDMS

415V SWITCHGEAR



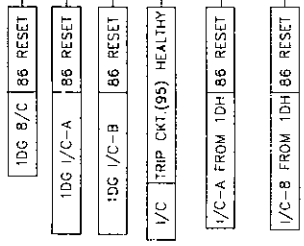
LOCAL TEST CLDSE



FUTURE INTERLOCK

CLOSING COMMAND

K12



REMOTE SERVICE CLOSE

NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR #2DH
2. SIMILAR LOGIC SHALL BE APPLICABLE FOR I/C-B FROM #1DH

LEGENDS:

OR

AND GATE

CLOSING SCHEME FOR EMERGENCY I/C TO EMERGENCY SGWR #1DG FROM DG PCC 1DH



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

TITLE
CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

DRAWING NO.
PE-DG-412-506-E004
SHEET 21 OF 22 REV. 01

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CUSTOMER'S DRAWING NO.

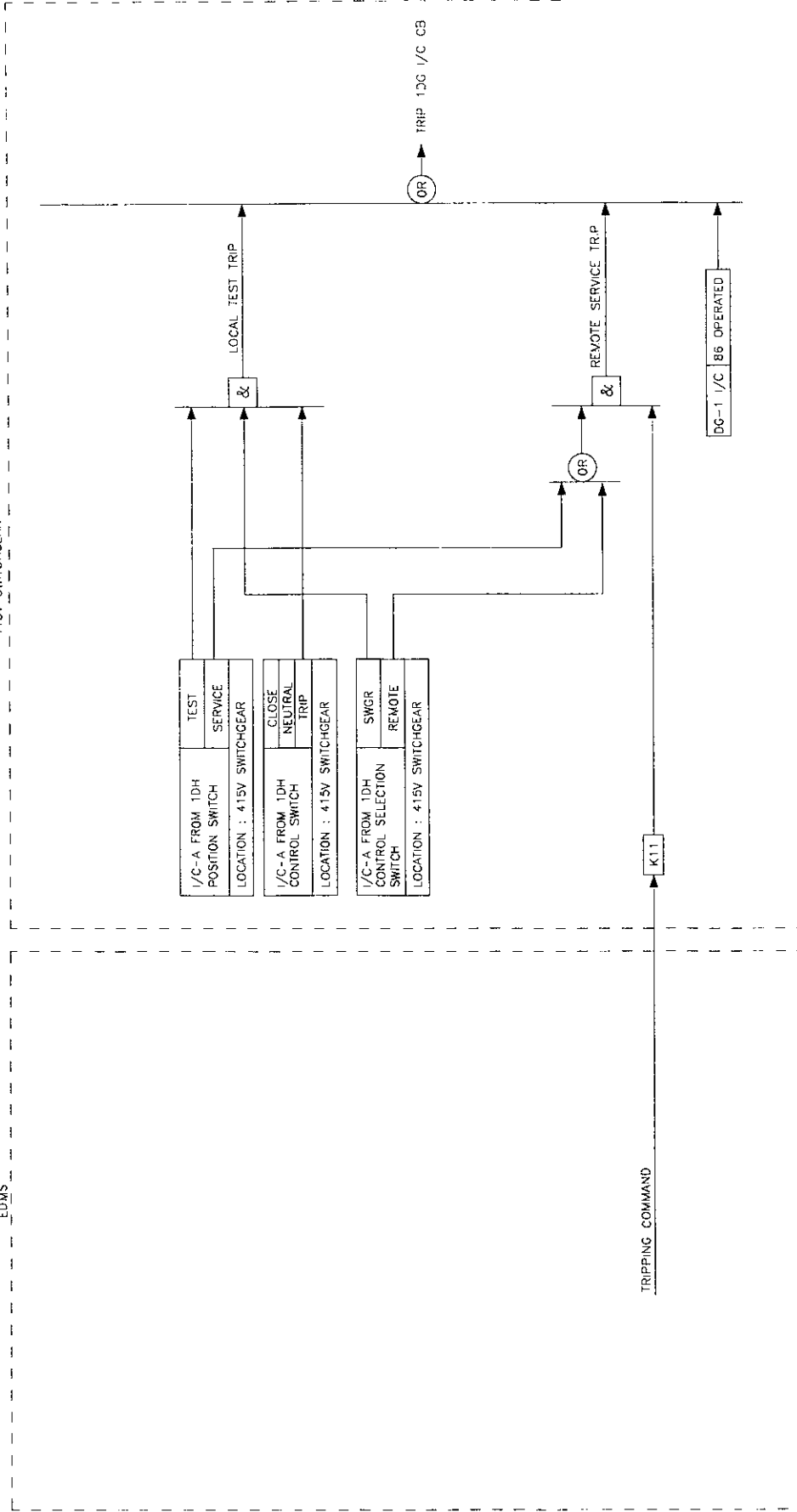
ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

DRAWING NO.
PE-DG-412-506-E004

EDMS

415V SWITCHGEAR



NOTE

1. SIMILAR LOGIC SHALL BE APPLICABLE FOR #2DH
2. SIMILAR LOGIC SHALL BE APPLICABLE FOR I/C-B FROM #1DH

LEGENDS:

(OR) OR GATE

(&) AND GATE



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
INDIA, INDIA

2X660MW ENNORE,
NCTPS (UNIT 1 & 2)

DRAWING NO.

PE-DG-412-506-E004

TITLE
CONTROL LOGIC FOR 415V PCC/MCC INCOMER
BUSCOUPLER & OUTGOING FEEDERS

SHEET

22 OF 22

REV.

01

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CUSTOMER'S DRAWING NO.

DRIVE CONTROL PHILOSOPHY (STATION C&I)

JOB NO.	412					
STATUS	CONTRACT					
PRINT SCALE 						
REV.	DATED	ALTD	CHD	APPD	DH-APP	DP
03	22.06.15	SK	SCS	SCS	SCS	SCS
1.	REMOVED AS PER CUSTOMER'S COMMENTS					
DATED 25.05.15 WIDE LETTER NO. D-66/15						
REV.	DATED	ALTD	CHD	APPD	DH-APP	DP
D2	01.05.15	SK	SCS	SCS	SCS	SCS
1.	REMOVED AS PER CUSTOMER'S COMMENTS					
DATED 11.03.15 WIDE LETTER NO. D-56/15						
REV.	DATED	ALTD	CHD	APPD	DH-APP	DP
D1	12.02.15	AR	SCS	SCS	SCS	SCS
1.	REMOVED AS PER CUSTOMER'S COMMENTS					
DATED 28.01.15 AND BHEL'S REPLY DTD 12.02.15						

PROJECT-		2 X 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI									
OWNER		TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED									
OWNER'S CONSULTANT		DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI									
EPC CONTRACTOR		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOKIDA									
I		DEPT CODE									
NAME		SIGN									
DATE		24.12.14									
24.12.14		24.12.14									
24.12.14		24.12.14									
SCS		SCS									
-sd-		-sd-									
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-sd-		24.12.14									
24.12.14		24.12.14									
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DRIVE CONTROL PHILOSOPHY(STATION C&I)											
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	DOCUMENT TITLE DRIVE CONTROL PHILOSOPHY(STATION C&I)	DOCUMENT NUMBER PE-DM-412-145-1002
PROJECT: 2 X 660 MW ENNORE SEZ STPP	REVISION NUMBER 03	SHEET 2 OF 11
DATE 22.06.2015		

A. DRIVE CONTROL PHILOSOPHY

The control philosophy for different type of Drives is detailed below:

1 Bi-directional drives with Integral Starter(Open/Close duty and inching/regulating duty)

- a) All bi-directional drives shall have integral starter. These drives shall be operable from Remote i.e. from Central Control Room (CCR). Local operation facility is provided for initial testing/commissioning only.
- b) Remote manual operation of all drives shall be done from Operator Works Station (OWS/LVS).
- c) Remote control commands i.e. open/close generated from DDCMIS shall be issued to Integral Starter through interposing relays, mounted in Integral Starter. For open/close duty bi-directional drives, DDCMIS output command shall be latched in DDCMIS, except for inching duty bi-directional drives where latching is not required.
- d) Necessary electrical protections shall be realized at Integral Starter, whereas process interlocks and protection shall be realised in DDCMIS.
- e) Following signal exchange shall take place between Integral Starter & DDCMIS.

- Open & close command
 - Integral Starter Disturbed (Loss of power supply/Loss of control supply/ Motor thermostat trip/ Thermal O/L /Local/off/Remote S/S in Local or Off mode/Stop PB optd/Torque open/close cutoff).
 - Valve status feedback by means of limit switches (open/close).
 - Valve position feedback (4-20mA) for inching duty drives.
- f) The Control & Operation from Backup Control Desk/UCP shall be envisaged for critical Drives.

The above signal exchanges are diagrammatically represented in sheet no. 7.

2 Unidirectional LT Drives (Contactor Operated)

- a. Unidirectional LT drives shall be operable from Remote i.e. from Central Control Room (CCR). Drives shall be provided with Local Emergency Stop Push Button (EPB). Local start operation of the drive can also be done through the start push button provided near the drive when the drive is in local mode.
- b. Remote manual operation of all drives shall be done from OWS/LVS and Local/remote selection of drives shall be done in DDCMIS. Back up remote operation from PB station mounted on UCP is provided for some essential drives for safe shutdown of plant.

	DOCUMENT TITLE DRIVE CONTROL PHILOSOPHY(STATION C&I)	PROJECT: 2 X 660 MW ENNORE SEZ STPP	
DOCUMENT NUMBER PE-DM-412-145-1002	REVISION 03 DATE 22.06.2015	SHEET 3 OF 11	

c. Control commands i.e. start/stop, shall be generated from DDCMIS and shall be issued to MCC through interposing relays located in respective MCC. DDCMIS output command shall be latched in MCC. EPB (stay put type), in MCC supplier's scope, shall be wired directly to MCC to stop the motor irrespective of motor being in remote/local mode. The EPB shall be provided with press to lock and turn to release type, keyless mechanism. Under its locked position, the drive operation shall be inhibited. The local start push button shall be wired to the DDCMIS to ensure interlock/protection requirement.

d. Necessary electrical protections for the drives shall be realised at MCC, whereas process interlocks and protections shall be realised in DDCMIS.

e. Following signal exchange shall take place between MCC & DDCMIS

- i. Drive Start & Stop commands.
- ii. Drive ON & OFF feedback.
- iii. MCC disturbed (Thermal O/L /Control supply fail/ MCC switched off).
- iv. EPB operated

f. Current transducers, 4-20mA types (in MCC suppliers scope), shall be mounted in the MCC for monitoring the current in DDCMIS for all drives ≥ 15 KW and for important drives < 15 KW. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective MCC.

g. The Control & Operation from Backup Control Desk/UCP shall be envisaged for critical Drives.

The above signal exchanges are diagrammatically represented in sheet no. 8.

Solenoid Operated Drives (24V DC/220V DC/240V AC)

a. Solenoid operated drives shall be operable from remote i.e. CCR only.

b. Remote manual operation of all drives shall be done from OWS.

c. Remote control commands i.e. open/close shall be generated from DDCMIS and shall be issued to the respective solenoid through interposing relays located in interposing Relay panels.

d. Necessary process interlocks shall be realized in DDCMIS.

e. Following signal exchange shall take place between solenoid operated drive & DDCMIS

- i. Valve open & close command.

	DOCUMENT TITLE	DOCUMENT PE-DM-412-145-1002
DRIVE CONTROL PHILOSOPHY (STATION C&I)	DOCUMENT REVISION NUMBER	PE-DM-412-145-1002
PROJECT: 2 X 660 MW ENNORE SEZ STPP	SHEET NUMBER	4 OF 11
	REVISION DATE	03 22.06.2015

4 HT/LT Unidirectional Drives (Breaker operated)

The above signal exchanges are diagrammatically represented in sh. no. 9.

- ii. Valve status feedback by means of limit switches (open/close), wherever available or from relay contact of interposing relays if limit switches are not provided.
- iii. For On-OFF type solenoid actuated valves, relay contacts shall be wired as feedback wherever limit switch feedbacks are not available. 1 No. contact for single coil & 2 No. contact for dual coil (open Limit switch & closed limit switch)
- f. BHEL will take care of de-energize to trip philosophy for fail safe control system (wherever required).

- a. Remote manual operation of Breaker operated drives shall be normally from remote i.e. Station DDCMIS in main Control Room through OWS/LVS and Local/remote selection of drives shall also be done in DDCMIS. Back up remote operation from PB station mounted on UCP is provided for some essential drives for safe shutdown of plant.
- b. Remote/Switchgear (SWG) selection shall be realized from SWGR mounted R/S selector switch.
- c. Following are the operational combinations for breaker operated drives:

-SERVICE POSITION – Drive Operation (Start/Stop) shall be from CCR with R/S (Remote/SWG) selector switch in Remote position.

-TEST POSITION – SWGR Testing (Start/Stop) from SWGR.

Switchgear mounted 'Trip/Neutral/Close' switch shall be provided for testing of switchgear when 'R/S' selector switch is selected as 'SWG' and SWGR is in test position.

- d. Remote control commands i.e. start/stop, pulse type, shall be generated from DDCMIS and shall be issued to Switchgear through interposing relays located in respective Switchgear. Further there is Local/remote selection in DDCMIS. Local selection in DDCMIS means, command from local PB, provided near the drive, will be executed through DDCMIS whereas in case of remote mode of selection in DDCMIS, the command from OWS will be processed, not through local PB.

- e. The EPB shall be wired directly to switchgear to stop the motor irrespective of motor being in remote/local mode. The EPB (stay put type), in SWGR supplier's scope, shall be provided with press to lock and turn to release type, keyless mechanism. Under its locked position, the drive operation shall be inhibited. The local start push

	DOCUMENT TITLE DRIVE CONTROL PHILOSOPHY(STATION C&I)	PROJECT:2 X 660 MW ENNORE SEZ STPP
DOCUMENT NUMBER PE-DM-412-145-1002	REVISION NUMBER 03 DATE 22.06.2015	SHEET 5 OF 11

button shall be wired to the DDCMIS to ensure interlock/protection requirement.

f. Necessary electrical protections for the drive shall be realised at Switchgear, whereas process interlocks and protections are realised in DDCMIS.

g. Following signal exchange shall take place between switchgear and DDCMIS:-

- i. Drive Start & Stop commands.
- ii. Drive ON & OFF status feedback.
- iii. Switchgear Disturbed (Control power supply fail/Trip coil Unhealthy/Master trip relay operated).
- iv. Switchgear Available (Breaker in Service & Trip ckt Healthy & Master Trip Relay Reset & Spring Charged).
- v. Master Trip Relay (86 Relay) operated.
- vi. Emergency Stop PB operated.
- vii. Local start Push Button shall be wired to DCS from LPBS near Drive.

h. Current transducers, 4-20mA types (in SWGR suppliers scope), shall be mounted in the SWGR for monitoring the current in DDCMIS. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective switchgear.

i. The Control & Operation from Backup Control Desk/UCP shall be envisaged for critical Drives.

The above signal exchanges are diagrammatically represented in sh. no. 10.

B. ANALOG DRIVE CONTROL PHILOSOPHY

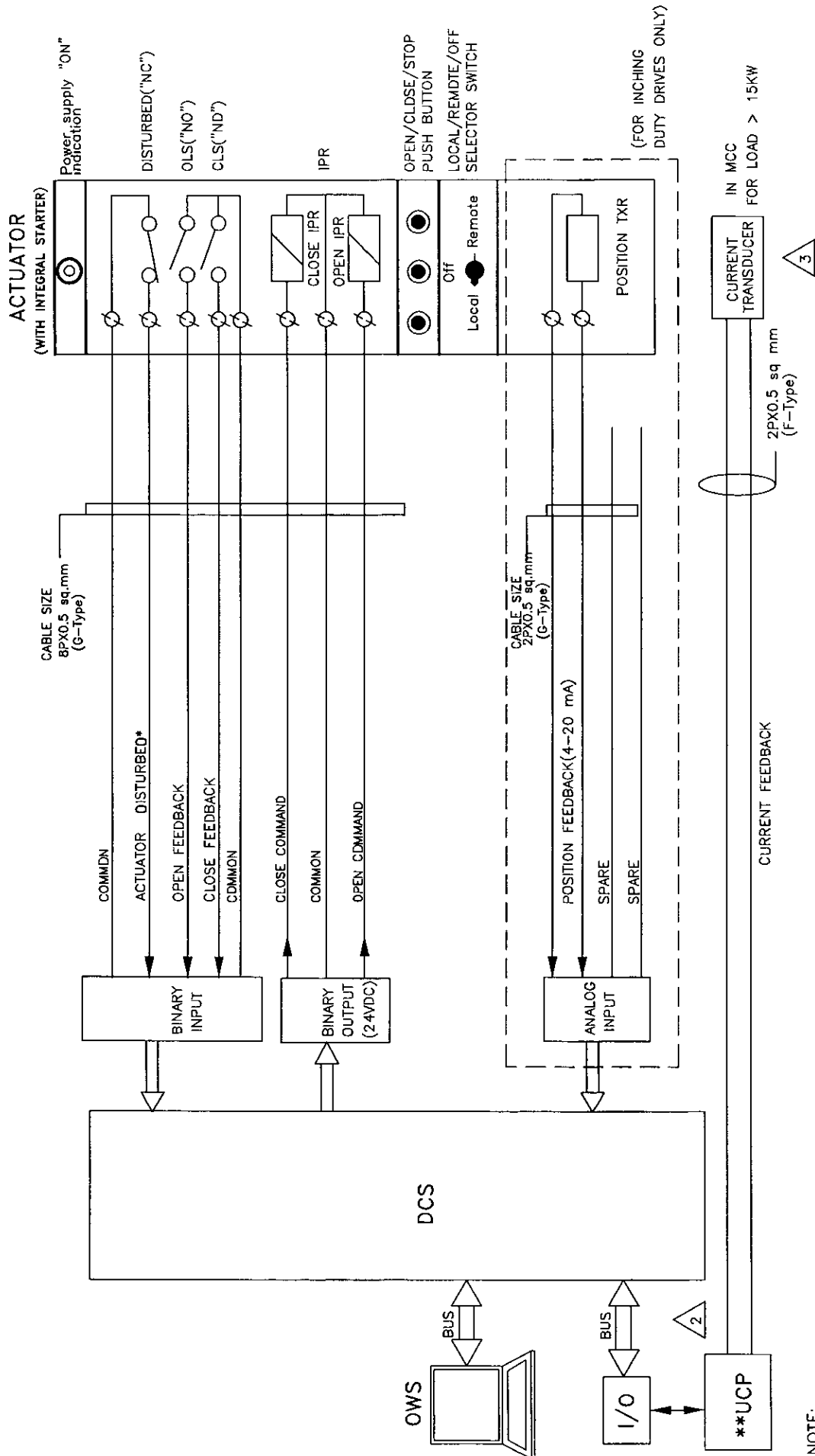
Analog Drives Control

1.1 A drive control function residing in Distributed Processing Units (DPUs) is used to position the pneumatically operated control valves/Dampers through SMART positioner (conventional positioner for Burner Tilt). Interlock and protection Open/Close Commands, originating from field or generated internally in Control Logics (ACS), are interfaced with the drive control function residing in processors.

1.2 Control Valve actuator design shall take care of fail safe condition i.e. bringing valve to full open/full close or stay put mode, on signal (pneumatic/electric) failure.

1.3 Auto/Manual operator control and display for various control loops shall be provided through OWS, using Analog Displays.

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



NOTE:

- * DISTURBED= Loss of Power supply (1 Phase/3 Phase)/ Loss of control supply/ Motor thermostat trip/ Thermal over load/Torque open/close cutoff
- Local/Off/Remote Sel: switch in local or off mode/ Stop PB optd.

** AS APPLICABLE.



PROJECT: 2X660 MW ENNORE SEZ STPP

TITLE DDCMIS INTERFACE FOR BIDIRECTIONAL DRIVE

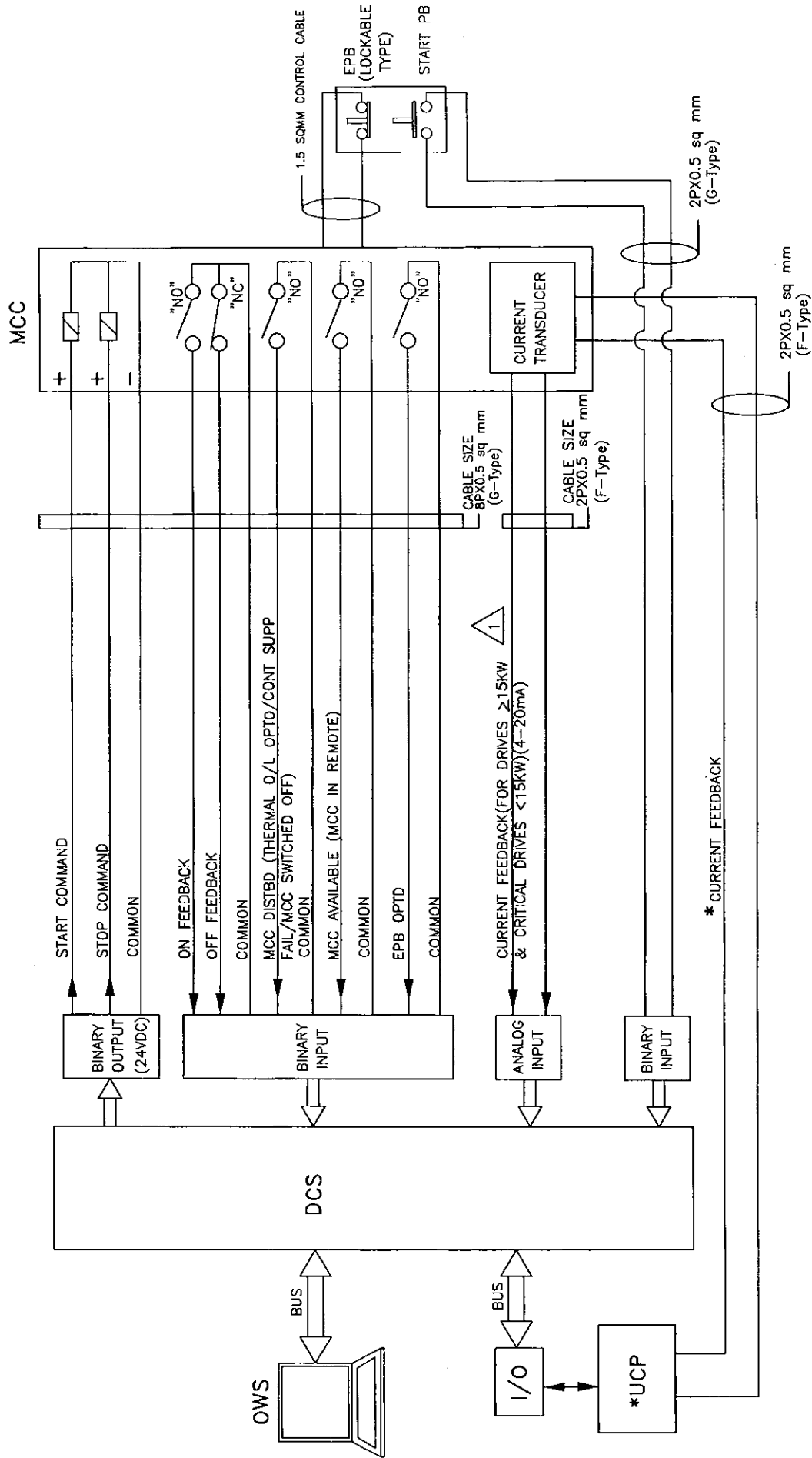
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DATE 22.06.2015

REV.NO. D3

SHT 7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



PROJECT: 2X660 MW ENNORE SEZ STPP

TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE

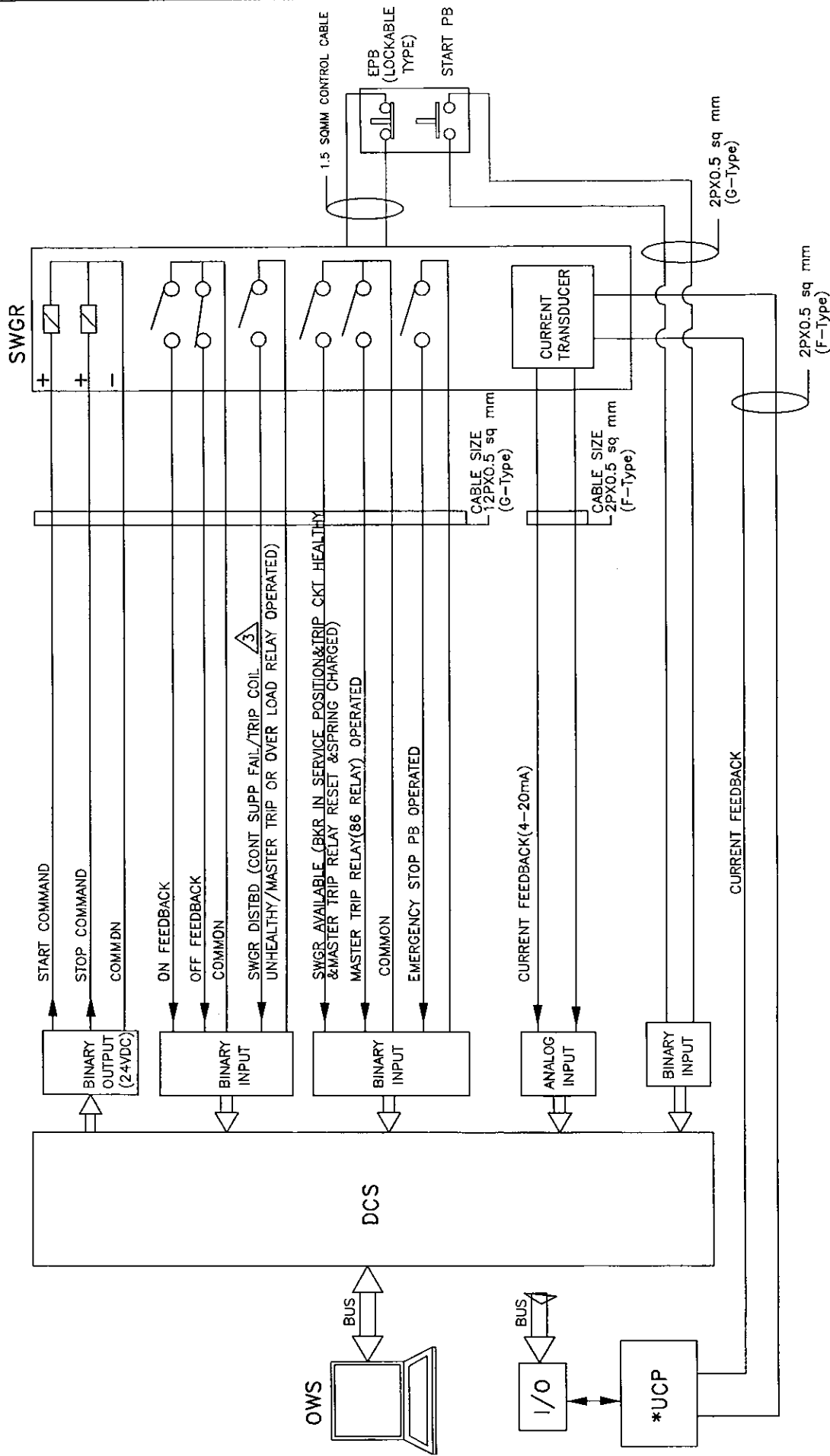
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DATE 22.06.2015

REV.NO. D3

SHT 8 OF 11

DCS INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)



NOTE:

* WHEREVER APPLICABLE

VIBRATION, WINDING & BEARING SIGNALS SHALL BE INTERFACED WITH DDCMIS AND INCLUDED IN EDN'S DOCUMENT.

1 REDUNDANCY OF I/O CARD SHALL BE AS PER SPECIFICATION REQUIREMENTS.



PROJECT: 2X660 MW ENNORE SEZ STPP

TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL HT DRIVE

DRG.NO. PE-DM-412-145-1002

DATE 22.06.2015

REV.NO. D3

SHT 10 OF 11

2X650 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
ANNEXURE-A

**LIST OF LT BAORDS FOR 2X660MW ENNORE SEZ COAL BASED STPP AT ASH DYKE
OF NCTPS, CHENNAI**

Sl. No.	Boards	Rating	UNIT	Qty
UNIT-1				
1	DG PCC #1DH	3000A	EA	1
2	UNIT EMERGENCY MCC #1DG	3000A	EA	1
3	BOILER SERVICE PMCC #1DA	3200A	EA	1
4	BLR VALVE & DAMPER ACDB #1HA	250A	EA	1
5	BOILER ACDB #1HB	400A	EA	1
6	STATION SERVICES PMCC #0DA	4000A	EA	1
7	AIR WASHER MCC #1SA	630A	EA	1
8	VENTILATION MCC #1TA	1000A	EA	1
9	MISC SERVICES MCC #0QA	630A	EA	1
10	CCR AIR CDNDITIONING MCC #0TA	1600A	EA	1
11	TURBINE SERVICE PMCC #0DP	2500A	EA	1
12	SERVICE ACDB #1QA	630A	EA	1
13	TURBINE VALVE DB #1RA	250A	EA	1
14	220V Main DCDB #1FA	1250A	EA	1
15	ESP & ID FAN AREA MCC #1HC	400A	EA	1
16	ESP A/C & VENT MCC #1TB	400A	EA	1
UNIT-2				
1	DG PCC #2DH	3000A	EA	1
2	UNIT EMERGENCY MCC #2DG	3000A	EA	1
3	BOILER SERVICE PMCC #2DA	3200A	EA	1
4	BLR VALVE & DAMPER ACDB #2HA	250A	EA	1
5	BOILER ACDB #2HB	400A	EA	1
6	STATION SERVICE PMCC #0DB	4000A	EA	1
7	AIR WASHER MCC #2SA	630A	EA	1
8	VENTILATION MCC #2TA	1000A	EA	1
9	MISC SERVICES MCC #0QB	630A	EA	1
10	SERVICE BUILDING AC & VENT. MCC #0TB	1000A	EA	1
11	TURBINE SERVICE PMCC #2DB	2500A	EA	1
12	SERVICE ACDB #2QA	630A	EA	1
13	TURBINE VALVE DB #2RA	250A	EA	1
14	220V Main DCDB #2FA	1250A	EA	1
15	ESP & ID FAN AREA MCC #2HC	400A	EA	1
16	ESP A/C & VENT MCC #2TB	400A	EA	1
COMMON FDR UNIT-1&2				
1	RD-DM PMCC #0DH	2500A	EA	1
2	SEA WATER INTAKE PMCC #0DF	1000A	EA	1
3	FUEL OIL P/H PMCC #0DC	2000A	EA	1
4	AUXILIARY BOILER MCC #0HA	400A	EA	1
5	FW/WATER SYSTEM PMCC #0DD	3200A	EA	1
6	GPU MCC #0WA	400A	EA	1
7	WORKSHOP ACDB #0SA	400A	EA	1
8	CANTEEN ACDB #0SH	250A	EA	1
9	HP/HPW PMCC #0DI	1600A	EA	1
10	SD PMCC #0WC	250A	EA	1
11	HYDROGEN GENERATION MCC #0SC	400A	EA	1
12	ADMIN BLDG PMCC #0DG	1600A	EA	1
13	CW/ELECTROCHLDINATION PMCC #0DE	4000A	EA	1
14	220V DC DB (WALL MDUNTED)		EA	18
15	415V AC MCCB DB (WALL MDUNTED)		EA	18

BOARDWISE BILL OF MATERIAL ANNEXURE-A

Name of the Board: DG PCC #1DH-2DH		
TYPE OF CONNECTION: BOTTOM CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
3200A	DAEG(I/C)	2
3200A	DAE(O/G)	2
1600A	DAE(O/G)	1
250A	E	3
400A	E	3
	G2	1
3200A	ACB I/C PANELS	
3200/3200A	ACB O/G PANELS	
3200/1600A	ACB O/G PANELS	
3200/630A	MCC DFDO	
3200A	DUMMY PANEL 500MM	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: UNIT EMERGENCY MCC #1DG-2DG		
TYPE OF CONNECTION: BOTTOM CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
3000A	DAE(I/C)	2
3000A	DAE-TIE	2
3000A	DAE(B/C)	1
UPTO 5.5KW	DK2	5
7.1-14.9KW	DK2	3
30.1-37.0KW	DK21	4
UPTO 5.5KW	DK2E	32
7.1-14.9KW	DK2E	10
15-22.0KW	DK21E	20
30.1-37.0KW	DK21E	4
55.1-75KW	DK21E	4
75.1-90KW	DK21E	4
90.1KW-150KW	DM	6
UP TO 32A	E3	30
63A	E3	20
100-160A	E3	18
200-250A	E3	5
400A	E3	8
	G1	2
1KVA	CS	2
3200A	ACB I/C PANELS	
3200A	ACB B/C PANEL	
3200A	ACB TIE PANELS	
3200A/630	ACB O/G PANELS	
3200/630A	MCC (DFDO)	
3200A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: BOILER SERVICE PMCC #1DA-2DA		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
3200A	DAET(I/C)	2
3000A	DAE-O/G	2
3200A	DAE(B/C)	1
UPTO 5.5KW	DK2	26
7.1-14.9KW	DK2	7
15-22KW	DK21	10
37.1-55.0KW	DK21	7
55.1-75.0KW	DK21	4
75.1-90KW	DK21	8
UPTO 5.5KW	DK2E	40
7.1-14.9KW	DK2E	7
15-22KW	DK21E	8
30.1-37.0KW	DK21E	4
37.1-55.0KW	DK21E	7
75.1-90KW	DK21E	4
90.1KW-150KW	DM	5
UPTO 5.5KW	EA3	15
UP TO 32A	E3	10
63A	E3	5
100-160A	E3	9
200-250A	E3	6
400A	E3	6
	G1	2
1KVA	CS	2
3200A	ACB I/C PANELS	
3200A	ACB B/C PANEL	
3200A	ACB O/G PANELS	
3200A/630	ACB O/G PANELS	
3200/630A	MCC (DFDO)	
3200A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: BLR VALVE & DAMPER ACDB #1HA-2HA		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE DOUBLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
250A	CC	2
UP TO 32A	E3	225
63A	E3	30
100-160A	E3	4
	VM	1
250/250A	MCC (DF FIXED TYPE)	
250A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: BOILER ACDB #1HB-2HB		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE DOUBLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
UP TO 32A	E3	30
63A	E3	40
100-160A	E3	12
UP TO 32A	E1	40
	VM	1
250/250A	MCC (DF FIXED TYPE)	
250A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: STATION SERVICES PMCC #0DA-0DB		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
4000A	DAET(I/C)	2
4000A	DAE(B/C)	1
1000A	DAE-O/G	3
1600A	DAE-O/G	2
630A	DAE-O/G	4
30.1-37.0KW	DK21	3
75.1-90KW	DK21	3
90.1KW-150KW	DM	3
100-160A	E3	3
200-250A	E3	12
400A	E3	6
	G1	2
1KVA	CS	2
4000A	ACB I/C PANELS	
4000A	ACB B/C PANEL	
4000A/1600A	ACB O/G PANELS	
4000A/1000A	ACB O/G PANELS	
4000A/630A	ACB O/G PANELS	
4000/630A	MCC (DFDO)	
4000A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: AIR WASHER MCC #1SA-2SA		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
630A	DAE(I/C)	2
630A	DAE(B/C)	1
UPTO 5.5KW	DK2	5
15-22KW	DK21	8
22.1-30.0KW	DK21	8
30.1-37.0KW	DK21	4
UP TO 32A	E3	20
63A	E3	5
100-160A	E3	4
	G1	2
1KVA	CS	2
630A	ACB I/C PANELS	
630A	ACB B/C PANEL	
6300/630A	MCC (DFDO)	
6300A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: VENTILATION MCC #1TA-2TA		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1000A	DAE(I/C)	2
1000A	DAE(B/C)	1
UPTO 5.5KW	DK2	50
15-22KW	DK21	5
22.1-30.0KW	DK21	4
75.1-90KW	DK21	4
UP TO 32A	E3	90
63A	E3	5
	G1	2
1KVA	CS	2
1000A	ACB I/C PANELS	
1000A	ACB B/C PANEL	
1000/630A	MCC (DFDO)	
1000A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: MISC SERVICES MCC #0QA-0QB		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
630A	DAE(I/C)	2
630A	DAE(B/C)	1
UPTO 5.5KW	DK2	10
7.1-14.9KW	DK2	5
15-22KW	DK21	5
UP TO 32A	E3	40
63A	E3	10
100-160A	E3	20
UP TO 32A	E1	50
63A	E1	10
	G1	2
1KVA	CS	2
630A	ACB I/C PANELS	
630A	ACB B/C PANEL	
630/630A	MCC (DFDO)	
630A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: CCR AIR CONDITIONING MCC #0TA		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1600A	DAE(I/C)	4
1600A	DAE(B/C)	2
UPTO 5.5KW	DK2	16
7.1-14.9KW	DK2	6
15-22KW	DK21	12
22.1-30KW	DK21	6
30.1-37.0KW	DK21	3
UPTO 5.5KW	EA3	20
7.1-15KW	EA3	8
22.1-30KW	EA3	6
30.1-37KW	EA3	8
UP TO 32A	E3	35
63A	E3	15
100-160A	E3	6
200-250A	E3	2
400A	E3	4
UP TO 32A	E1	10
	G1	2
1KVA	CS	2
1600A	ACB I/C PANELS	
1600A	ACB B/C PANEL	
1600/630A	MCC (DFDO)	
1600A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: SERVICE BUILDING AC & VENT. MCC #0TB		
TYPE OF CONNECTION: CABLE ENTRY		
DDUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1000A	DAE(I/C)	2
1000A	DAE(B/C)	1
UPTO 5.5KW	DK2	8
7.1-14.9KW	DK2	6
15-22KW	DK21	4
22.1-30KW	DK21	6
30.1-37.0KW	DK21	3
UPTO 5.5KW	EA3	14
7.1-15.0KW	EA3	8
22.1-30KW	EA3	6
30.1-37KW	EA3	8
UP TO 32A	E3	25
63A	E3	8
100-160A	E3	6
400A	E3	4
UP TO 32A	E1	10
	G1	2
1KVA	CS	2
1000A	ACB I/C PANELS	
1000A	ACB B/C PANEL	
1000/630A	MCC (DFDO)	
1000A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical-Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: TURBINE SERVICE PMCC #1DB-2DB		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
2500A	DAET(I/C)	2
2500A	DAE(B/C)	1
630A	DAE-O/G	3
UPTO 5.5KW	DK2	25
7.1-14.9KW	DK2	6
15-22KW	DK21	10
30.1-37.0KW	DK21	4
55.1-75.0KW	DK21	4
90.1KW-150KW	DM	3
30.1-37.0KW	EA3	4
100-160A	E3	4
200-250A	E3	8
400A	E3	5
	G1	2
1KVA	CS	2
2500A	ACB I/C PANELS	
2500A	ACB B/C PANEL	
2500/630A	ACB O/G PANELS	
2500/630A	MCC (DFDO)	
2500A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: SERVICE ACDB #1QA-2QA		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE DOUBLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
630A	DAE(I/C)	2
630A	DAE(B/C)	1
UP TO 32A	E3	30
63A	E3	25
UP TO 32A	E1	50
	G1	2
630A	ACB I/C PANELS	
630A	ACB B/C PANEL	
630/630A	MCC (DF FIXED TYPE)	
630A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: TURBINE VALVE DB #1KA-2KA		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE DOUBLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
250A	CC	2
UP TO 32A	E3	300
63A	E3	20
100-160A	E3	25
	VM	1
250/250A	MCC (DF FIXED TYPE)	
250A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: 220V Main DCDB #1FA-2FA		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE SINGLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1250A	DB+DC+CH+HD	1
UP TO 16A	X1	65
32A	X1	30
63A	X1	50
100-160A	X1	8
250-250A	X2	8
400A	X2	5
	S	2
1250A	ACB I/C PANELS	
1250A	ACB B/C PANELS	
1250/630A	MCC (DF FIXED TYPE)	
1250A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: ESP & ID FAN AREA MCC #1HC-2HC		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
UPTO 5.5KW	DK2	10
7.1-14.9KW	DK2	4
15-22KW	DK21	4
UPTO 5.5KW	EA3	8
UP TO 32A	E3	20
63A	E3	15
	VM	1
1KVA	CS	1
400/400A	MCC (DFDO)	
400A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: ESP A/C & VENT MCC #1TB-2TB		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
UPTO 5.5KW	DK2	6
7.1-14.9KW	DK2	3
15-22KW	DK21	3
UPTO 5.5KW	EA3	6
7.1-15.0KW	EA3	6
UP TO 32A	E3	25
63A	E3	7
100-160A	E3	10
UP TO 32A	E1	5
	VM	1
1KVA	CS	1
400/400A	MCC (DFDO)	
400A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: RO-DM PMCC #0DH		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
2500A	DAET(I/C)	2
2500A	DAE(B/C)	1
630A	DAE-O/G	2
UPTO 5.5KW	DK2	80
7.1-14.9KW	DK2	12
15-22KW	DK21	16
30.1-37.0KW	DK21	18
55.1-75.0KW	DK21	4
75.1-90KW	DK21	4
90.1KW-150KW	DM	6
UPTO 5.5KW	EA3	16
30.1-37.0KW	EA3	14
UP TO 32A	E3	10
63A	E3	5
100-160A	E3	2
200-250A	E3	2
	G1	2
1KVA	CS	2
2500A	ACB I/C PANELS	2
2500A	ACB B/C PANEL	2
2500/630A	ACB O/G PANELS (2 TIER)	4
2500/630A	MCC (DFDO)	18
2500A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: SEA WATER INTAKE PMCC #0DF		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1000A	DAET(I/C)	2
1000A	DAE(B/C)	1
630A	DAE-O/G	2
UPTO 5.5KW	DK2	12
7.1-14.9KW	DK2	6
15-22KW	DK21	6
30.1-37.0KW	DK21	4
55.1-75.0KW	DK21	3
90.1KW-150KW	DM	3
UP TO 32A	E3	16
63A	E3	10
200-250A	E3	8
400A	E3	2
	G1	2
1KVA	CS	2
1000A	ACB I/C PANELS	
1000A	ACB B/C PANEL	
1000/630A	ACB O/G PANELS	
1000/630A	MCC (DFDO)	
1000A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: FUEL OIL P/H PMCC #0DC		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
2000A	DAET(I/C)	2
2000A	DAE(B/C)	1
630A	DAE-O/G	2
UPTO 5.5KW	DK2	15
7.1-14.9KW	DK2	9
15-22KW	DK21	6
90.1KW-150KW	DM	5
UP TO 32A	E3	30
63A	E3	10
100-160A	E3	10
200-250A	E3	2
400A	E3	4
	G1	2
1KVA	CS	2
2000A	ACB I/C PANELS	
2000A	ACB B/C PANEL	
2000/630A	ACB O/G PANELS	
2000/630A	MCC (DFDO)	
2000A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: AUXILIARY BOILER MCC #0HA		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
7.1-14.9KW	DK2	10
15-22KW	DK21	5
UP TO 32A	E3	25
63A	E3	10
100-160A	E3	5
UP TO 32A	E1	15
	VM	1
1KVA	CS	1
400/400A	MCC (DFDO)	
400A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: FW/WATER SYSTEM PMCC #0DD		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
3200A	DAET(I/C)	2
3200A	DAE(B/C)	1
UPTO 5.5KW	DK2	10
7.1-14.9KW	DK2	8
15-22KW	DK21	8
30.1-37.0KW	DK21	14
55.1-75.0KW	DK21	10
90.1KW-150KW	DM	3
UPTO 5.5KW	EA3	5
7.1-15.0KW	EA3	5
UP TO 32A	E3	30
63A	E3	15
100-160A	E3	10
200-250A	E3	4
400A	E3	6
	G1	1
1KVA	CS	1
3200A	ACB I/C PANELS	
3200A	ACB B/C PANEL	
3200/630A	ACB O/G PANELS	
3200/630A	MCC (DFDO)	
3200A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: CPU MCC #0WA		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
UPTO 5.5KW	DK2	24
7.1-14.9KW	DK2	5
15-22KW	DK21	12
UPTO 5.5KW	EA3	3
30.1-37.0KW	EA3	2
55.1-75.0KW	EA3	4
UP TO 32A	E3	15
63A	E3	8
200-250A	E3	3
UP TO 32A	E1	10
	VM	1
1KVA	CS	1
400/400A	MCC (DFDO)	
3200A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: WORKSHOP ACDB #0SA		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE DOUBLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
UP TO 32A	E3	75
63A	E3	10
100-160A	E3	5
200-250A	E3	4
400A	E3	4
UP TO 32A	E1	20
	VM	1
400/400A	MCC (DF FIXED TYPE)	
400A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: CANTEEN ACDB #0SB		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE DOUBLE FRONT		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
250A	CC	2
UP TO 32A	E3	40
63A	E3	20
100-160A	E3	5
200-250A	E3	6
400A	E3	6
UP TO 32A	E1	20
	VM	1
250/250A	MCC (DF FIXED TYPE)	
250A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: ETP/PTP PMCC #0DJ		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1600A	DAET(I/C)	2
1600A	DAE(B/C)	1
UPTO 5.5KW	DK2	50
7.1-14.9KW	DK2	15
15-22KW	DK21	25
30.1-37.0KW	DK21	4
75.1-90KW	DK21	3
UP TO 32A	E3	40
63A	E3	15
100-160A	E3	6
200-250A	E3	4
400A	E3	2
	G1	2
1KVA	CS	2
1600A	ACB I/C PANELS	
1600A	ACB B/C PANEL	
1600/630A	MCC (DFDO)	
1600A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: STP MCC #0WC		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
250A	CC	2
UPTO 5.5KW	DK2	25
7.1-14.9KW	DK2	15
15-22KW	DK21	5
UP TO 32A	E3	30
63A	E3	15
100-160A	E3	4
	VM	1
1KVA	CS	1
250/250A	MCC (DFDO)	
250A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: HYDROGEN GENERATION MCC #0SC		
TYPE OF CONNECTION: CABLE ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
400A	CC	2
UPTO 5.5KW	DK2	15
7.1-14.9KW	DK2	6
15-22KW	DK21	2
UP TO 32A	E3	25
63A	E3	10
100-160A	E3	2
	VM	1
1KVA	CS	1
400/400A	MCC (DFDO)	
400A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: ADMIN BLDG PMCC #0DG		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
1600A	DAET(I/C)	2
1600A	DAE(B/C)	1
UPTO 5.5KW	DK2	18
7.1-14.9KW	DK2	4
15-22KW	DK21	4
UPTO 5.5KW	EA3	4
7.1-15.0KW	EA3	25
UP TO 32A	E3	40
63A	E3	15
100-160A	E3	5
200-250A	E3	4
400A	E3	4
	G1	2
1KVA	CS	2
1600A	ACB I/C PANELS	
1600A	ACB B/C PANEL	
1600/630A	MCC (DFDO)	
1600A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: CW/ELECTROCHLORINATION PMCC #0DE		
TYPE OF CONNECTION: BUSUDCT ENTRY		
DOUBLE FRONT D/O TYPE		
FLOOR MOUNTED		
RATING	MODULE TYPE	ACTUAL
4000A	DAET(I/C)	2
4000A	DAE(B/C)	1
UPTO 5.5KW	DK2	40
7.1-14.9KW	DK2	7
15-22KW	DK21	3
30.1-37.0KW	DK21	6
37.1-55.0KW	DK21	12
90.1KW-150KW	DM	4
UPTO 5.5KW	EA3	6
7.1-15.0KW	EA3	10
UP TO 32A	E3	50
63A	E3	10
100-160A	E3	4
200-250A	E3	6
400A	E3	4
UP TO 32A	E1	15
	G1	2
1KVA	CS	2
4000A	ACB I/C PANELS	
4000A	ACB B/C PANEL	
4000/630A	ACB O/G PANEL	
4000/630A	MCC (DFDO)	
4000A	500mm DUMMY PANEL	1

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: 415V AC MCCB DB		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE SINGLE FRONT		
WALL MOUNTED		
RATING	MODULE TYPE	ACTUAL
63A	H3	1
16A	H1	6
32A	H1	6

**2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke
of NCTPS**

**BOARDWISE BILL OF MATERIAL
ANNEXURE-A**

Name of the Board: 220V DC DB		
TYPE OF CONNECTION: CABLE ENTRY		
FIXED TYPE SINGLE FRONT		
WALL MOUNTED		
RATING	MODULE TYPE	ACTUAL
63A	H2	1
16A	X1	6
32A	X1	6

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL

ANNEXURE-B

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/D TYPE, WITHOUT RELEASES, CONTRDL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTRDL MCB 6A	7
		CONTRDL MCB 16A	4
		MPCB 16A	1
		INDICATING LAMP	11
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	3
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-SP20	3
		CURRENT TRANSFORMER (PRDTECTION) with VDR 10VA, CL-P5	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	3
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTIDN METER	1
		AUXILIARY CONTACTDR 2NO+2NC, CV 220DC	5
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-DISCONNECTING TYPE	As required
		POWER TERMINAL	As required
		DDUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		BREAKER CONTROL SWITCH-16A 220V DC	1
		2POLE 2POS(LLOCAL REMDTE) SELECTOR SWITCH KEY -10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHDRT CIRCUIT PROTECTION (51) • EARTH FAULT PRDTECTIDN (51N) • DYER LOAD PRDTERCTIDN • RESTRICTED EARTRH FAULT PROTECTION • RESIOUAL EARTH FAULT PROTECTIDN • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRDNZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMNET, MINIMUM 10 O/P • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FDR BINARY INPUT SHALL BE 18V DC (+/- 5%). RELAY SPECIFICATION SHALL BE READ INCONJUNCTION WITH TENDER SPECIFICATION.	0
		HAND RESET LOCKOUT RELAY	1
		BREAKER CONTACT MULTIPLICATION LATCH RELAY	1
		INTERPDSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNDB & FREEWHEELING DIODE	2
2	DAE (I/C)	MCC INCDMER OF 400A, 630A, 800A, 1000A, 1250A, 1600A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CDNTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL MCB 6A	7
		CONTROL MCB 16A	4

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		MPCB 16A	1
		INDICATING LAMP	11
		CURRENT TRANSFORMER (METERING) 10VA,CL-1	3
		CURRENT TRANSFORMER (PROTECTION) 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	3
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTION METER	1
		AUXILIARY CONTACTOR 2NO+2NC, CV 220DC	5
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-DISCONNECTING TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V AC	1
		BREAKER CONTROL SWITCH-16A 220V DC	1
		2POLE 2POS(LDCAI/REMDTE) SELECTOR SWITCH KEY-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, MINIMUM 10 DI/P • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%). RELAY SPECIFICATION SHALL BE READ IN CONJUNCTION WITH TENDER SPECIFICATION.	0
		HAND RESET LOCKOUT RELAY	1
		BREAKER CONTACT MULTIPLICATION LATCH RELAY	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
3	DAET/DAE (B/C)	PMCC/MCC BUSCOUPLER OF 400A, 630A, 800A, 1000A, 1250A, 1600A, 2500A, 3000A, 3200A, 4000A SHALL	
		ACB TP, ELECTRICALLY OPERATED D/D 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 MCB 6A	7
		CONTROL MCB 16A	4
		INDICATING LAMP	8
		CURRENT TRANSFORMER (METERING) 10VA,CL-1	3
		CURRENT TRANSFORMER (PROTECTION) 10VA,CL-5P20	3
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTION METER	1
		AUXILIARY CONTACTOR 2NO+2NC, CV 220DC	5

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-DISCONNECTING TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		BREAKER CONTROL SWITCH-16A 220V DC	1
		2POLE 2POS1 (LOCAL/REMOTE) SELECTOR SWITCH KEY -10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (S1) • EARTH FAULT PROTECTION (S1N) • OVER LOAD PROTECTION • RESTRICTED EARTH FAULT PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (9S) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of O/I/OO SHALL BE AS PER SCHEME REQUIREMENT, MINIMUM 10 O/P • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%). RELAY SPECIFICATION SHALL BE READ IN CONJUNCTION WITH TENDER SPECIFICATION.	0
		HAND RESET LOCKOUT RELAY	1
		BREAKER CONTACT MULTIPLICATION LATCH RELAY	1
		INTERPOSING RELAY REM30Z/EQVT, WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		DC SOURCE SELECTION SWITCH	1
		DIODE MODULE FOR DC CHANGEDOVER	1
4	DAEG(-I/C)	EMERGENCY MCC INCOMER OF 800A, 1000A, 1250A, 1600A, 2000A, 2500A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED O/O TYPE, WITH DUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. 5SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 1NC contacts.	1
		CONTROL MCB 6A	7
		CONTROL MCB 16A	4
		MPCB 16A	1
		INDICATING LAMP	11
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	3
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-SP20	3
		CURRENT TRANSFORMER (PROTECTION) with VDR 10VA, CL-P5	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	3
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTION METER	1
		AUXILIARY CONTACTOR 2NO+2NC, CV 220DC	5
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-DISCONNECTING TYPE	As required

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		BREAKER CONTROL SWITCH-16A 220V DC	1
		2POLE 2POS(LOCAL REMOTE) SELECTOR SWITCH KEY -1DA, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-6185D FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (S1) • EARTH FAULT PROTECTION (S1N) • OVER LOAD PROTECTION • RESTRICTED EARTH 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 REQUIREMENT, MINIMUM 10 O/P • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%). RELAY SPECIFICATION SHALL BE READ IN CONJUNCTION WITH TENDER SPECIFICATION.	0
		HAND RESET LOCKOUT RELAY	1
		BREAKER CONTACT MULTIPLICATION LATCH RELAY	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LEO, TEST KNOB & FREEWHEELING DIODE	2
5	DAE/DAE-TIE (D/G)	OUTGOING BREAKER FEEDER OF 630A, 800A, 1000A, 1250A, 1600A, 2500A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED O/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NC + 2NC contacts.	1
		CONTROL MCB 6A	7
		CONTROL MCB 16A	4
		INDICATING LAMP	8
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-SP20	3
		AUXILIARY CONTACTOR 2NO+2NC, CV 2200C	5
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-DISCONNECTING TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		BREAKER CONTROL SWITCH-16A 220V DC	1
		2POLE 2POS(LOCAL/REMOTE) SELECTOR SWITCH KEY -1DA, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-6185D FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (S1) • EARTH FAULT PROTECTION (S1N) • 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, MINIMUM 10 O/P • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%). RELAY SPECIFICATION SHALL BE READ IN CONJUNCTION WITH TENDER SPECIFICATION.	0
		HAND RESET LOCKOUT RELAY	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		BREAKER CONTACT MULTIPLICATION LATCH RELAY	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
6	DM /PM	BREAKER CONTROLLED MOTOR ABOVE 90KW SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/D TYPE, WITH DUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL MCB 6A	7
		CONTROL MCB 16A	4
		INDICATING LAMP	8
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-5P20	3
		CURRENT TRANSFORMER (METERING) 10VA, CL-1.0	1
		CURRENT TRANSOUCE WITH DUAL OUTPUT CL 0.5 4-20MA	1
		AUXILIARY CONTACTOR 2NO+2NC ,CV 220DC	5
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL- DISCONNECTING TYPE	As required
		POWER TERMINAL	As required
		DOUBLE PDLE ON/OFF SWITCH-16 A, 220 V DC	1
		BREAKER CONTROL SWITCH-16A 220V DC	1
		2PDLE 2PDS(LCAL/REMOTE) SELECTOR SWITCH KEY -10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (S1) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION UNDER VOLTAGE • EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • BLOCKED RDTDR PROTECTION CURRENT UNBALANCE PROTECTION • No of OI/OO 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%)	0
		HAND RESET LOCKOUT RELAY	1
		BREAKER CONTACT MULTIPLICATION LATCH RELAY	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
7	G1	BUS PT MODULE FOR PCC / PMCC SHALL COMPRISE OF:	
		MCB-6A	3
		MPCB 16A	1
		POTENTIAL TRANSFORMER -415/ROOT3 /110/ROOT3, 50 VA CL-0.5 INSL CL-E	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS(FIXED)	As required
		DIGITAL VOLTMETER (3 PHASE)	1
		VOLTAGE TRANSOUCE WITH DUAL OUTPUT CL 0.5 4-20MA	3

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
8	G2	BUS PT MODULE FOR DG PCC SHALL COMPRISE OF:	
		MCB-6A	3
		MPCB 16A	1
		POTENTIAL TRANSFORMER -415/ROOT3 /110/ROOT3, 50 VA CL-0.5 INSL CL-E	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS(FIXED)	As required
		DIGITAL VOLTMETER (3 PHASE)	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	3
9	VM	BUS PT MODULE FOR MCC/ACDB SHALL COMPRISE OF:	
		MCB-6A	2
		MPCB-6A	1
		AUX. CONTACTOR 2NO+2NC CV. 415 V AC	1
		DIGITAL VOLTMETER (3 PHASE)	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	3
		CDNTRDL TERMINALS(FIXED)	As required
1D	CS	EACH CONTROL SUPPLY OUTGOING SHALL COMPRISE OF:	
		MCB-6A	4
		MCB-32A	4
		MPCB 16A	1
		AUX. CDNTACTDR , 2NO+2NC,CV. 110 V AC	4
		NEUTRAL LINK-32A	6
		CONTROL TERMINALS(FIXED)	As required
		POWER TERMINALS	As required
		CONTROL TRANSFORMER, DRY TYPE, CAST RESIN, 415/110 V, 3KVA	1
		4POLE, 2PDSI, SELECTOR SWITCH FOR CDNTRDL TRF -25A, 110V AC	1
11	DB+DC+CH+HD	220V DC INCOMER FROM BATTERY SHALL COMPRISE OF:	
		MECHANICAL OPERATED 220V DC AIR CIRCUIT BREAKER	5
		DC SHUNT 75mV	2
		0-1250A DC AMMETER	2
		4-20mA DUAL O/P DC VOLTAGE TRANSDUCER	2
		MCB-6A	2
		INDICATION LAMP	3
		3 LOCK WITH 1 KEY INTERLOCK ARRANGEMENT SHALL BE PROVIDED FOR MODULE TYPE DC & HD	1
		FIXED CONTROL TBS	As required
12	S	220V DCDB BUS MODULE FOR METERING & PROTECTION SHALL COMPRISE OF:	

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		UNDERVOLTAGE (INSTANTANEOUS WITH SETTING OF 95% OF 220VDC. THE RESETING OF RELAY SHOULD NOT BE MORE THAN 1.05)	1
		OVERVOLTAGE (INSTANTANEOUS WHICH SHALL OPERATE AT 110% OF 220V DC. THE RESETING RATION SHOULD NOT BE LESS THAN .95)	1
		EARTHFAULT (CAEM21 OR EQV.)	1
		INDICATING LAMP	2
		MCB-6A	3
		NEUTRAL LINK	1
		DC VOLTAGE METER (0-300V)	1
		VOLTMETER SELECTOR SWITCH	1
		AUXILIARY CONTACTOR, 2NO+2NC, CV 220AC	1
		PUSH BUTTON- SPRING RETURN WITH 1NO+1NC AUX. CONTACT	2
13(A)	X1	220V DC OUTGOING FEEDER BELOW 200A SHALL COMPRISE OF:	
		DC MCB	1
		MCB 1NO ADD-ON CONTACT	1
		MCB 1NO TRIP CONTACT	1
		INDICATION LAMP	2
13(B)	X2	220V DC OUTGOING FEEDER 200A AND ABOVE SHALL COMPRISE OF:	
		2P SWITCH FUSE UNIT	1
		POWER FUSE	2
		SFU 1NO +1NC AUX CONTACT	1
		INDICATION LAMP	2
		DC SHUNT 75mV	1
		DC AMMETER	1
14	CC	ISOLATOR INCOMER WITH CONTACTOR UPTO 400A SHALL COMPRISE OF	
		MCCB TP. ADJ. O/L, S/C WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		SHUNT TRIP RELEASE	1
		UNDER VOLTAGE RELEASE	1
		EXTENDED ROTARY HANDLE	1
		INDICATING LAMP	2
		CURRENT TRANSFORMER (METERING) 1DVA, CL-1.D	3
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTION METER	1
		MCB-6A	5

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		MPCB 16A	2
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 500VA	1
		SERVICE POSITION LIMIT SWITCH	1
		TRIPLE PDLE POWER CONTACTOR WITH CDIL SUITABLE FOR 110V AC WITH 2NO+2NC AUX	1
		AUXILIARY CONTACTOR 2NO+2NC ,CV 110V AC	2
		CONTROL TERMINALS (DRAWOUT/FIXED)	A.R
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
15	EM3 (I/C)	INCDMER MCCB FOR MCC / ACDB FOR RATING UPTO 400A	
		MCCB TP ADJ. O/L,S/C WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/D	1
		SHUNT TRIP RELEASE	1
		UNDER VOLTAGE RELEASE	1
		EXTENDED ROTORY HANDLE	1
		INDICATION LAMP	3
		CURRENT TRANSFORMER (METERING) 10VA,CL-1.0	3
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		VOLTAGE TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTIDN METER	1
		MCCB-6A	3
		MPCB 16A	2
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		CONTROL TERMINALS (DRAWOUT/FIXED)	A.R
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		NEUTRAL LINK AS PER MCCB RATING	1
		NEUTRAL LINK 32A	1
16	EM3 (B/C)	BUSCOUPLER MCCB FOR MCC / ACDB FOR RATING UPTD 400A	
		MCCB TP ADJ. D/L,S/C WITH INSULATIDN SHIELDS B/W THE PHASES	1
		AUX. SWITCH FDR MCCB-2C/O	1
		ALARM SWITCH FDR MCCB-1C/O	1
		SHUNT TRIP RELEASE	1
		UNDER VOLTAGE RELEASE	1
		EXTENDED RDTORY HANDLE	1
		INDICATING LAMP	3
		CURRENT TRANSFORMER (METERING) 10VA,CL-1.0	3

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		CURRENT TRANSDUCER WITH DUAL OUTPUT CL 0.5 4-20MA	1
		1.0 CLASS DIGITAL MULTI-FUNCTION METER	1
		AUXILIARY CONTACTOR 2NO+2NC	2
		MCCB 6A	2
		MPCB 16A	2
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		NEUTRAL LINK AS PER MCCB RATING	1
		CONTROL TERMINALS (DRAWOUT/FIXED)	A.R
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
17	E/E3	TPN AC OUTGOING MCCB OPERATED FEEDER	
		MCCB TP ADJ. O/L/S/C/E/F WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FOR MCCB-2C/D	1
		ALARM SWITCH FOR MCCB-1C/O	1
		SHUNT TRIP RELEASE	1
		UNDER VOLTAGE RELEASE	1
		EXTENDED ROTARY HANDLE	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
18	E2	DP AC OUTGOING MCCB OPERATED FEEDER	
		MCCB DP ADJ. O/L/S/C/E/F WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		SHUNT TRIP RELEASE	1
		UNDER VOLTAGE RELEASE	1
		EXTENDED ROTARY HANDLE	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
19	E1	SP AC OUTGOING MCCB OPERATED FEEDER	
		MCCB DP ADJ. D/L/S/C/E/F WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/D	1
		SHUNT TRIP RELEASE	1
		UNDER VOLTAGE RELEASE	1
		EXTENDED ROTARY HANDLE	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
20	DK2/PK2/ AK2	UNIDIRECTIONAL MOTDR FEEDER BELDW 15KW (AU/BU/CU CONTROLLED FROM ATR/DDCMIS/PLC SHALL COMPRISE OF:	

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/D	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1ND AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	3
		ADD DN AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIODE	2
21	DK21/PK21/ AK21	UNIDIRECTIONAL MOTOR FEEDER 15KW TO 90KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC), 96 X 96 mm2, CRAMPED SCALE- 240 DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL D/P, AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1ND AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD DN AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		STOP/ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR FOR., 10A, 240VAC	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		COUPLING RELAY WITH BUILT IN DIDDE, 24V DC 2C/D	2
22	DK2E	UNIDIRECTIONAL MOTOR FEEDER (ESSENTIAL) BELOW 15KW CONTROLLED FROM DDCMIS/PLC/ ATRS SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIDDE	2
		MOTOR RESTART TIMER	1
23	DK21E	UNIDIRECTIONAL MOTOR FEEDER (ESSENTIAL) 15KW TO 90 KW CONTROLLED FROM ATRS/DDCMIS/PLC SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC), 96 X 96 mm ² , CRAMPED SCALE- 240 DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL D/P, ALIX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-8

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		5P ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR FOR.,10A, 240VAC	1
		COUPLING RELAY WITH BUILT IN DIDDE,24V DC 2C/O	2
		MOTOR RESTART TIMER	1
24	K2	UNIDIRECTIONAL MOTOR FEEDER BELOW 15KW CONTROLLED FROM LPBS SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/D	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLDCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
25	K21	UNIDIRECTIONAL MOTOR FEEDER 15KW TO 90KW CONTROLLED FROM LPBS SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC),96 X 96 mm2, CRAMPED SCALE- 240 DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC),4-20mA, DUAL O/P,AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLDCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		SP DN/DFW SWITCH FOR MOTOR SPACE HTR. OF MOTDR FDR.,10A, 240VAC	1
26	EA3	HEATER FEEDER UPTO 90KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL CDMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/D	1
		EXTENDED ROTDRY HANDLE	1
		Indication lamp	2
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	3
		ADD DN AUX. CONTACTOR BLDCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	36
		COUPLING RELAY WITH BUILT IN DIODE	2
27	DN1	BIDIRECTIONAL MOTOR FEEDER BELDW 15KW (AU/BU/CU CONTROLLED FROM ATRS/DDCMIS/PLC SHALL CDMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTDRY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	5
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	45

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		COUPLING RELAY WITH BUILT IN DIODE	2
28	DN21	BIDIRECTIONAL MOTOR FEEDER 15KW TO 90KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC), 96 X 96 mm2, CRAMPED SCALE- 240 DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL O/P, AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD DN AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR FDR., 10A, 240VAC	1
		COUPLING RELAY WITH BUILT IN DIODE, 24V DC 2C/O	2
29	K1	UNIDIRECTIONAL MOTOR FEEDER BELOW 15KW CONTROLLED FROM MCC SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	5
		ADD DN AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		2P 2PDS ON OFF ROTARY SWITCH	1
30	K11	UNIDIRECTIONAL MOTOR FEEDER RATED FROM 15KW to 90KW CONTROLLED FROM MCC SHALL COMPRISE OF:	
		3P MCCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC), 96 X 96 mm ² , CRAMPED SCALE- 24D DEG, CL-1.D	1
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL O/P, AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD DN AUX. CONTACTOR BLOCK 2ND+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		5P ON/OFF SWITCH FOR MOTOR SPACE HTR. DF MOTOR FDR, 10A, 240VAC	1
		2P 2PDS ON OFF ROTARY SWITCH	1
31	DK2/PK2/ AK2 (WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER BELOW 15KW (AU/BU/CU CONTROLLED FROM ATRs/DDCMIS/PLC SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/D	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIODE	2
32	DK21/PK21/ AK21 (WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER 15KW TO 90KW CONTROLLED FROM DDCMI5/PLC/ATRS SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTIDN	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTORY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD REAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC),96 X 96 mm2, CRAMPED SCALE- 24D DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC),4-20mA, DUAL O/P,AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2ND+2NC CV. 110 V AC	3
		ADD 0N AUX. CONTACTOR BLDCK 2NO+2NC	2
		MCCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		SP DN/DFF SWITCH FOR MOTOR SPACE HTR. DF MOTOR FDR, 10A, 240VAC	1
		CDUPLING RELAY WITH BUILT IN DIODE, 24V DC 2C/O	2
33	DK2E (WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER (ESSENTIAL) BELOW 15KW CONTROLLED FROM DDCMI5/PLC/ ATR5 SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FDR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTORY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1ND AUX CDNTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	3

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		ADD ON AUX. CONTACTOR BLOCK 2ND+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIODE	2
		MOTOR RESTART TIMER	1
34	DK21E (WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER (ESSENTIAL) 15KW TO 90 KW CONTROLLED FROM ATR/DDCMIS/PLC SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC), 96 X 96 mm2, CRAMPED SCALE - 240 DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL O/P, AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		CONTRDL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR F0/R, 10A, 240VAC	1
		COUPLING RELAY WITH BUILT IN DIODE, 24V DC 2C/O	2
		MOTOR RESTART TIMER	1
35	K2(WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER BELOW 15KW CONTROLLED FROM LPBS SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
MODULEWISE BILL OF MATERIAL
ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
36	K21(WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER 15KW TO 90KW CONTROLLED FROM LPB5 SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC), 96 X 96 mm2, CRAMPED SCALE- 240 DEG, CL-1.0	1
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL O/P, AUX. 110V AC	1
		POWER CONTACTOR(AC) WITH 1ND AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2ND+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		3P DN/DF SWITCH FOR MOTOR SPACE HTR. DEF MOTOR FOR., 10A, 240VAC	1
37	EA3(WITH MPCB)	HEATER FEEDER UPTO 90KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL COMPRISE OF:	
		3P MPCB WITH S/C & O/L PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		Indication lamp	2
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	3
		ADD DN AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTRDL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	36
		COUPLING RELAY WITH BUILT IN DIDDE	2
38	DN1(WITH MPCB)	BIDIRECTIONAL MOTOR FEEDER BELOW 15KW (AU/BU/CU CONTROLLED FROM ATRS/DDCMIS/PLC SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTORY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	5
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTRDL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	45
		COUPLING RELAY WITH BUILT IN DIDDE	2
39	DN21(WITH MPCB)	BIDIRECTIONAL MOTOR FEEDER 15KW TO 90KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTORY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC),96 X 96 mm2, CRAMPED SCALE- 240 DEG, CL-1.0	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		CURRENT TRANSDUCER (AC), 4-20mA, DUAL O/P, AUX.-110V AC	1
		POWER CONTACTOR (AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR, 2NO+2NC CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR FDR., 10A, 240VAC	1
		COUPLING RELAY WITH BUILT IN DIODE, 24V DC 2C/O	2
40	K1(WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER BELDW 15KW CONTROLLED FROM MCC SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1
		POWER CONTACTOR (AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR, 2NO+2NC, CV. 110 V AC	5
		ADD ON AUX. CONTACTOR BLOCK 2ND +2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC, 50VA	1
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		2P 2POS ON OFF ROTARY SWITCH	1
41	K11(WITH MPCB)	UNIDIRECTIONAL MOTOR FEEDER RATED FROM 15KW to 90KW CONTROLLED FROM MCC SHALL COMPRISE OF:	
		3P MPCB WITH S/C PROTECTION	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTARY HANDLE	1
		Indication lamp	3
		ELECTRONIC OVERLOAD RELAY WITH CURRENT DISPLAY	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC),96 X 96 mm2, CRAMPEO SCALE- 240 DEG, CL-1.0	1
		CURRENT TRANSOUCE (AC),4-20mA, DUAL O/P,AUX.-110V AC	1
		POWER CONTACTOR(AC) WITH 1ND AUX CONTACT COIL VOLTAGE 110V AC	2
		AUX. CONTACTOR,2NO+2NC CV. 110 V AC	3
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	2
		MCB-6A	2
		MPCB 16A	1
		CONTROL SUPPLY TRANSFORMER 415V/110V AC , 50VA	1
		NEUTRAL LINK	1
		CDNTRDL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL- DISCONNECTING TYPE	A.R
		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. DF MOTOR FDR,10A, 240VAC	1
		2P 2POS ON OFF ROTARY SWITCH	1
42	X1 (WITH SFU)	220V DC OUTGOING FEEDER BELOW 200A SHALL COMPRISE OF:	
		2P SWITCH FUSE UNIT	1
		POWER FUSE	2
		SFU 1NO +1NC AUX CONTACT	1
		INDICATION LAMP	2
43	X2 (WITH SFU)	220V DC OUTGOING FEEDER 200A AND ABOVE SHALL COMPRISE OF:	
		2P SWITCH FUSE UNIT	1
		POWER FUSE	2
		SFU 1NO +1NC AUX CDNTACT	1
		INDICATIO N LAMP	2
		DC SHUNT 75mV	1
		DC AMMETER	1
44	H1	1-Ph MCB controlled outgoing feeder (H1) from AC MCCB DB	
		2P MCB	1
		MCB AUXILIARY 1NO+1NC	1
		INDICATION LAMP	2
45	H3	415V AC MCCB DB Incomer-- Module Type H3	
		MCCB TP AOI O/L,S/C,E/F WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FOR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED ROTORY HANDLE	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

MODULEWISE BILL OF MATERIAL

ANNEXURE-B

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		DIGITAL VOLTMETER	1
		INDICATION LAMP	5
		SP MCB 2A	2
46	H2	220V DC Fuse DB Incomer from DCDB - Module type H2	
		MCCB TP ADJ. D/L,S/C,E/F WITH INSULATION SHIELDS B/W THE PHASES	1
		AUX. SWITCH FDR MCCB-2C/O	1
		ALARM SWITCH FOR MCCB-1C/O	1
		EXTENDED RDTORY HANDLE	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		DC DIGITAL VOLTMETER	1
		INDICATION LAMP	5
		SP MCB 2A	1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

PRICE SCHEDULE

ANNEXURE-C

2X660MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI

Sl. No.	Boards	Rating	UNIT	Qty	UNIT PRICE	TOTAL PRICE
1	DG PCC #1DH	3000A	EA	1		
2	UNIT EMERGENCY MCC #1DG	3000A	EA	1		
3	BOILER SERVICE PMCC #1DA	3200A	EA	1		
4	BLR VALVE & DAMPER ACDB #1HA	250A	EA	1		
5	BOILER ACDB #1HB	400A	EA	1		
6	STATION SERVICES PMCC #0DA	4000A	EA	1		
7	AIR WASHER MCC #1SA	630A	EA	1		
8	VENTILATION MCC #1TA	1000A	EA	1		
9	MISC SERVICES MCC #0QA	630A	EA	1		
10	CCR AIR CONDITIONING MCC #0TA	1600A	EA	1		
11	TURBINE SERVICE PMCC #1DB	2500A	EA	1		
12	SERVICE ACDB #1QA	630A	EA	1		
13	TURBINE VALVE DB #1KA	250A	EA	1		
14	220V Main DCDB #1FA	1250A	EA	1		
15	ESP & ID FAN AREA MCC #1HC	400A	EA	1		
16	ESP A/C & VENT MCC #1TB	400A	EA	1		
17	DG PCC #2DH	3000A	EA	1		
18	UNIT EMERGENCY MCC #2DG	3000A	EA	1		
19	BOILER SERVICE PMCC #2DA	3200A	EA	1		
20	BLR VALVE & DAMPER ACDB #2HA	250A	EA	1		
21	BOILER ACDB #2HB	400A	EA	1		
22	STATION SERVICE PMCC #0DB	4000A	EA	1		
23	AIR WASHER MCC #2SA	630A	EA	1		
24	VENTILATION MCC #2TA	1000A	EA	1		
25	MISC SERVICES MCC #0QB	630A	EA	1		
26	SERVICE BUILDING AC & VENT. MCC #0TB	1000A	EA	1		
27	TURBINE SERVICE PMCC #2DB	2500A	EA	1		
28	SERVICE ACDB #2QA	630A	EA	1		
29	TURBINE VALVE DB #2KA	250A	EA	1		
30	220V Main DCDB #2FA	1250A	EA	1		
31	ESP & ID FAN AREA MCC #2HC	400A	EA	1		
32	ESP A/C & VENT MCC #2TB	400A	EA	1		
33	RD-DM PMCC #0DH	2500A	EA	1		
34	SEA WATER INTAKE PMCC #0DF	1000A	EA	1		
35	FUEL DIL P/H PMCC #0DC	2000A	EA	1		
36	AUXILIARY BOILER MCC #0HA	400A	EA	1		
37	FW/WATER SYSTEM PMCC #0DD	3200A	EA	1		
38	CPU MCC #0WA	400A	EA	1		
39	WORKSHOP ACDB #0SA	400A	EA	1		
40	CANTEEN ACDB #0SB	250A	EA	1		
41	ETP/PTP PMCC #0DJ	1600A	EA	1		
42	STP MCC #0WC	250A	EA	1		
43	HYDROGEN GENERATION MCC #0SC	400A	EA	1		
44	ADMIN BLDG PMCC #0DG	1600A	EA	1		
45	CW/ELECTROCHLORINATION PMCC #0DE	4000A	EA	1		
46	220VDC DB (WALL MOUNTED)		EA	18		
47	415VAC MCCB DB (WALL MOUNTED)		EA	18		
48	SITE MODIFICATION CHARGES (ANNEXURE-D)		LOT	1		
49	ERECTION AND COMMISSIONING SPARES (ANNEXURE-E)		LOT	1		
50	MANDATORY SPARE (ANNEXURE-F)		LOT	1		
51	TDDLS & TACKLES (ANNEXURE-G)		LOT	1		
52	SITE MODIFICATION ITEM AS 1% OF TOTAL CDST		LOT	1		
TOTAL						

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(MIN 75MM), FOUNDATION BOLTS, CABLE GLANDS & LUGS AND TOOLS & TACKLES AS MENTIONED IN DIFFERENT SECTIONS.

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-A.

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

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 ±30% OF THE TOTAL CONTRACT VALUE DERIVED ON THE BASIS OF ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.

8. Price of components for Panels, E&C spres, Tools and Tackles are to be quoted in Unit Price Schedule given in specification.

a. COMPLETE DIMENSIONS OF ALL THE BDARDS INCLUDING ND OF ACB, MCC. GA DRAWING SHALL BE DULY SUBMITTED FOR ALL BDARDS.

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..

9. DOUBLE COMPRESSION, NICKLE PLATED BRASS CABLE GLANDS & HEAVY DUTY LUGS OF 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.



2X660 MW ENNORE SEZ Supercritical
Thermal Power Project at Ash Dyke of NCTPS

TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-D)

SPECIFICATION NO. EPD-TS-CPBG-14063

VOLUME

SECTION

REV NO. 00

DATE :06/10/2017

SHEET 1 OF 1

ANNEXURE-D

SITE MODIFICATION CHARGES
(SL No. 48 of Main Price list)

SL.NO.	DETAILS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	LUMP SUM ALL INCLUSIVE CHARGES PER VISIT FOR SKILLED TECHNICIAN (EXCEPT DAILY CHARGES)	10 VISITS		
2	LUMP SUM ALL INCLUSIVE DAILY CHARGES FOR SKILLED TECHNICIAN	30 DAYS		
3	LUMP SUM ALL INCLUSIVE CHARGES PER VISIT FOR SERVICE ENGINEER (EXCEPT DAILY CHARGES)	15 VISITS		
4	LUMP SUM ALL INCLUSIVE DAILY CHARGES FOR SERVICE ENGINEER	60 DAYS		
			TOTAL	

NOTES:

- 1) AMOUNT PAYABLE FOR SKILLED TECHNICIAN PER VISIT TO SITE = VISIT CHARGES AS PER SL. NO. 1 ABOVE + (DAILY CHARGES AS PER SL. NO. 2 ABOVE X NO. OF DAYS AT SITE) (TO BE CERTIFIED BY BHEL SITE)
- 2) AMOUNT PAYABLE FOR SERVICE ENGINEER PER VISIT TO SITE = VISIT CHARGES AS PER SL. NO. 3 ABOVE + (DAILY CHARGES AS PER SL. NO. 4 ABOVE X NO. OF DAYS AT SITE) (TO BE CERTIFIED BY BHEL SITE)



**2X660 MW ENNORE SEZ Supercritical
Thermal Power Project at Ash Dyke of NCTPS**

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

SPECIFICATION NO. EPD-TS-CPBG-14063

VOLUME

SECTION

REV NO. 00

DATE :06/10/2017

SHEET 2 OF 1

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ERECTION AND COMMISSIONING SPARE

ANNEXURE-E					
S.No.	ITEM / COMPONENT	UNIT	Qty	UNIT PRICE (EX WORKS)	TOTAL PRICE
1	MCCB/MPCB				
	16A	No	2		
	32A	No	2		
	100A	No	2		
	160A	No	2		
	250A	No	2		
	400A	No	2		
	630A	No	2		
2	POWER CONTACTORS				
	Contactor (110V AC)				
	16A	No.	5		
	32A	No.	5		
	63A	No.	5		
	80A	No.	5		
	115A	No.	5		
	185A	No.	5		
	265A	No.	5		
	400A	No.	5		
3	AUXILIARY CONTACTORS				
	2NO + 2NC AC	No	15		
	2NO + 2NC DC	No	15		
	3NO + 1NC AC	No	15		
	3NO + 1NC DC	No	15		
4	PUSH BUTTONS with 2NO+2NC	Nos	50		
5	INDICATING CLUSTER LED of each Type, Rating and Color	Nos.	50		
6	control switch (each type and rating)	Nos	10		
7	AC Voltmeter	No.	5		

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR MANDATORY SPARE

ANNEXURE-F

S.NO.	ITEM.	QUANTITY
1	Complete pole of breaker	1 no of each type and rating
2	Spring charging motors	6 nos.
3	Aux. contact set	12 set.
4	Limit switches	6 nos.
5	Arc chutes	4 nos.
6	Fixed contact set	6 sets
7	Moving contact set	6 sets
8	Arcing contact	6 sets
9	Charging spring	3 nos.
10	Current transformer (metering)	3 nos.
11	Current transformer (protection)	3 nos.
12	Closing coil	12 nos.
13	Trip coil	12 nos.
14	CT for Bimetal O/L relays	1 no of each type and rating.
15	Voltage transformer	3 nos. each
16	Control supply transformer	1 no each rating.
17	Ammeter	1 no of each rating and size.
18	Voltmeter	1 no of each rating and size.
19	Relays	1 no of each type and rating.
20	Power contactor	5 nos of each rating.
21	Coil of above contactor	10 nos.
22	Air break switches	10 % of each rating.
23	DP air break switches (DC)	2 nos. each
24	Control & selector switches	5 % of each type and size.
25	Control fuses & neutral links	30 % Of population for fuses, 10 % Of population for link.
26	Indicating lamps	20 % of installed quantity.
27	Bus bar support insulators(each type)	5 % of installed quantity.
28	Bus duct flexible connectors	1 no of each type.
29	Primary disconnect in MCC (Male/ female contact)	1 set of each rating.
30	Push buttons	10 % of each type.
31	Power fuses	50 % of each type.
32	Thermal bimetal relays	6 nos. of each rating and size.
33	Indication Lamp Holders complete	20 % of installed quantity.
34	Maintenance tools and accessories for Maintenance (bidder to list)	3 nos.
35	Terminal blocks	10 % of installed quantity.
36	Busbar aluminium flat pieces	12 meters of each size.
37	Busbar angles/formed pieces for breaker	1 no.

NOTE:

- a. Quantity mentioned in percentage (%) is the % of total installed.
- b. If percentage comes as fraction next higher integer should be considered for the purpose of quantity required.



2X660 MW ENNORE SEZ Supercritical Thermal
Power Project at Ash Dyke of NCTPS

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
PRICE SCHEDULE FOR TOOLS & TACKLES**

SPECIFICATION NO.
EPD-TS-CPBG-14063

VOLUME NO. :

SECTION :

REV NO. : 00 DATE 06/10/2017

SHEET : 1 OF 1

ANNEXURE-G

TOOLS & TACKLES AND ACCESSORIES

SL. NO.	ITEM DESCRIPTION	QUANTITY	UNIT PRICE (EX. WORKS)	TOTAL PRICE (EX. WORKS)
1	BREAKER LIFTING AND HANDLING TROLLEY	6 NO'S		
2	MODULE RACKING HANDLE FOR BREAKERS	12 NO'S		
3	MODULE RACKING HANDLE FOR MCC MODULES	20 NO'S		
4	TEST CABINET WITH COUPLING CABLES FOR TESTING BREAKER IN WITHDRAWN POSITION	4 SET		
5.	ELECTRICAL TOOLS KIT	2 SET		
6	MECHNICAL TOOLS KIT	2 SET		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

1

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO. / ITEM DESCRIPTION	UNIT PRICE (Rs.)
1	INCOMING FEEDER UNIT		
a)	ACB Incomer to PCC/PMCC from Trafo. - Module Type DAET (I/C)		
	630A		
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
	4000A		
b)	ACB Incomer to MCC - Module Type DAE/ DAEN/ AE (I/C)		
	630A		
	800A		
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
c)	MCCB Incomer for MCC / ACDB – Module Type EM3 (I/C)		
	Upto 63A – Fixed Type		
	125A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	Upto 63A – Drawout Type		
	125A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
d)	SFU Incomer for MCC / ACDB – Module Type EM3 (I/C)		
	Upto 63A – Fixed Type		
	125A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	Upto 63A – Drawout Type		
	125A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
e)	220V DCDB Incomer from charger - Module type CH (I/C)		
	150A – CH Fixed Type		
	200A – CH Fixed Type		
	400A – CH Fixed Type		
	630A – CH Fixed Type		
	1250A – CH Fixed Type		
	150A – CH Drawout Type		
	200A – CH Drawout Type		
	400A – CH Drawout Type		
	630A – CH Drawout Type		
f)	220V DC Fuse DB Incomer from DCDB - Module type H2		
	32A		
	50A		
	63A		
g)	415V AC MCCB DB Incomer– Module Type H3		
	32A		
	63A		
	125A		
h)	ACB Incomer to Emergency Board - Module Type DAEG/ DAEGN (I/C)		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

2

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO. / ITEM DESCRIPTION	UNIT PRICE (Rs.)
	1600A		
	2500A		
	3000A		
2	BUSCOUPLER UNIT		
a)	ACB Buscoupler to PCC/PMCC/MCC from Trafo. - Module Type DAET/ DAE (B/C)		
	630A		
	800A		
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
	4000A		
b)	MCCB Buscoupler for MCC / ACDB – Module Type EM3 (B/C)		
	Upto 63A – Fixed Type		
	125A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	Upto 63A – Drawout Type		
	125A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
c)	SFU Buscoupler for MCC / ACDB – Module Type EM3 (B/C)		
	Upto 63A – Fixed Type		
	125A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	Upto 63A – Drawout Type		
	125A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
d)	220V DCDB Buscoupler from charger - Module type DC & HD (B/C)		
	150A – DC & HD Fixed Type		
	200A – DC & HD Fixed Type		
	400A – DC & HD Fixed Type		
	630A – DC & HD Fixed Type		
	1250A – DC & HD Fixed Type		
	150A – DC & HD Drawout Type		
	200A – DC & HD Drawout Type		
	400A – DC & HD Drawout Type		
	630A – DC & HD Drawout Type		
	1250A – DC & HD Drawout Type		
e)	ACB BUSCOUPLER to Emergency Board - Module Type DAEG (B/C)		
	1600A		
	2500A		
	3000A		
3	Outgoing ACB supply feeder - Module Type DAE/DAE-TIE (O/G)		
	630A		
	800A		
	1000A		
	1600A		
	3000A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

3

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
4	Outgoing ACB motor feeder - Module Type DM/PM (controlled from DDCMIS/PLC)		
	110KW		
	130KW		
	150KW		
5.1	DOL Motor Starter - Unidirectional Drive(MPCB CONTROLLED) - Drawout Type		
a)	Module Type K2 (Controlled from LPBS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
b)	Module Type K21 (Controlled from LPBS)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
c)	Module Type K1 (Controlled from MCC)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
d)	Module Type K11 (Controlled from MCC)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
e)	Module Type DK2/PK2/AK2 (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
f)	Module Type DK21/PK21/AK21 (Controlled from DDCMIS/PLC/ATRS)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
g)	Module Type DK2E/PK2E/AK2E (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
h)	Module Type DK21E/PK21E/AK21E (Controlled from DDCMIS/PLC/ATRS)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

4

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
5.2	DOL Motor Starter - Unidirectional Drive(MCCB CONTROLLED) - Drawout Type		
a)	Module Type K2 (Controlled from LPBS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
b)	Module Type K21 (Controlled from LPBS)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
c)	Module Type K1 (Controlled from MCC)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
d)	Module Type K11 (Controlled from MCC)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
e)	Module Type DK2/PK2/AK2 (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
f)	Module Type DK21/PK21/AK21 (Controlled from DDCMIS/PLC/ATRS)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
g)	Module Type DK2E/PK2E/AK2E (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
h)	Module Type DK21E/PK21E/AK21E (Controlled from DDCMIS/PLC/ATRS)		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

5

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	75.1 - 90KW		
6.1	RDOL Motor Starter – Bidirectional Drive(MPCB CONTROLLED) Drawout Type		
a)	Module Type DN1/ PN1/ AN1 (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
a)	Module Type DN21/ PN21/ AN21 (Controlled from DDCMIS/PLC/ATRS)		
	15 - 22KW		
	22.1 - 30.0KW		
6.2	RDOL Motor Starter – Bidirectional Drive(MCCB CONTROLLED) Drawout Type		
a)	Module Type DN1/ PN1/ AN1 (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
a)	Module Type DN21/ PN21/ AN21 (Controlled from DDCMIS/PLC/ATRS)		
	15 - 22KW		
	22.1 - 30.0KW		
7	Contactor control heater FEEDER(Module Type EA3) - Drawout Type		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 14.9KW		
	15 - 22KW		
	22.1 - 30.0KW		
	30.1 - 37.0KW		
	37.1 - 45KW		
	45.1 - 55.0KW		
	55.1 - 75KW		
	75.1 - 90KW		
8	Outgoing MCCB controlled feeders		
a)	Outgoing MCCB controlled supply feeder - Module Type E3 (O/G)		
	upto 10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	125A - Fixed type		
	160A - Fixed type		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	600A - Fixed type		
	upto 10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	63A - Drawout type		
	125A - Drawout type		
	160A - Drawout type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	600A - Drawout type		
B)	Outgoing MCCB controlled supply feeder - Module Type E2 (O/G)		
	upto 10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	125A - Fixed type		
	160A - Fixed type		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	600A - Fixed type		
	upto 10A - Drawout type		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

6

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	63A - Drawout type		
	125A - Drawout type		
	160A - Drawout type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	600A - Drawout type		
	C) Double pole MCCB controlled 1-ph feeder - E1 (D/G)		
	16A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	125A - Fixed type		
	16A - Drawout type		
	32A - Drawout type		
	63A - Drawout type		
	125A - Drawout type		
9	1-Ph MCB controlled outgoing feeder (H1) from AC MCCB DB		
	10A		
	16A		
	32A		
10	220V DC Outgoing MCB feeders		
	a) 220V DC Outgoing feeder (X1)		
	2A - Fixed type		
	4A - Fixed type		
	6A - Fixed type		
	10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	50A - Fixed type		
	63A - Fixed type		
	100A - Fixed type		
	125A - Fixed type		
	2A - Drawout type		
	4A - Drawout type		
	6A - Drawout type		
	10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	50A - Drawout type		
	63A - Drawout type		
	100A - Drawout type		
	125A - Drawout type		
	B) 220V DC Outgoing MCB feeder (X2)		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	500A - Fixed type		
	630A - Fixed type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	500A - Drawout type		
	630A - Drawout type		
11	220V DC Outgoing SFU feeders		
	A) 220V DC Outgoing feeder (X1)		
	2A - Fixed type		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

7

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	4A - Fixed type		
	6A - Fixed type		
	10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	50A - Fixed type		
	63A - Fixed type		
	100A - Fixed type		
	125A - Fixed type		
	2A - Drawout type		
	4A - Drawout type		
	6A - Drawout type		
	10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	50A - Drawout type		
	63A - Drawout type		
	100A - Drawout type		
	125A - Drawout type		
	B) 220V DC Outgoing SFU feeder (X2)		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	500A - Fixed type		
	630A - Fixed type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	500A - Drawout type		
	630A - Drawout type		
	12 Common Auxiliary Module		
	a) PT module		
	i) Bus PT module for PCC/PMCC-G1 Type		
	ii) Bus PT module for Emergency MCC-G2 Type		
	iii) Bus PT DCDB-S Type		
	iv) Bus PT module for MCC-VM Type		
	b) Space heater and Power Socket - TT		
	c.1) 110V AC control supply module – Type CS (consisting of 415/110V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
	c.2) 240 V AC control supply module – type CS (consisting of 415/240V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
	d) 240V AC motor space heater module		
	e) 220V DC supply module (for receiving 220V DC supply)		
	f) 24 V winding heating module		
	g) Alarm module		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

8

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
h)	Test supply module		
i)	240 V AC Panel Space heating supply module – type SH (consisting of 415/240V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
13	Contactor controlled MCCB Incomer for MCC / ACDB – Module Type CC (I/C)		
	Upto 63A – Fixed Type		
	125A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	Upto 63A – Drawout Type		
	125A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
14	Empty Panel with Horizontal & Vertical Busbar, Support & Auxiliary Busbar		
a)	MCC Panel (Double Front Drawout Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
b)	MCC Panel (Double Front Fixed Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
c)	220V DCDB Panel (Double Front Fixed type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
d)	220V DCDB Panel (Double Front Drawout type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
15	Empty Panel With Horizontal & Vertical Busbar, Support & Auxiliary Busbar		
a)	PCC Panel (Single Front Drawout Type)		
	1600 / 1600A		
	2000 / 2000A		
	2500 / 2500A		
	3000 / 3000A		
	4000 / 4000A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

9

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
b)	MCC Panel (Single Front Drawout Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
c)	MCC Panel (Single Front Fixed Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
d)	220V DCDB Panel (Single Front Fixed Type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
e)	220V DCDB Panel (Single Front Fixed Type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
16	ACB Panel with Horizontal & Vertical Busbar, Support & Auxiliary Busbar		
	630 / 630A		
	800 / 630A		
	800 / 800A		
	1000 / 630A		
	1000 / 800A		
	1000 / 1000A		
	1600 / 630A		
	1600 / 800A		
	1600 / 1000A		
	1600 / 1600A		
	2000 / 630A		
	2000 / 800A		
	2000 / 1000A		
	2000 / 1600A		
	2000 / 2000A		
	2500 / 630A		
	2500 / 800A		
	2500 / 1000A		
	2500 / 1600A		
	2500 / 2000A		
	2500 / 2500A		
	3000 / 630A		
	3000 / 800A		
	3000 / 1000A		
	3000 / 1600A		
	3000 / 2000A		
	3000 / 2500A		
	3000 / 3000A		
	4000 / 630A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

- 10

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	4000 / 800A		
	4000 / 1000A		
	4000 / 1600A		
	4000 / 2000A		
	4000 / 2500A		
	4000 / 3000A		
	4000 / 4000A		
17	Dummy Panel (500MM)		
	UPTO 630A		
	800A		
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
	4000A		
18	Unit Prices For Circuit Components		
a)	Air Circuit Breaker without releases		
	630A MDO		
	800A MDO		
	1000A MDO		
	630A ACB, 3P, EDO, AC		
	800A ACB, 3P, EDO, AC		
	1000A ACB, 3P, EDO, AC		
	4000A ACB, 3P, EDO, AC		
	3200A ACB, 3P, EDO, AC		
	2500A ACB, 3P, EDO, AC		
	2000A ACB, 3P, EDO, AC		
	1600A ACB, 3P, EDO, AC		
	1250A ACB, 3P, EDO, AC		
	1250A ACB, 2P, MDO, DC		
b)	MCCB, 2NO+2NC AUX, FSC		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
	630A		
c)	MCCB, 2NO+2NC AUX, ASC		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
	630A		
d)	MCCB with LSIG release		
	200A		
	250A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

11

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	300A		
	350A		
	400A		
	630A		
e)	MCCB - Motorized with LSIG release		
	200A		
	250A		
	300A		
	350A		
	400A		
	630A		
f)	POWER FUSE LINK FOR SFU (AC) - TPN		
	Upto 16A		
	25A		
	32A		
	63A		
	125A		
	250A		
	400A		
	630A		
g)	POWER FUSE LINK FOR SFU (DC) - DP		
	Upto 16A		
	25A		
	40A		
	50A		
	60A		
	80A		
	100A		
	200A		
	300A		
	400A		
	630A		
h)	SFU WITHOUT POWER FUSE LINK (AC) - TPN		
	Upto 16A		
	25A		
	32A		
	63A		
	125A		
	250A		
	400A		
	630A		
i)	SFU WITHOUT POWER FUSE LINK (DC) - DP		
	Upto 16A		
	25A		
	40A		
	50A		
	60A		
	80A		
	100A		
	200A		
	300A		
	400A		
	630A		
j)	HRC Fuse Links (Offset tag Type)		
	Upto 10A		
	16A		
	25A		
	32A		
	50A		
	63A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

12

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
k)	HRC Fuse DIN Type (Blade Contact)		
	Upto 10A		
	16A		
	20A		
	32A		
	36A		
	50A		
	63A		
	80A		
	100A		
	125A		
	160A		
	200A		
	250A		
	315A		
	400A		
	Control Fuse Link		
l)	Power contactor (AC)		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
m)	Power contactor (DC)		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	400A		
n)	Fuse Base		
	UPTD 20A		
	32A		
	50/63A		
	100A		
	250A		
	400A		
	630A		
o)	Auxiliary contactor AC/DC		
i)	AC Aux. contactor		
	2NO + 2NC		
	3NO + 3NC		
	4NO + 4NC		
	6NO + 6NC		
ii)	DC Aux. contactor		
	2NO + 2NC		
	3NO + 3NC		
	4NO + 4NC		
	6NO + 6NC		
p)	Protection Relay		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

13

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	VAGM 23		
	CTU 12		
	CTU 32		
	VTT 11		
	VAG 11		
	VAA 11		
	VAJHM 13		
	VAJHM 23		
	CDGM-12		
	CAG 12		
	CAG 34		
	CCUM 21		
	CDG 11		
	CDG 31		
	CDG 61		
	VDG 14		
	CDV 62		
	CAG 14		
	VAX 31		
	CAG 37		
	CAEM-21		
	VAG-21		
	VAJC-11		
	CTMM-501		
	MOTPRD		
	VAA21		
	VTT12		
	VTIG		
	VTU21		
	NUMERICAL RELAY FDR PROTECTION, T/C SUPERVISION, LDGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, REF PROTECTION, FUSE FAILURE, ENERGY METERING, OVER LOAD PROTECTION, 50, 50N, 51, 51N, 27, 98, 86, 25, 95, 30A, 30B, 64R		
	SEF NUMERICAL RELAY		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LDGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, FUSE FAILURE, ENERGY METERING, OVER LOAD PROTECTION 50, 50N, 51, 51N, 27, 98, 86, 25, 95, 30A, 30B		
	NUMERICAL RELAY FDR PROTECTION, T/C SUPERVISION, LDGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, FUSE FAILURE, 50, 50N, 51, 51N, 27, 98, 86, 25, 95, 30A, 30B		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, FUSE FAILURE, ENERGY METERING, OVER LOAD PROTECTION 50, 50N, 51, 51N, 27, 98, 86, 25, 95, 30A, 30B, DG PROTECTION (Like Neutral Under-voltage-27N, Power Direction / Reverse Power (Islanding)-32, Negative Phase Sequence Over-current (Phase unbalance, reverse phase sequence) -46, , Negative Sequence Voltage -47, Ground Over-voltage trip or ground over-current trip-51G, Instantaneous Over-voltage trip (ferro-resonance)-59, Over-voltage trip-59T, Neutral over-voltage-59N, Over/Under Frequency trip-81O/ 81U etc.)		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & FUSE FAILURE, OVER LOAD PROTECTION 50, 50N, 51, 51N, 27, 98, 86, 95, 30A, 30B		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION-95, LOGIC, METERING FUNCTION & FUSE FAILURE-98, OVER LOAD PROTECTION, LOCKED ROTOR PROTECTION-14, RESTART INHIBIT PROTECTION-49, NEGATIVE SEQUENCE PROTECTION-46, 50, 50N, 51, 51N, 27, 86, 30A, 30B		
	Communicable type Numerical relay for D/C, E/F, TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for O/C, E/F, Check Synchronization, TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for Voltage control O/C, 3Phase O/C, Reverse power, Differential, Neutral Displacement, E/F, U/V, O/V protection, Check Synchronization, TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for Under voltage, Over voltage etc. on IEC-61850 protocol		
	Communicable type Numerical relay for E/F protection for DCD8 on IEC-61850 protocol		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

14

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO. / ITEM DESCRIPTION	UNIT PRICE (Rs.)
	Communicable type Numerical relay for composite motor protection including TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for Neutral Displacement on IEC-61850 protocol		
	Communicable type Numerical relay for O/C, E/F, TC Supervision on Modbus protocol		
	Communicable type Numerical relay for O/C, E/F, Check Synchronization, TC Supervision on Modbus protocol		
	Communicable type Numerical relay for Voltage control O/C, 3Phase O/C, Reverse power, Differential, Neutral Displacement, E/F, U/V, O/V protection, Check Synchronization, TC Supervision on Modbus protocol		
	Communicable type Numerical relay for Under voltage, Over voltage etc. on Modbus protocol		
	Communicable type Numerical relay for E/F protection for DCDB on Modbus protocol		
	Communicable type Numerical relay for composite motor protection including TC Supervision on Modbus protocol		
	Communicable type Numerical relay for Neutral Displacement on Modbus protocol		
	Numerical Check synchronising Relay		
	Check synchronising Relay Type-SKE11 or better		
	Guard Relay		
	NUMERICAL RELAY Over current and Earth fault		
	BATTERY EARTH FAULT RELAY, 1-7mA, NOMINAL VOLTAGE-220V DC, 1DV, 2NO S/R, FLUSH		
	OVERLOAD RELAY, NOMINAL VOLTAGE-220V DC, O/V VLTAGE SETTING-110%, 1/4NV, 1ND+1NC S/R		
	UNDER VDLTAGE RELAY, NOMINAL VOLTAGE-220V DC, U/V SETTING-80%, AUX.-240V AC, 1/2NH, 1ND+2NC S/R		
	JAMING RELAY - CAG17		
	q) Bimetal Thermal O/L Relays		
	i) Thermal D/L relay with SPP - DLR		
	Upto 5.5KW		
	5.6 to 11KW		
	11.1 to 22KW		
	22.1 to 45KW		
	45.1 to 75KW		
	75 to 110KW		
	ii) Heavy Duty Thermal D/L relay with SPP - OLR		
	Upto 5.5KW		
	5.6 to 11KW		
	11.1 to 22KW		
	22.1 to 45KW		
	45.1 to 75KW		
	75 to 110KW		
	r) Timer (DC)		
	ON DELAY TIMER, 0.5-5SEC., 220V DC, 2NO+2NC		
	ON DELAY TIMER, 1.0-10SEC. 220V DC, 2NO+2NC		
	240VAC MTR RESTART CONTRDL TIMER (2-60SECS)		
	240VAC ON DELAY TIMER(1-10SECNS)WITH 1NO		
	220VDC ON DELAY TIMER(.5-5SECS) WITH 1NO		
	220VDC ON DELAY TIMER(0.5-5SECS)WITH 3NO		
	220VDC ON DELAY TIMER(1-10SECS) WITH 3NO		
	s) Meter		
	AC ammeter (Digital)		
	AC ammeter (Analog) linear scale		
	AC ammeter (Analog) compressed scale		
	DC ammeter (Digital)		
	DC ammeter (Analog)		
	AC voltmeter (Digital)		
	DC voltmeter (Analog)		
	Wattmeter (3 Phase)		
	Wattmeter (1 Phase)		
	TVM meter		
	DIGITAL ENERGY METER		
	Frequency meter		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

15

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	Synchroscope		
	Differential Voltmeter		
	Differential Frequency meter		
	Multifunction digital Energy meter with RS485 Port (0.2 Acc. Class)		
	Multifunction digital Energy meter with RS485 Port (0.5 Acc. Class)		
	Multifunction digital Energy meter with RS485 Port (1.0 Acc. Class)		
t)	Single Phase Preventor Relay		
u)	MCB		
	6A, 4P 415V AC		
	6A DP, 240V AC		
	10A DP, 240V AC		
	16A DP, 240V AC		
	32A DP, 240V AC		
	6A DP, 110V AC		
	10A DP, 110V AC		
	16A DP, 110V AC		
	32A DP, 110V AC		
	16A DP, 220V DC		
	6A DP, 220V DC		
	6A DP, 240V AC		
	10A SP, 240V AC		
	16A SP, 240V AC		
	32A SP, 240V AC		
	6A SP, 110V AC		
	10A SP, 110V AC		
	16A SP, 110V AC		
	32A SP, 110V AC		
	16A SP, 220V DC		
	6A SP, 220V DC		
v)	SWITCH & PUSH BUTTON		
	BREAKER CONTROL SWITCH, 16A,220V DC, 2CLOSE+2TRIP		
	DC ISOLATING SWITCH 16A,220V DC, DP, BASE MTG.		
	16A,240V AC SELECTOR SWITCH 3WAY, 4POLE, FLUSH MTG		
	25A,240V AC SELECTOR SWITCH 3WAY, 4POLE, FLUSH MTG		
	16A,240V AC SELECTOR SWITCH 2WAY, 2POLE, FLUSH MTG		
	NORMAL/ TRIAL SEL. SWITCH, 2POLE , 2WAY, 10A 240V AC, FLUSH MTG,		
	MCC/ NORMAL/ TRIAL SEL. SWITCH, 2POLE ,3WAY, 10A 240V AC, FLUSH MTG		
	SWGR/ REMOTE SEL. SWITCH 3PDLE 2WAY,16A 220V DC, FLUSH MTG		
	SWGR/ NORMAL/ TRIAL SEL. SWITCH, 3POLE, 3WAY, 16A 220V DC, FLUSH MTG.		
	NORMAL/ TRIAL SEL. SWITCH, 2POLE , 2WAY, 10A 240V AC, FLUSH MTG, LOCKABEL TYPE		
	MCC/ NORMAL/ TRIAL SEL. SWITCH, 2POLE ,3WAY, 10A 240V AC, FLUSH MTG, LOCKABEL TYPE		
	SWGR/ REMOTE SEL. SWITCH 3POLE 2WAY,16A 220V DC, FLUSH MTG. LOCKABLE TYPE		
	SWGR/ NORMAL/ TRIAL SEL. SWITCH, 3POLE, 3WAY, 16A 220V DC, FLUSH MTG., LOCKABLE TYPE		
	AMMETER SELECTOR SWITCH		
	VOLTMETER SELECTOR SWITCH		
	TOGGLE SWITCH 5A, 240V AC		
	AC SWITCH SPST-5A,240V AC		
	10A, 220V DC SWITCH		
	Door Limit switch		
	Ammeter selector switch		
	Voltmeter selector switch		
	Synchronisation selector switch		
	Trip selector switch		
	Push Button		
	2NO + 2NC Shrouded		
	1NO + 1NC Shrouded		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

16

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	2NO + 2NC Mushroom head stayput		
	2NO + 2NC Lockable type		
w)	Indicating Lamp Assembly (LED Type)		
	240V AC-GREEN		
	240V AC-RED		
	240V AC- AMBER		
	110V AC-GREEN		
	110V AC-RED		
	110V AC- AMBER		
	220V DC-WHITE		
	220V DC-RED		
	220V DC-GREEN		
	220V DC-BLUE		
	220V DC- AMBER		
	63.5V AC-RED		
	63.5V AC-YELLDW		
	63.5V AC-BLUE		
x)	CT		
i)	Metering CT		
	Upto 75/1A		
	100/1A		
	125/1A		
	150/1A		
	200/1A		
	250/1A		
	300/1A		
	400/1A		
	500/1A		
	630/1A		
	600/1A		
	1000/1A		
	1250/1A		
	1600/1A		
	2000/1A		
	2500/1A		
	3000/1A		
	4000/1A		
ii)	Protection CT (5P20)		
	Upto 75/1A		
	100/1A		
	125/1A		
	150/1A		
	200/1A		
	250/1A		
	300/1A		
	400/1A		
	500/1A		
	630/1A		
	800/1A		
	1000/1A		
	1250/1A		
	1600/1A		
	2000/1A		
	2500/1A		
	3000/1A		
	4000/1A		
	630/5A		
	800/5A		
	1000/5A		
	1250/5A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

17

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	1600/5A		
	2000/5A		
	2500/5A		
	3000/5A		
	4000/5A		
iii)	PS Class CT		
	1600/1A		
	2500/1A		
	3000/1A		
	4000/1A		
	1600/5A		
	2500/5A		
	3000/5A		
	4000/5A		
y)	Voltage Transformer		
i)	415/√3 : 110/√3V, 1ph, 50VA		
ii)	415/√3 : 110/√3V, 1ph, 100VA		
iii)	415/√3 : 240/√3V, 1ph, 50VA		
iv)	415/√3 : 240/√3V, 1ph, 100VA		
z)	Toggle switch (16A)		
aa)	Secondary Isolating Contact Block		
ab)	Control Terminal (Fixed)		
ac)	Thermostat		
ad)	CONTROL TRANSFORMER		
	415/240V,CL-E, 1 KVA		
	415/240V,CL-E, 2KVA		
	415/240V,CL-E, 2.5KVA		
	415/240V,CL-E, 3KVA		
	415/240V,CL-E, 5KVA		
	415/240V,CL-E, 10KVA		
	415/110V,CL-E, 1 KVA		
	415/110V,CL-E, 2KVA		
	415/110V,CL-E, 2.5KVA		
	415/110V,CL-E, 3KVA		
	415/110V,CL-E, 5KVA		
	415/110V,CL-E, 10KVA		
ac)	4-20mA Dual o/p, Aux sup 220V DC, 1A, Current Transducer		
	4-20mA Dual o/p, Aux sup 240V AC, 1A, Current Transducer		
	4-20mA Dual o/p, Aux sup 110V AC, 1A, Current Transducer		
	4-20mA Dual o/p, Aux sup 220V DC, Voltage Transducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 240V AC, Voltage Transducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 110V AC, Voltage Transducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 220V DC, Frequency Transducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 220V DC, Input 0-75mV DC, Current Transducer-DC		
	4-20mA Dual o/p, Aux sup 240V AC, Input Voltage 0-220V DC, Voltage Transducer-DC		
ad)	4-20mA Dual Output kW transducer		
ae)	4-20mA Dual Output kVA transducer		
af)	4-20mA Dual Output PF transducer		
ag)	4-20mA Dual Output Frequency transducer		
ah)	Interposing relay RE 302 or Eqvt with freewheeling diode & LED		
ai)	Laptop PC alongwith software & hardware		
aj)	3 PIN SOCKET - 5A, 110V AC, 3PIN		
ak)	THERMOSTATE, DIAL TYPE		
am)	SPACE HEATER		
an)	CFL WITH HDLDER		
ao)	NEUTRAL LINK		
	20A FDR CONTROL CKT. & PDWER CKT. UPTO 25A MCCB RATING		
	32A FOR 50A MCCB RATING		
	63A FOR 100A & 125A MCCB RATING		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

18

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO. / ITEM DESCRIPTION	UNIT PRICE (Rs.)
	125A FOR 250A MCCB RATING		
	250A FOR 400A & 500A MCCB RATING		
ap)	CASTLE KEY INTERLOCK FOR MCCB - 3LOCK+2KEY		
aq)	MECHANICAL INTERLOCK FOR POWER CONTACTOR		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
ar)	AUX. CONTACTOR		
	2NO+2NC, CV-220V DC		
	4NO, CV-220V DC		
	2NO+2NC, CV-240V AC		
	3NO+1NC, CV-240V AC		
	2NO+2NC, CV-110V AC		
	3NO+1NC, CV-110V AC		
	1NO + 1NC 240V AC		
	1NO + 1NC 110V AC		
	1NO + 1NC 220V DC		
	1NO 240V AC		
	1NO 110V AC		
	1NO 220V DC		
as)	ISOLATING TRANSFORMER-15kVA		
	ISOLATING TRANSFORMER-20kVA		
	ISOLATING TRANSFORMER-25kVA		
	ISOLATING TRANSFORMER-30kVA		
19	Foundation Frame		
a)	MCC panel		
	upto 1600A (SF)		
	2500A (SF)		
	3000A (SF)		
	4000A (SF)		
	upto 1600A (DF)		
	2500A (DF)		
	3000A (DF)		
	4000A (DF)		
b)	220V DCDB panel		
	SF		
	DF		
c)	PCC / PMCC panel		
	upto 1600A		
	2500A		
	3000A		
	4000A		
20	Connection from PMCC/MCC panel to PMCC/MCC panel		
	250A		
	400A		
	630A		
	800A		
	1000A		
	1600A		
	2500A		
	3000A		
	4000A		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

19

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
21	Cable Glands & Lugs:		
a)	Single Compression Cable Glands for cable sizes:		
	2C X 2.5 Sq. mm.		
	3C X 2.5 Sq. mm.		
	5C X 2.5 Sq. mm.		
	7C X 2.5 Sq. mm.		
	12C X 2.5 Sq. mm.		
	16C X 2.5 Sq. mm.		
	2C X 10 Sq. mm.		
	2C X 16 Sq. mm.		
	2C X 25 Sq. mm.		
	2C X 35 Sq. mm.		
	2C X 50 Sq. mm.		
	2C X 70 Sq. mm.		
	2C X 95 Sq. mm.		
	3C X 2.5 Sq. mm.		
	3C X 10 Sq. mm.		
	3C X 16 Sq. mm.		
	3C X 25 Sq. mm.		
	3C X 35 Sq. mm.		
	3C X 50 Sq. mm.		
	3C X 70 Sq. mm.		
	3C X 95 Sq. mm.		
	3C X 150 Sq. mm.		
	3C X 185 Sq. mm.		
	3C X 240 Sq. mm.		
	3.5C X 25 Sq. mm.		
	3.5C X 50 Sq. mm.		
	3.5C X 70 Sq. mm.		
	3.5C X 300 Sq. mm.		
	3.5C X 240 Sq. mm.		
	3.5C X 185 Sq. mm.		
	3.5C X 95 Sq. mm.		
	4C X 16 Sq. mm.		
	4C X 35 Sq. mm.		
	1C X 400 Sq. mm.		
	1C X 630 Sq. mm.		
b)	Double Compression Cable Glands for cable sizes:		
	2C X 2.5 Sq. mm.		
	3C X 2.5 Sq. mm.		
	5C X 2.5 Sq. mm.		
	7C X 2.5 Sq. mm.		
	12C X 2.5 Sq. mm.		
	16C X 2.5 Sq. mm.		
	2C X 10 Sq. mm.		
	2C X 16 Sq. mm.		
	2C X 25 Sq. mm.		
	2C X 35 Sq. mm.		
	2C X 50 Sq. mm.		
	2C X 70 Sq. mm.		
	2C X 95 Sq. mm.		
	3C X 2.5 Sq. mm.		
	3C X 10 Sq. mm.		
	3C X 16 Sq. mm.		
	3C X 25 Sq. mm.		
	3C X 35 Sq. mm.		
	3C X 50 Sq. mm.		
	3C X 70 Sq. mm.		
	3C X 95 Sq. mm.		
	3C X 150 Sq. mm.		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

20

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	3C X 185 Sq. mm.		
	3C X 240 Sq. mm.		
	3.5C X 25 Sq. mm.		
	3.5C X 50 Sq. mm.		

**2x660 MW Ennore SEZ Supercritical Thermal Power
Project at Ash Dyke of NCTPS
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

21

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	3.5C X 70 Sq. mm.		
	3.5C X 300 Sq. mm.		
	3.5C X 240 Sq. mm.		
	3.5C X 185 Sq. mm.		
	3.5C X 95 Sq. mm.		
	4C X 16 Sq. mm.		
	4C X 35 Sq. mm.		
	1C X 400 Sq. mm.		
	1C X 630 Sq. mm.		
c)	Cable Lugs for sizes:		
	2.5 Sq. mm.		
	10 Sq. mm.		
	16 Sq. mm.		
	25 Sq. mm.		
	35 Sq. mm.		
	50 Sq. mm.		
	70 Sq. mm.		
	95 Sq. mm.		
	120 Sq. mm.		
	150 Sq. mm.		
	185 Sq. mm.		
	240 Sq. mm.		
	300 Sq. mm.		
	400 Sq. mm.		
	630 Sq. mm.		
22	Module Name plate		
23	Wires for Secondary wiring:		
a)	1.5 Sq. mm. per meter		
b)	2.5 Sq. mm. per meter		
c)	4.0 Sq. mm. per meter		
24	Control Terminal for Secondary wiring suitable for cable size:		
a)	0.5 Sq. mm.		
b)	1.5 Sq. mm.		
c)	2.5 Sq. mm.		
25	ISMC channels		
a)	ISMC 75 channel per meter		
a)	ISMC 100 channel per meter		
26	ANY OTHER ITEM WHICH MAY BE REQUIRED FOR ADDITION / DELETION DURING DETAILED ENGINEERING		



**2X660 MW ENNORE SEZ Supercritical
Thermal Power Project at Ash Dyke of
NCTPS
TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-I)**

SPECIFICATION NO: EPD-TS-CPBG-14063

VOLUME NO. :

SECTION :

REV NO. : **00** DATE: 06.10.2017

SHEET : 1 OF 1

ANNEXURE-I

DRAWINGS AND DOCUMENTS DISTRIBUTION SCHEDULE



**2X660 MW ENNORE SEZ Supercritical
Thermal Power Project at Ash Dyke of
NCTPS**

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

SPECIFICATION NO. EPD-TS-CPBG-14063

VOLUME

SECTION

REV NO. 00 DATE 06/10/2017

SHEET 1 OF 1

ANNEXURE-I

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	5
7	TYPE TEST CERTIFICATES	5		

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

MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012			MANUFACTURING QUALITY PLAN			CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS						
ITEM : L V SWITCH BOARDS			REFERENCE DOCUMENT									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK	7.	8.	9.	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	M	T	C	11.
	(CTD & VTD)	ROUTINE TEST INCLUDING CALIBRATION 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 RELAY	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				P	V	V	
1.15		MAKE, TYPE, RATING		VISUAL	5% OF EACH TYPE	APPROVED DRG/TECH SPEC	APPROVED DRG/TECH SPEC	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			CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS					
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	11.
	TIMERS	CONTACT CONFIGURATION	MAJOR	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/MNFR CAT	APPROVED DRG/TECH SPEC/MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK	MAJOR	ELECT	5% OF EACH TYPE			LOG BOOK	P	V	V	
1.18	INDICATING INSTRUMENTS AMMETER, VOLTMETER MEM. WATT HOUR METER	MAKE, TYPE, RANGE & CLASS ROUTINE TEST	MAJOR	VISUAL	5% OF EACH TYPE	IS 1248(93) APPROVED	IS 1248(93) /APPROVED	LOG BOOK	P	V	V	
				ELECT	5% OF EACH TYPE			SUPPLIER TC	P	V	V	
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	

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

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS									
ITEM : L V SWITCH BOARDS				REFERENCE DOCUMENT			ACCEPTANCE NORMS			FORMAT OF RECORD			AGENCY			REMARKS
													M	T	C	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK	7.	8.	9.	10.			11.				
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					
		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		ELECT	-DO-			SUPPLIER TC/ LOG BOOK	P	V	V					
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		ELECT	-DO-			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					

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

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS					
ITEM: L V SWITCH BOARDS												
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.	
1.26	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	
		PAIN'T 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 TYPE	APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		SURFACE FINISH, CHCEK FOR WAVINESS AND FLATNESS	MAJOR	VISUAL	5% OF EACH TYPE	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	

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

 MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN				CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS						
ITEM : L V SWITCH BOARDS		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY			REMARKS	
								M	T	C		
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK	7.	8.	9.	10.			11.
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	
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	
3.0	IN-PROCESS	COMPRESSION, ELONGATION AT BREAK AND AGING, TEST,OZONE RESISTANCE	MAJOR	TEST	-DO-	-DO-	-DO-	SUPPLIER TC	V	V	V	
										V	V	

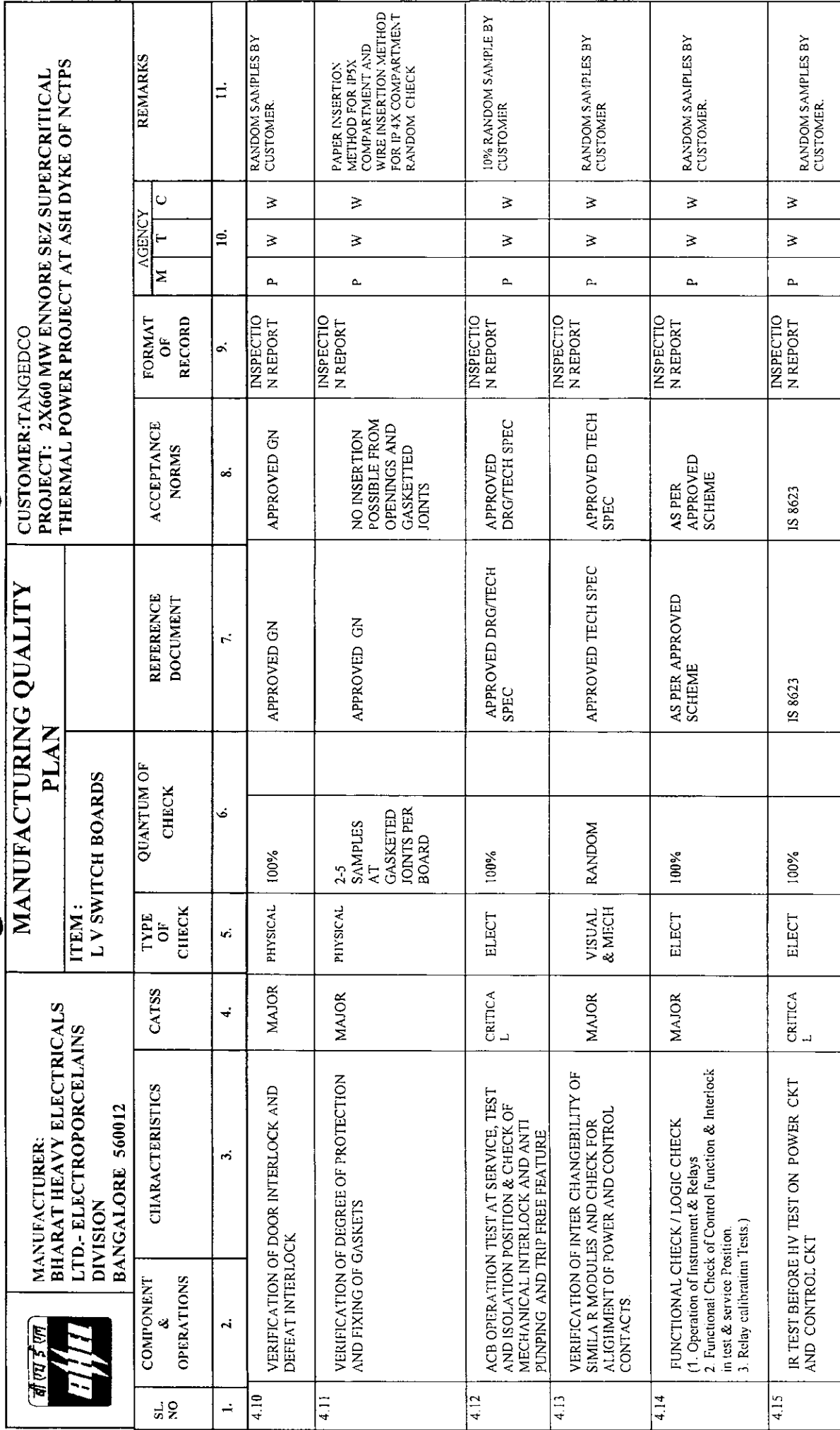
MANUFACTURER/ SIGNATURE		LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRV/UNL P: PERFORM, W: WITNESS, V: VERIFICATION			
				APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012			MANUFACTURING QUALITY PLAN			CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCritical THERMAL POWER PROJECT AT ASH DYKE OF NCTPS				
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	11.
3.1	PRE TREATMENT AND PAINTING (POWDER COATING)	1. CHEMICAL CONCENTRATION CHECK OF ALL TANKS FOR PRE TREATMENT OF SHEET STEEL (7 TANK PROCESS) 2. PAINT SHADE 3. PAINT THICKNESS AND ADHESION	MAJOR	CHEMICAL	MANFR STD	MANFR STD/ IS 6005	MANFR STD/ IS 6005	SUPPLIER TC	V	V	V	
			MAJOR	VISUAL	1 SAMPLE PER LOT	TECH. SPEC/ APPROVED DRAWING	TECH. SPEC/ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
			MAJOR	MEASUR / TEST	MANUF. PRACTICE	TECH. SPEC/ APPROVED DRAWING	TECH. SPEC/ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
3.2	DRAWOUTS	SIZE/ TYPE	MAJOR	MEASUR	1 NO OF EACH TYPE	APPROVED DRG	APPROVED DRG	SUPPLIER TC/ LOG BOOK	V	V	V	
		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	

LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMER: RRVUNL			
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MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012			MANUFACTURING QUALITY PLAN			CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS						
ITEM : L V SWITCH BOARDS			REFERENCE DOCUMENT									
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	
4.4	MEASUREMENT OF TIGHTENING TORQUE OF BUSBAR JOINTS BY TROUQUE WRENCH		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.
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	INSPECTIO N 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	INSPECTIO N REPORT	P	W	W	
4.8	VERIFICATION OF SINGLE LINE DIAGRAM COMPONENTS AND LEGENDS		MAJOR	VISUAL	100%	APPROVED DRG SLD	APPROVED DRG SLD	INSPECTIO N 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	INSPECTIO N REPORT	P	W	W	

LEGEND: M: MANUFACTURER , VENDOR, T: CONSULTANT , TCE & BHEL, C: CUSTOMER: RRVUNL				
MANUFACTURER/ SIGNATURE		APPROVED BY		APPROVAL SEAL



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

MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012			MANUFACTURING QUALITY PLAN				CUSTOMER:TANGEDCO PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS						
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.	
4.16	HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%	IS 8623	IS 8623	INSPECTIO N 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	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.	
4.18	TYPE TEST		CRITICAL	ELECT	I/ITEM	PO SPEC, DRG IS 60529 IS 8623	PO SPEC, DRG IS 60529 IS 8623	INSPECTIO N REPORT	P	V	V	AS PER BELOW NOTE	
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 IEC60439)

3. SHORT CIRCUIT TEST (AS PER IEX60439)

FUNCTIONAL/ PERFORMANCE CHECKS TO BE CONDUCTED ON ENTIRE BOARD WHILE ALL POWER SUPPLIES SWITCHED ON.

C.

		LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMER: RRVUNL	
MANUFACTURER/ SIGNATURE			
		APPROVED BY	APPROVAL SEAL



**2X660 MW ENNORE SEZ Supercritical
Thermal Power Project at Ash Dyke of
NCTPS
TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. EPD-TS-CPBG-14063
VOLUME NO. :
SECTION :
REV NO. : 00
SHEET : Page 1 of 3

LIST OF CODES & STANDARDS

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 appartatus 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 busbars	[✓] 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 catridge fuses	[✓] IS:13703	[] BS: 88	[] IEC : 269-1



**2X660 MW ENNORE SEZ Supercritical
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LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. EPD-TS-CPBG-14063
VOLUME NO. _____
SECTION : _____
REV NO. : 00
SHEET : Page 2 of 3

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



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TECHNICAL SPECIFICATION FOR
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SPECIFICATION NO. EPD-TS-CPBG-14063
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 :

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

PROPOSED MAKE OF COMPONENTS

SL.NO	ITEM CATEGORY	PROPOSED MAKE
1	AIR CIRCUIT BREAKER (ACB)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
2	MOULDED CASE CIRCUIT BREAKER (MCCB)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
3	SWITCH FUSE UNIT (SFU)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
4	MOTOR PROTECTION CIRCUIT BREAKER (MPCB)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
5	MINIATURE CIRCUIT BREAKER (MCB)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T 7.HAVELLS 8.LEGRAND 9.STANDARD
6	ELECTRONIC MOTOR PROTECTION RELAY (EMPR)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
7	CURRENT TRANSFORMER (CT)	1.AE 2.PRECISE 3.KAPPA 4.INDCOIL 5.KALPA 6.PRAGATI
8	VOLTAGE TRANSFORMER (VT/PT)	1.AE 2.PRECISE 3.KAPPA 4.INDCOIL 5.KALPA 6.PRAGATI

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
PROPOSED MAKE OF COMPONENTS

SL.NO	ITEM CATEGORY	PROPOSED MAKE
9	CONTROL TRANSFORMER (CST)	1.AE 2.PRECISE 3.KAPPA 4.INDCOIL 5.KALPA 6.PRAGATI
10	INTERPOSING/COUPLING RELAY	1.JYOTI 2.OEN 3.PLA 4.SCHNEIDER 5.OMRON 6.GUARDIAN
11	NUMERICAL PROTECTION RELAY	1.ABB 2.GE(ALSTOM) 3.SIEMENS 4.SEL 5.SCHNEIDER
12	ELECTROMECHANICAL PROTECTION RELAY	1.ABB 2.ALSTOMS/GE 3.L&T 4.SIEMENS 5.JVS
13	THERMAL OVERLOAD RELAY (OLR)	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
14	TIMER/TIME DELAY RELAY	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
15	MULTIFUNCTION METER (MFM)	1. AE 2.RISHAB 3.SECURE 4.SCHNEIDER/CONZERV 5.MECO 6.L&T 7.ELMEASURE
16	ENERGY METER (TVM)	1. ABB 2. SCHNEIDER 3. SECURE
17	AC POWER CONTACTOR	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
PROPOSED MAKE OF COMPONENTS

SL.NO	ITEM CATEGORY	PROPOSED MAKE
18	DC POWER CONTACTOR	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T 7.BCH
19	AC AUXILIARY CONTACTOR	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
20	DC AUXILIARY CONTACTOR	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
21	AUXILIARY RELAY	1.ABB 2.ALSTOMS/GE 3.L&T 4.SIEMENS 5.JVS
22	AMMETER (ANALOG)	1. AE 2.RISHAB 3.IMP 4.MECO
23	VOLTMETER(ANALOG)	1. AE 2.RISHAB 3.IMP 4.MECO
24	AMMETER (DIGITAL)	1. AE 2.RISHAB 3.SECURE 4.SCHNEIDER/CONZERV 5.MECO 6.L&T
25	VOLTMETER(DIGITAL)	1. AE 2.RISHAB 3.SECURE 4.SCHNEIDER/CONZERV 5.MECO 6.L&T
26	FUSE BASE WITH HOLDER	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

PROPOSED MAKE OF COMPONENTS

SL.NO	ITEM CATEGORY	PROPOSED MAKE
27	POWER/CONTROL FUSE	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T 7.COPPER-BUSSMANN
28	CONTROL SWITCHES	1.KAYCEE 2.L&T (SALZER) 3.RECOM 4.SWITRON
29	ETHERNET SWITCHES	1.RUGGEDCOM 2.GARRETCOM 3.NETGEAR 4.HIRSCHMANN 5.MOXA 6.CISCO
30	TRANSDUCER	1. AE 2.RISHAB 3.SECURE 4.SOUTHERN 5.MECO
31	INDICATION LAMP	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC(RASS) 4.SIEMENS 5.L&T(ESBEE) 6.VAISHNO 7.TEKNIC 8.SECO
32	PUSH BUTTON	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC(RASS) 4.SIEMENS 5.L&T(ESBEE) 6.VAISHNO 7.TEKNIC
33	CABLE GLANDS	1.HEX 2.COMET 3.DOWELLS 4.3D 5.SUNIL & CO. 6.JAINSON
34	CABLE LUGS	1.HEX 2.COMET 3.DOWELLS 4.3D 5.SUNIL & CO. 6.JAINSON
35	TERMINAL BLOCK	1. PHOENIX 2.CONNECTWELL 3.ELEMEX 4.WAGO

2X660 MW ENNORE SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

PROPOSED MAKE OF COMPONENTS

SL.NO	ITEM CATEGORY	PROPOSED MAKE
36	INDUSTRIAL SOCKET	1. SCHNEIDER 2. ANCHOR 3. BAJAJ 4. PHILIPS 5. CROMPTON GREAVES 6.BCH

NOTE:- ABOVE MAKE OF COMPONENTS ARE INDICATIVE AND SUBJECT TO CUSTOMER ACCEPTANCE AND APPROVAL.