

1X800MW NORTH CHENNAI TPP-III

TECHNICAL SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR

BHEL DOCUMENT NO. : EPD-TS-CPBG-16004, REV-0



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



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SPECIFICATION NO. : EPD-TS-CPBG-16004

VOLUME NO. :

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SHEET : 1 OF 1

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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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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Un-priced copy of TECHNICAL SPECIFICATION and all Annexures 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 Vertical consider by vendor for each boards are to be compulsory given along with offer in such a way that entire tender load data of respective switchboard can be accommodated.**
 - 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 in deviation sheet if any. Deviations mentioned elsewhere will not be considered for evaluation.
10. Vendor to complete the panel in all respect and offer to BHEL for inspection prior to offering the same to customer for inspection.

BIDDER'S STAMP & SIGNATURE



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SECTION – ‘A’

SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacturing, assembly, relay parameterization and site support, inspection and testing at manufacturer's works, proper packing and delivery of **LOW VOLTAGE SWITCHGEAR** to site, as mentioned in different sections of this specification for 1X800MW NORTH CHENNAI 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



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III

EPC TENDER SPECIFICATION FOR BTG PACKAGE



CHAPTER 2 PROJECT INFORMATION

1.1 GENERAL

TANGEDCO has planned to establish 1X800MW Coal Based Super Critical North Chennai Thermal Power Project Stage III in the premises of existing NCTPS at Ennore & Puzhuthivakkam Village, Ponneri Taluk, Thiruvallur District, Tamil Nadu, India. This project will be executed in two package mode i.e, BTG with related Civil Works and BOP with related Civil Works.

1.2 LOCATION

The proposed site for main power plant is located near Ennore port (approx 5 km) and also 35 km from Chennai City.

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

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

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

1.3 PROJECT INFORMATION

1.1	Project Title	:	1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III.
1.2	Plant capacity	:	800 MW
1.3	Type of project	:	Brown field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	In the premises of North Chennai Thermal Power Station (NCTPS)
1.6	Location co-ordinates	:	80 19' E to 80 20' E Longitude 13 13' N to 13 18' N Latitude
1.7	Nearest Village	:	Ennore & Puzhuthivakkam Village
1.8	Nearest Town & City	:	Chennai (35 Km)
1.9	State Capital	:	Chennai (35 Km)



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1.10	Nearest Railway Station	:	Athipattu Pudunagar (5 Km) on Chennai Vijayawada Line
1.11	Nearest Airport	:	Chennai (60 Km)
1.12	Nearest Seaport	:	Ennore (3 Km)
1.13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur Ponneri highway
2.0	Meteorological Condition		
2.1	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
2.2	Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	45 C
b.	Annual Minimum Mean Temperature	:	15 C
c.	Design ambient temperature	:	30 C
2.4	Relative Humidity		
a.	Maximum	:	90
b.	Minimum	:	36
c.	Design	:	75
2.5	Annual Rainfall		
	Maximum	:	2540 mm
	Average	:	1600 mm
	Minimum	:	1175 mm
2.6	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)



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2.7	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
2.7	Seismic zone	:	Zone: III as defined in IS:1893-2002
2.8	Design ambient temperature for Electrical equipment	:	50 C

1.4 ACCESS TO SITE

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

1.5 PLANT RATING, CAPACITY, AVAILABILITY, PLF

Plant continuous rating will be 800MW at Generator terminals based on the following site conditions.

- Ambient Air temperature
- Condenser cooling water inlet temperature of 33 Deg. C and 9 Deg. C temperature rise across the condenser.
- Generator Power factor of 0.85
- Fuel Specification as given elsewhere
- Design temperature of electrical equipment is 50 Deg. C

The VWO capacity of the steam turbine shall not be less than 105 TMCR flow at rated parameters. Boiler maximum Continuous Rating (MCR) is at least 1.02 times the steam flow at turbine VWO condition plus continuous auxiliary steam requirement of unit at TMCR, rounded to next integer divisible by 5.

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 .

1.6 SOURCES OF FUEL

TANGEDCO has long term linkage of Coal from the coal sources of Talcher or Mahanadi in Orissa. Domestic coal requirement for the power plant will be sourced from kalinga block of the Talcher, Mahanadhi and IB valley coal field.

The Imported coal has been sourced from foreign countries through sea to Ennore port. The coal will be conveyed from port through conveying system.

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



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EPC TENDER SPECIFICATION FOR BTG PACKAGE

1.7 Coal Analysis

1.7.1 Coal Quality parameter

a) Domestic Coal

A. Proximate Analysis			
1.	Total Moisture		16.0
2.	Ash		45.0
3.	Volatile matter		19.0
4.	Fixed Carbon		20.0
5.	Gross calorific value (as received basis)	kcal/kg	2800
B. Ultimate Analysis			
1.	Carbon		27.7
2.	Hydrogen		2.6
3.	Sulphur		0.5
4.	Nitrogen		0.52
5.	Oxygen		7.26
6.	Moisture		16.0
7.	Ash		45.0
8.	HGI		45 -55, Avg 52
9.	Carbonates		0.38
10.	Phosphorous		0.04
11.	YGP Index	mg/kg	50-70
12.	Shale and Sand stone Content		Max 20
13.	Feed Coal Size	mm	Upto 50
C. Ash Fusion Temperature			
	Initial Deformation, IT	Deg. C	1100
	Spherical, ST	Deg. C	1200
	Hemispherical, HT	Deg. C	1300
	Fluid, FT	Deg. C	-
ASH ANALYSIS			
	SiO ₂		59.54
	Al ₂ O ₃		29.00
	Fe ₂ O ₃		6.42
	CaO		1.50
	Na ₂ O		0.08
	K ₂ O		-
	TiO ₂		1.60
	SO ₃		0.25
	P ₂ O ₅		0.51
	MgO		0.50
	Others		0.60
	Total		100.00
	Resistivity of Fly Ash	Ohm-cm	1.73 X10 ⁻¹²



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b) Imported Coal

A. Proximate Analysis			
1.	Total Moisture		16.50
2.	Ash		6.62
3.	Volatile matter		36.45
4.	Fixed Carbon		40.43
5.	Gross calorific value (as received basis)	kcal/kg	5642
B. Ultimate Analysis			
1.	Carbon		60.12
2.	Hydrogen		4.38
3.	Sulphur		0.53
4.	Nitrogen		1.48
5.	Oxygen		10.37
6.	Moisture		16.5
7.	Ash		6.62
8.	HGI		51
9.	Carbonates		-
10.	Phosphorous		-
11.	Total		100
C Ash fusion temperature			
	Initial Deformation, IT	Deg. C	1230
	Spherical, ST	Deg. C	1270
	Hemispherical, HT	Deg. C	1320
	Fluid, FT	Deg. C	-
ASH ANALYSIS			
	SiO ₂		36.00
	Al ₂ O ₃		13.90
	Fe ₂ O ₃		14.80
	CaO		12.70
	Na ₂ O		0.70
	K ₂ O		1.70
	TiO ₂		0.80
	SO ₃		10.6
	P ₂ O ₅		0.20
	MgO		8.60
	Others		-
	Total		100.00



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

A. Proximate Analysis			
1.	Total Moisture (ARB)		Upto 23 Max
2.	Ash (ADB)		6.62
3.	Gross calorific value (as dried basis)	kcal/kg	5800 - 6500
4.	Fixed Carbon(ADB)		30 - 50
5.	Volatile Matter (ADB)		25 - 45
6	HGI		45 - 60
7	IDT (Under Reducing Atmosphere)	Deg.C	1100 - 1250
3.	Sulphur (ADB)		Upto 1 Max
4.	Size	mm	< 50

1.7.2 Specification of LDO

Specific Gravity 15 °C kg/cu.m	: 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 content Vol. Max.	: 0.25
Sediment Max. Content by Wt	: 0.1
Relevant Indian Standard	: IS 1460

1.7.3 Specification of HFO

Flash point °C min.	: 66
Sulphur % T max.	: 4.5
Viscosity in Centistokes 50 °C	: 370
Ash by wt.	: 0.1
Water content Vol. Max.	: 1.0
Sediment Max. Content by Wt	: 0.25
Gross Calorific Value, kcal/kg	: 10800

1.8 Fuel Transportation

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



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1.9 SOURCE OF WATER

Source of water for the proposed project is sea water. The intake shall be from the existing cooling water fore bay of NCTPS Stage-II. Treated water shall be provided to the plant cycle makeup and other requirements of BTG package at the respective terminal points. Refer Chapter 4 of this section.

1.10 SOURCE OF EQUIPMENT

The proposed plant will be supplied, erected and commissioned on dual EPC basis, i.e, BTG with related civil works and BOP with related civil works.

1.11 POWER EVACUATION PLAN

1x800MW Steam Generating Units shall be with a SF6 Generator Circuit Breaker GCB along with necessary additional items between Generator Transformer GT and Generator. Therefore GT shall be used for unit start-up / unit shutdown as well as for power evacuation by synchronization of unit by closing GCB.

Power will be evacuated from the proposed thermal power station at 765 KV voltage level through 765 KV transmission lines. The power evacuation lines would be double circuit 765 KV lines which will act as Line in & Line out circuit.

TECHNICAL SPECIFICATION
FOR
LT Switchgear



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2.2.11 LT SWITCHGEAR

2.2.11.1 CODES AND STANDARDS

All equipment and materials shall be designed, manufactured and tested in accordance with the latest editions including all applicable official amendments of relevant Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

Equipment and material conforming to any other standards, which ensure equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

All works shall be carried out as per the following codes and standards.

Sl.No	Code	Description
1	IEC-60947 IEC-60439 IS-13947	Low voltage switchgear and control gear assemblies.
2	IS-8623	Specification for Low-Voltage Switchgear and Control gear Assemblies
3	IEC-60664 IS-15382	Insulation coordination for equipment with low voltage systems
4	IEC-60044	Instrument transformers
5	IEC-60529	Degrees of protection provided by enclosures
6	IS-13118	High Voltage alternating circuit breakers
7	IS-2675	Enclosed distribution fuse boards and cut outs for voltages not exceeding 1000 V AC and 1200 V DC
8	IS-8828	Electrical Accessories – Circuit breaker for over current Protection
9	IS -12021	Specification for Control transformer for switchgear and control gear for voltages not exceeding 1000V AC
10	IS-5082	Wrought aluminium & aluminium alloy for electrical Purposes
11	IS-13703	Specification for low voltage fuses for voltages not exceeding 1000 V AC and 1500 V



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		DC
12	IS-8187	Specification for D Type fuses
13	IS- 6005	Code of practice for phosphating iron and steel
14	IS-694	694 PVC insulated cables for working voltages up to and including 1100
15	IS-722	AC Electricity Meters
16	IS-1248	Electrical Indicating instruments
17	IS-2551	Danger Notice Plates
18	IS-2629	Hot dip galvanizing
19	IS-2705	Current Transformers
20	IS-3043	Code of practice for earthing
21	IS-3072	Code of practice for installation and maintenance of Switchgear
22	IS-3156	Voltage Transformers
23	IS-3202	Code of practice for climate proofing of electrical equipment
24	IS-3231	Electrical relays for power system protection
25	IS-8686	Static Relays
26	IS-10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear
27	IS-11171	Specification for dry type transformers
28	IS-11353	Guide for uniform system of marking and identification of conductors and apparatus terminals

2.2.11.3.1 TYPE

Circuit Breakers	Shall be air break, three pole, spring charged, and horizontal
Switchgear	Fully draw out type single front



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MCC	Fully draw out type single front/Double front.
ACDB/DCDB	Fixed type single front

2.2.11.3.2 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	2.5 kV	2.5 kV
	frequency withstand voltage Main circuit Auxiliary Circuit	2.0 KV	2.0 KV
7)	System Earthing	Solidly Grounded	Unearthed
8)	Maximum system fault level	50KA for 1sec	25KA for 1 sec

2.2.11.3.3 General Technical Requirements

Power from LV service transformers shall be supplied to 415 V switchgears. Power from 415 switchgears to the various MCCs, PDBs, ACDBs etc. shall be supplied from redundant incomers. These switchgears shall distribute power to LV auxiliary motors and also to other auxiliary loads viz. MCCs / ACDBs, etc. LV switchgears shall be of metal enclosed indoor type. Incomers / bus-couplers, outgoing tie feeders rated 630A & above and motor feeders rated 90 kW & above shall be equipped with air circuit breakers of fault interrupting capacity of 50 KA rms.

All PCC/PMCC/MCC shall be of intelligent type compatible with IEC-61850 communication protocol. Utility MCCs like service building MCC, Welding DBs, AC & Ventilation MCCs, etc., shall be non-intelligent type.



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All the boards shall be sectionalized, except for turbine valve DB.

Not more than 2 out of 3 ACBs can be closed at a time unless at the time of planned short time paralleling through synchro check.

Under normal mode of operation each incoming source shall be connected to the respective bus sections with bus coupler open.

During the normal mode of operation if there is a loss of normal source to any bus-section, slow bus auto changeover shall be initiated to first trip the normal incomer connected to this section and further close the bus coupler to extend power from healthy bus section.

Restoration of normal operating condition (described in 1.14.6 above) shall be through planned manual changeover through synchro check paralleling or manual dead bus closing.

Incase parallel running between two sources prolong over a set time, an alarm shall be generated and the last ACB to close shall be opened.

The AC control supply voltage for motors rated below 90 kW shall be 110V AC. For this purpose each motor feeder of PMCC/MCC shall be provided with suitable rated 415/110V Control Transformer. Separate control transformer for test bus supply shall be provided for each bus section.

All circuit breakers shall have 220V DC control.

2.2.11.3.4 List of minimum required LV switchgears

S.No	N a m e of LV Switchboard
1.	UNIT PMCC
2.	BUNKER FLOOR MCC
3.	UNIT MLDB
4.	VENTILATION MCC
5.	AC MCC
6.	BOILER MCC
7.	SOOT BLOWER MCC
8.	BOILER VALVE DAMPER MCC
9.	MILL SYSTEM MCC



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10. TURBINE AUX. MCC
11. TURBINE VALVE DB
12. BOILER ACDB
13. ESP # 1A PMCC
14. ESP # 1B PMCC
15. ESP # 1C PMCC
16. ESP # 1D PMCC
17. ESP # 1E PMCC
18. ESP # 1F PMCC
19. ESP ACDB
20. ESP AC & VENTILATION MCC
21. ESP MLDB
22. DG SWGR AMF PANEL
23. UNIT NORMAL CUM EMERGENCY PMCC
24. 415 V AC ELDB
25. 415 V AC TG Building
26. FUEL OIL UNLOADING PH PMCC
27. SERVICE BUILDING MCC
28. AIR WASHER MCC
29. WELDING PDBs
30. AC AND VENTILATION MCC
31. CPU REGENERATION MCC
32. Main Lighting Distribution Boards (MLDB)
33. Emergency Main Lighting Distribution Board (EMLDB)
34. DC Lighting Distribution Board (DCLDB)
35. AC Fuse Boards

Any other PCC/PMCC/MCC/DB required as per the geographical distribution of load and for any other system which is part of mechanical system under BTG package and required for safe and reliable functioning of the plant.



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2.2.11.2 TEMPERATURE RISE

The temperature rise of the horizontal and vertical busbars and main bus link including all the power drawout contracts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg c with silver plated joints and 40 deg c with all other types of joints over an ambient of 50 deg c.

2.2.11.3 OPERATIONAL REQUIREMENTS

2.2.11.3.1 Breakers

- I. Breakers shall have anti-pumping feature and it shall be electrically drawout type. The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.
- II. 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 energisation of lockout relay. All breakers Shall have built in interlocks for equipment and personnel safety
- III. Paralleling of two supplies shall be avoided by except for switchgear where auto-changeover is provided. Breaker contact multiplication, if required, shall be through latch relay.
- IV. Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.
- V. 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.
- VI. Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.
- VII. Supervision relay shall be provided for trip coil monitoring

2.2.11.3.2 Switches, Contactors and Fuses

- a. Incomers for MCCs and DBs rated up to 630A could be MCCB's & for above ratings ACB are preferred.
- b. 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 utilisation category.



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- c. Fuses shall be HRC, preferably link type, with a minimum interrupting capacity equal to the short circuit current of the LT system. Fuses shall be furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element. Visible indication shall be provided on blowing of the fuse.
- d. Motor fuse characteristics and ratings shall be chosen to ride over starting period without blowing. The fuse on incoming feeder wherever provided, shall be chosen to provide discrimination with motor/feeder fuses.
- e. Isolating switches and MCCBs shall have door interlocks and padlocking facility.
- f. Wherever two incoming switches and one bus-section switch/breaker are provided for an assembly, these shall be electrically interlocked to ensure that only two out of the three can be closed at time.
- g. Wherever two incoming switches are provided for an assembly, these shall be electrically interlocked to ensure that one of the two can be closed at time.

2.2.11.3.3 Panels

- a. All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved identification plates.
- b. Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall be of DOP IP55. Push buttons shall be of latch type with mushroom knobs.
- c. Where 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.
- d. All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galvanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.
- e. 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.



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- f. The incoming connection to transformer of more than 1000KVA and inter-connecting Sections between switchboards shall preferably be of bus ducts. The bus duct enclosure shall be made of minimum 3mm thick aluminium alloy. The section of the bus duct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor bus duct enclosure joints to provide additional protection against water ingress. The bus duct top shall be sloped to prevent retention of water. The bus duct shall have DOP of IP55.
- g. It should be possible to carryout maintenance on a feeder with adjacent feeders alive

2.2.11.3.4 Control, Protection & Metering Requirements

- i) Control circuits shall operate at suitable voltage of 110V AC or 220V DC. Necessary control supply transformers having primary and secondary fuses shall be provided for each MCC, 2 x 100% per section. However the breakers shall operate on 220V DC. The auxiliary bus bars for control supply shall be segregated from main bus bars. The control supplies shall be monitored.
- ii) Contractor shall fully co-ordinate overload and short circuit tripping of breaker with upstream and downstream breakers/fuses/MCCBs motor starters. Various equipment's shall meet requirement of Type-II class of coordination as per IEC.
- iii) All relays 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.
- iv) All equipment's shall have necessary protections. However, following minimum protections shall be provided:

MPCB with Contactor controlled LV motor feeders (Motors rated 18.5kW & below) having intelligent controller
 - a. Instantaneous short circuit protection
 - b. Overload protection
- v) MCCB with Contactor controlled LV motor feeders (Motors rated above 18.5kW but below 90 kW) having intelligent controller
 - a. Instantaneous short circuit protection



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- b. Overload protection
- vi) Single phasing protection for motors rated 30 kW and above rating
- vii) In Instantaneous short circuit protection on all phases through HRC cartridge type fuses / MCCB rated for 80 kA rms (prospective breaking capacity at 415V).
- viii) Thermal overload protection
- ix) Single phasing protection for motors protected by fuses.
- x) Breaker controlled motors feeders (motors rated above 90kW) Numerical, comprehensive motor protection relay with following minimum facility as indicated below :
 - a. Instantaneous short circuit protection
 - b. Overload protection
 - c. Under voltage protection
 - d. Locked Rotor protection
 - e. Earth fault protection
 - f. Current unbalance.
 - g. Temperature monitoring (stator, bearing etc.).
 - h. Phase reversal.
 - i. Thermal model based with RTD feedback and negative sequence current.
 - j. Voltage compensated acceleration.
- xi) Incomers (ACB):
 - a. 3 ph IDMT Overcurrent & earth fault protection (51,51N)
 - b. 3 ph Instantaneous Overcurrent protection (50)



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- c. Standby earth fault protection for service transformer protection (connected on transformer neutral CT side)
 - d. Under voltage protection (27) with Timer & Fuse failure protection
 - e. Neutral dEviation relay
- xii) Buscoupler (ACB):
 - a. 3ph IDMT Overcurrent & earth fault protection (51 & 51N)
 - b. Sync check relay (25)
- xiii) Bus PT:
 - a. Under voltage protection (27)
 - b. No voltage protection (27)
 - c. Fuse failure protection (97)
- xiv) ACB outgoing feeders:
 - 3 ph IDMT Overcurrent protection (51, 51N)
- xv) 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)
 - e) Voltage controlled Overcurrent relay
 - f) Generator under/over voltage Protection
 - g) Hand Reset/Lockout Relay with a blue lamp.
 - h) 3 Phase Energy Meter having accuracy of 1.0 class



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Apart from protection relays, each electrically operated breaker shall also be provided with Anti pumping (94), trip annunciation (30), lockout (86). Lockout supervision (95) and trip supervision (74) relays. Lockout relay shall be hand reset type.

2.2.11.3.5 Meters / instruments

- I. All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. Size with 90 degree linear scales and accuracy class of 2.0. All motors above 7.5 kW shall have directly connected ammeter and Motors above 30kW shall have CT connected Ammeter with ASS. Necessary Current transducers shall be provided for the same. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. 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.
- II. All Incoming feeders shall be provided with MFM, Ammeter with selector switches & with necessary kW transducer, Current transducers etc., Bus PT feeder shall be provided with Voltmeter + VSS & necessary Transducers. All Outgoing supply feeders shall be provided with Ammeters + ASS & necessary transducers.
 - a. In case of remote controlled breaker panels, following shall be ensured. 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.
 - b. Control from Remote 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.

2.2.11.3.6 DESIGN AND CONSTRUCTIONAL FEATURES

- 1) All 415V switch gear motor control centres (MCCs), AC & DC distribution boards (DBs), etc. shall have following features
- 2) Shall be of metal enclosed, indoor, floor mounted and free standing type.



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- 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 2mm.
- 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 cut-outs shall have synthetic rubber gaskets.
- 6) All switchboards, MCCs and DB s shall have following distinct vertical sections.
 - i) Completely enclosed bus bar compartment for horizontal and vertical busbars.
 - ii) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or switch-fuse feeder).
 - iii) 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.
 - iv) For cable connection to circuit breaker a separately enclosed cable compartment shall also be acceptable.
 - v) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary.
 - vi) The switchboards/MCC/DBs of 1600A & above rating shall be of DOP IP42 & of IP52 for less than 1600A rating.
 - vii) All 415V 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 RAL7032 for extreme end covers of all boards.
- 7) Busbars shall be of high conductivity aluminium alloy or copper.
- 8) 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



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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. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.

- 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. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.
- 10) Busbar insulators shall be of track-resistant high strength non-hygro- 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 types of relays and timer shall be subject to Purchaser's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, drawout 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/PLC.
- 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. Bidder 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 discribing 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



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transformers shall have CTs for transformer restricted earth fault protection. The accuracy shall be as follows:

- 15) Other CT particulars like ratio, burden knee-point voltage, excitation current and secondary resistance shall be decided by the Tenderers
- 16) CT secondary shall be rated for 1 A for metering and either 5 A or 1 A for protection.
- 17) indicating lamps shall be cluster LED type
- 18) 20% spare feeders of each type & rating used in the MCC with a minimum one (1) number on each bus section shall be provided.

2.2.11.3.7 ESSENTIAL SERVICE MODULE

During auto changeover of the supply the contactors in the affected bus would have dropped off. Services, which, shall be restarted immediately without time lapse to keep the unit running, are considered essential services. Such auxiliaries shall restart automatically without any action by the operator after an auto changeover. These modules shall have additional hardware like timer (or time delayed closing from DCS), aux. contactors and associated circuitry in the module. Such essential services shall be identified during the detailed engineering stage and suitable module/scheme shall be provided.

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

2.2.11.3.8 Type Tests

GENERAL

All equipment's to be supplied shall be of type tested quality. The Contractor shall submit for Purchaser's approval the reports of all the type tests as listed in this specification and carried out within last five years from the zero date of the project. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the zero date of the project, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Purchaser and submit the reports for approval.



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All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The following type test certificates on each type & rating of L.T. 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.
- e. Degree of protection tests

2.2.11.3.9 ROUTINE TEST

LT SWITCHGEAR

Switchgear shall be subjected to all routine tests as per relevant standards along with following tests:

Temperature rise test on power circuits

- a. Short time current tests on power circuits.
- b. Mechanical operation test
- c. Insulation resistance and 500V DC Megger before/ after 1 minute HV xvi) test
- d. Electrical control, interlock and sequential operation tests
- e. Verification of wiring as per approved schematic.



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LT SWITCHGEAR TECHNICAL DATA SHEET

Sl.No	Description		
1.01.00	Application		
1.02.00	Make		
1.03.00	Installation (Indoor/Outdoor)		
1.04.00	Specification and standards		
1.05.00	Degree of protection as per IS:13947		
1.05.01	Breaker/MCC cubicles		
1.05.02	Busbar chamber		
1.06.00	Design ambient temperature	(deg.C)	
1.07.00	System particulars		
1.08.00	Supply for motors winding/ space heating		
1.08.01	Motors upto 30 KW	(V)	
1.08.02	Motors above 30 KW	(V)	
1.09.00	Painting shade as per IS:5		
1.09.01	External surfaces		
1.09.02	Internal surfaces		
2.00.00	SWITCHGEAR		
2.01.00	Type		
2.02.00	Installation		
2.03.00	Rated voltage:		
2.03.01	Nominal	(KV)	
2.03.02	Maximum	(KV)	



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2.04.00	Control supply voltage		
2.04.01	Breakers		
2.04.02	DOL starters		
2.05.00	Supply for cubicles space heating and illumination		
2.06.00	Number of phase		
2.07.00	Frequency		
2.08.00	Symmetrical short circuit withstand capacity	(KA)	
2.09.00	Rated one (1) second short time current	(KA)	
2.10.00	Rated dynamic current	(KA peak)	
2.11.00	One (1) minute power frequency dry and wet withstand voltage		
2.11.01	Complete Switchgear	(KV)	
2.11.02	Power circuit and its components	(KV)	
2.11.03	Control, instrumentation and protection circuits	(KV)	
2.12.00	1.2x50 microsecond impulse withstand voltage full wave of positive and negative polarities		
2.12.01	Complete Switchgear	(KV peak)	
2.12.02	Power circuit and its components	(KV peak)	
2.12.03	Control, instrumentation and protection circuits	(KV peak)	
3.00.00	SWITCHGEAR CONSTRUCTIONAL FEATURES		
3.01.00	Type and designation		



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3.02.00	Type of construction		
3.03.00	Cubicle sheet metal details		
3.03.01	Cold rolled/hot rolled	(mm)	
3.03.02	Thickness, structural frames and load bearing members	(mm)	
3.03.03	Thickness, Front and rear	(mm)	
3.03.04	Thickness, sides and top	(mm)	
3.03.05	Equipment mounting plate	(mm)	
3.03.06	Door with cut-out	(mm)	
3.03.07	Door without cut-out	(mm)	
3.03.08	Cover bolted/screwed cover		
3.03.09	With cut-out	(mm)	
3.03.10	Without cut-out	(mm)	
3.03.11	Insulating cover/partition plate/separator plate	(mm)	
3.04.00	Dimensions of Complete Board		
3.04.01	Height	(mm)	
3.04.02	Length	(mm)	
3.04.03	Depth	(mm)	
3.05.00	Standard height, width and depth of typical panel		
3.05.01	MCC Panel	(mm)	
3.05.02	PCC Panel	(mm)	
3.05.03	Distribution Board Panel	(mm)	
3.06.00	Weight		



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3.06.01	Each MCC vertical panel	(Kg)	
3.06.02	Each DB Vertical Panel	(Kg)	
3.06.03	Each PCC (Breaker Panel) Vertical Panel		
3.06.04	Each transformer (for LDB/ELDB/PDB)		
3.07.00	Size of separate mounting channel	(mm)	
3.08.00	Width of cable alley	(mm)	
3.09.00	Recommended dynamic loading for foundation design		
3.10.00	Following accessories provided		
3.10.01	Each vertical panel provided with space heater, thermostat & SPN MCB		
3.10.02	Each vertical panel provided with space heater, thermostat & SPN MCB		
3.10.03	Name plates front and rear		
3.10.04	Danger plate (wherever it is required)		
3.11.00	Type of Swgr./MCC/DB (i.e.) whether Double/Single Front)		
3.12.00	Execution (i.e. whether fully drawout/semi-drawout/fixed)		
4.00.00	POWER BUS BARS AND INSULATORS		
4.01.00	Material and applicable standard		
4.02.00	Cross-sectional area per phase for different current rating along with calculations (attach sheet if required)		
4.02.01	Horizontal Busbar		
4.02.02	Vertical Busbar		



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4.03.00	Type of Busbar (HBS & VBB) insulation [bare/Painted/Epoxy Insulated/PVC Sleeved]		
4.04.00	Minimum clearance in air		
4.04.01	Between phases	(mm)	
4.04.02	Between phases to earth	(mm)	
4.05.00	Continuous current rating (for various HBB & VBB sizes)		
4.05.01	At 40 Deg.C ambient	(Amp)	
4.05.02	At 50 Deg.C ambient	(Amp)	
4.06.00	One (1) second short time current rating	(KA)	
4.07.00	Dynamic current rating	(KA peak)	
4.08.00	Maximum temperature rise over design ambient temperature of fifty (50) degree centigrade for continuous rating	(C)	
4.09.00	One (1) minute power frequency dry and wet withstand voltage	(KV)	
4.10.00	Is horizontal and vertical busbar provided with heat shrinkable PVC sleeve?		
4.11.00	All busbars joints have been shrouded properly		
4.12.00	Calculation justifying adequacy of Horizontal as well as vertical bus bar size selected furnished for following :		
4.12.01	Continuous current carrying capacity		
4.12.02	Short time current carrying capacity		



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4.12.03	Short circuit dynamic force withstand capacity		
4.13.00	Calculation justifying adequacy of each size of fish plate selected for continuous as well as short time current rating furnished		
4.14.00	Busbar joints silver faced		
4.15.00	Material of the support insulators		
4.16.00	Tracking index in insulators		
	Material of interface barriers and its characteristics		
5.00.00	AUXILIARY BUSBARS		
5.01.00	24V AC (motor winding heating)		
5.01.01	Material		
5.01.02	Size		
5.01.03	Continuous current rating	(A)	
5.01.04	Is busbar provided with heat shrinkable PVC sleeve?		
5.02.00	240V AC (for motor space heater control circuit, panels space heating panel illumination and sockets)		
5.02.01	Material		
5.02.02	Size		
5.02.03	Continuous current rating	(A)	



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MANDATORY SPARES FOR LT SWITCHGEAR

5. LV SWITCHGEAR

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



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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.



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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.		



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QUALITY ASSURANCE PLAN

2.5.2.7 LT SWITCHGEAR & BUSDUCT

LT SWITCHGEAR (MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)														
ATTRIBUTES/ CHARACTERISTICS ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per relevant standard & Spec.	Item to conform to relevant Standards	Pre-treatment as per IS 6005	Paint Shade, Adhesion, Thickness & Finish	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per relevant standard.	All Routine tests as per spec. & IS
Sheet Steel (IS : 513)	Y	Y		Y	Y		Y							
Aluminium Bus bar Material (IS : 5082)	Y	Y	Y	Y	Y		Y							
Copper Bus bar Material (IS : 613)	Y	Y	Y	Y	Y		Y							
Support Insulator (IS : 9431,IS : 10912, IEC : 660)	Y	Y	Y	Y			Y							
Air Circuit Breaker (IS: 13947)	Y	Y				Y	Y			Y	Y			Y
Energy Meters (IS : 722)	Y	Y				Y	Y			Y				Y
Power & Aux. Contactors (IS : 13947)	Y	Y				Y	Y			Y				Y
Protection & Aux. Relays (IS : 3231)	Y	Y				Y	Y			Y				Y
Control & Selector Switches (IS : 6875)	Y	Y				Y	Y			Y				Y
CT's & PT's (IS 2705 / 3156)	Y	Y					Y							
MCCB (IS : 13947)	Y	Y					Y							



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LT SWITCHGEAR (MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)														
ATTRIBUTES/ CHARACTERISTICS ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY	Make, Model, Type, Rating & IC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per relevant standard & Spec.	Item to conform to relevant Standards	Pre-treatment as per IS 6005	Paint Shade, Adhesion, Thickness & Finish	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per relevant standard.	All Routine tests as per spec. & IS
Indicating Meters (IS : 1248)	Y	Y				Y	Y			Y				Y
Indicating Lamps (IS : 13947)	Y	Y				Y	Y			Y				Y
Air Break Switches (IS : 13947)	Y	Y				Y	Y			Y				
Control Terminal Blocks	Y	Y				Y	Y							
Fuse (IS 13703)	Y	Y				Y	Y			Y				
Control Transformer (IS : 12021)	Y	Y				Y	Y			Y				Y
Push Buttons (IS : 4794)	Y	Y				Y	Y			Y				Y
Transducer (IEC : 60688)	Y	Y				Y	Y			Y				Y
MCB (IS : 8828)	Y	Y				Y	Y			Y				Y
Breaker Handling Trolley	Y	Y				Y			Y	Y				Y
Synthetic Rubber Gasket (IS : 11149)	Y	Y		Y	Y		Y							
LT SWITCHGEAR (IS : 8623)	Y	Y				Y	Y	Y	Y		Y	Y	Y	



1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III



EPC TENDER SPECIFICATION FOR BOP PACKAGE

LT SWITCHGEAR (MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)											
ATTRIBUTES/ CHARACTERISTICS											
ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY											
		Make, Model, Type, Rating & IC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per relevant standard & Spec.	Item to conform to relevant Standards	Pre-treatment as per IS 6005	Paint Shade, Adhesion, Thickness & Finish	Functional Checks
										Milli-volt drop Test	IR – HV – IR Test
										Degree of Protection Routine test as per relevant standard.	All Routine tests as per spec. & IS
Notes: This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 3. Makes of all major Bought Out Items will be subject to Customer approval. Y – Test Applicable.											

FOR TENDERING PURPOSE ONLY

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:TANGEDCO PROJECT: 1X800MW NORTH CHENNAI TPP-III						
				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
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1	BOUGHT OUT ITEMS (ELECTRICAL COMPONENTS)				M	T / C							
1.1	AIR CIRCUIT BREAKER	VERIFICATION OF MAKE, TYPE RATING	MAJOR	VISUAL	100%		IS 13947 , TECH SPEC AND APPROVED DRG	IS 13947 , TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		ROUTINE TEST	CRITICAL	ELECT	100%				SUPPLIER TC	V	V	V	
1.2	MCCB	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH TYPE		IS 13947 , SPEC AND APPROVED DRG	IS 13947 , SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUCITIONL CHECK		FUCNTIONAL	10% OF EACH TYPE				LOG BOOK	P	V	V	
1.3	ROTARY SWITCHES (CONTROL AND SELECTOR)	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	5 SAMPLE OF EACH TYPE		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK			FUNCTI ONAL	10%				LOG BOOK	P	V	V
1.4	DOOR , TOGGLE & TNC SWITCH	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH TYPE		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
1.5	SWITCH FUSE UNITS	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10%		IS 13947, TECH SPEC AND	IS 13947 , TECH SPEC AND	LOG BOOK	P	V	V	

	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : FICHTNER & BHEL, C: CUSTOMR: TANGEDCO 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: 1X800MW NORTH CHENNAI TPP-III						
				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
1.	2.	3.	4.	5.	6.		7.	8.	9.	M	T	C	
		CONTINUITY TEST	MAJOR	FUNCTIONAL	10% OF EACH RATING		APPROVED DRG	APPROVED DRG		P	V	V	
1.6	ETHERNET SWITCH	MAKE, TYPE , RATING MODEL	MAJOR	VISUAL	100%		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	100%				SUPPLIER TC	V	V	V	
1.7	CONTROL TRANSFORMER	MAKE, TYPE, RATING VOLTAGE RATIO & CLASS	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 121021 (81)	IS 121021(87)	LOG BOOK	P	V	V	
		VOLTAGE RATIO			100% OF EACH RATING					LOG BOOK	P	V	V
		ROUTINE TEST		ELEC	100%					SUPPLIER TC	V	V	V
1.8	CURRENT TRANSFORMER CTS	MAKE, TYPE, RATING VOLTAGE RATIO	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 2705 (92)	IS 2705(92)	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%					SUPPLIER TC	V	V	V
1.9	VOLTAGE/ POTENTIAL/ TRANSFORMER PTS	MAKE, TYPE, RATING VOLTAGE RATIO	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 2705 (92) APPROVED DRG/TECH SPEC	IS 2705(92) APPROVED DRG	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%					SUPPLIER TC	V	V	V

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				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
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	TRANSducers CURRENT AND VOLTAGE (CTD & VTD)	MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH RATING		IS 14570 /IEC 16088 APPROVED DRG /TECH SPEC/	IS 14570 /IEC 16088 APPROVED DRG /TECH SPEC	LOG BOOK	P	V	V	
		ROUTINE TEST INCLUDING 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		
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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1.15	TIMERS	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH	APPROVED DRG/TECH	LOG BOOK	P	V	V	
		CONTACT CONFIGURATION		ELECT	5% OF EACH TYPE		TECH SPEC/ MNFR CAT	TECH SPEC/ MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.16	THERMOSTAT	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MNFR CAT	APPROVED DRG/TECH SPEC/MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.17	SPACE HEATER	MAKE TYPE RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK	MAJOR	ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.18	INDICATING INSTRUMENTS AMMETER, VOLTMETER MFM, WATT HOUR METER	MAKE, TYPE, RANGE & CLASS	MAJOR	VISUAL	5% OF EACH TYPE		IS 1248(93) APPROVED	IS 1248(93) /APPROVED	LOG BOOK	P	V	V	
		ROUTINE TEST		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	

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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1.20	PUSH BUTTON SWITCHES	MAKE, TYPE, RATING AND COLOR	MAJOR	VISUAL	5% OF EACH TYPE		IS 4794/APPROVED DRG	IS 4794 /APPROVED DRG	LOG BOOK	P	V	V	
1.21	2/3 PIN SOCKET/LAMP HOLDER/ HOOTER	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
1.22	TERMINAL BLOCK FOR POWER AND CONTROL CKT	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
1.23	AC/ DC POWER AND AUX CONTACTORS	MAKE, TYPE, RATING	MAJOR	VISUAL	100%		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		FUCTIONAL		ELECT	5 % OF EACH TYPE				LOG BOOK	P	V	V	
1.24	BUSBAR SUPPORT INSULAOR	MAKE, TYPE, RATING, DIM.	MAJOR	VISUAL AND PHY	5 % OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		IR/ HV TEST	MAJOR	ELECT	-DO-		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	P	V	V	
1.25	SHROUDS (FIRE RESISTANT TYPE)	MAKE, TYPE	MAJOR	VISUAL	ONE SAMPLE OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		HV TEST	MAJOR	ELECT	-DO-		2.5 KV FOR 1 MIN WITHSTAND	2.5 KV FOR 1 MIN WITHSTAND	SUPPLIER TC/ LOG BOOK	P	V	V	
		FLAME RESISTANCE TEST	MAJOR	FLAME TEST	SAMPLING AS PER MNFT STD		MNFR STDQ	MNFR STD	SUPPLIER TC	V	V	V	

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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	
		PAINT THICKNESS AND ADHESION TEST.	MAJOR	TEST	RANDOM		APPROVED DRG/	IS 6005/ APPROVED DRG.	LOG BOOK	P	V	V	
2.2	ENCLOSURE ANGLES, CHANNELS AND SHEET(CR)/ GLAND PLATE	DIMENSION/THICKNESS	MAJOR	MEASUR	5% OF EACH TYLPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		SURFACE FINISH, CHCEK FOR WAVINESS AND FLATNESS	MAJOR	VISUAL	5% OF EACH TYLPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		TENSILE / BENDING STRENGTH	MAJOR	MECH	AS PER IS		IS 513/ IS 1079/ IS 2062	IS 513/ IS 1079/ IS 2062	SUPPLIER TC	V	V	V	
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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
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	
		COMPRESSION , ELONGATION AT BREAK AND AGING, TEST,OZONE RESISTANCE	MAJOR	TEST	-DO-		-DO-	-DO-	SUPPLIER TC	V	V	V	
3.0	IN-PROCESS										V	V	

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1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
3.1	PRE TREATMENT AND PAINTING (POWDER COATING)	1. CHEMICAL CONCETRATIOIN CHECK OF ALL TANIKS FOR PRE TREATMENT OF SHEET STEEL (7 TANK PROCESS)	MAJOR	CHEMIC AL	MANFR STD		MANFR STD/ IS 6005	MANFR STD/ IS 6005	SUPPLIER TC	V	V	V	
		2. PAINT SHADE	MAJOR	VISUAL	1 SAMPLE PER LOT		TECH. SPEC./ APPROVED DRAWING	TECH. SPEC./ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
		3. PAINT THICKNESS AND ADHESION	MAJOR	MEASUR / TEST	MANUF. PRACTICE		TECH. SPEC./ APPROVED DRAWING	TECH. SPEC./ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
3.2	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	

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1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
		SHROUDING OF POWER TERMINALS	CRITICAL	VISUAL	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	
4.0 FINAL INSPECTION													
4.1	VERIFICATION OF DEMENSION OF VERTICALS, SHEET. VISUAL CHECK FOR VERTICALITY, ALLIGNMENT OF PANELS.		MAJOR	VISUAL & MEASUR	100%		AS PER APPROVED DRG.GA	AS PER APPROVED GA DRG.	LOG BOOK	P	W	W	
4.2	VERIFICATION OF PAINT FINISH, SHADE, THICKNESS & ADHESIION TEST		MAJOR	VISUAL AND MEASUR	100% FOR SHADE AND FINISH 2-3 SAMPLES FOR THICKNESS AND ADHESION 2-3 SAMPLES/ BOARD		AS PER IS/ APPROVED DRG GN	AS PER IS/ APPROVED DRG GN	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.3	VERIFICATION OF BUSBAR (MAIN, CONTROL AND AUX). MATERIAL, COLOR CODING, PHASE SEQUENCE IDENTIFICATION, PROVISION OF COLOR (R-Y-B) / BLACK HEAT SHRINKING SLEEVE. & EARTH BUSBAR		CRITICAL	VISUAL AND MEASUR	10%		APPROVED DRG GA	APPROVED DRG GA	INSPECTIO N REPORT	P	W	W	

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										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.4	MEASUREMENT OF TIGHTENING TORQUE OF BUSBAR JOINTS BY TROQUE WRENTCH		CRITICAL	MECH	10%		M6 = 0.30- 0.7KGFM M8 = 1.25- 2.5KGFM M10= 2.50- 4.0KGFM M12= 4.30- 7.0KGFM	M6 = 0.30- 0.7KGFM M8 = 1.25- 2.5KGFM M10= 2.50- 4.0KGFM M12= 4.30- 7.0KGFM	INSPECTION 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	INSPECTION 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	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.7	VERIFICATION OF CONTROL WIRING, TERMINAL ARRANGEMENT AND FERRULING		MAJOR	VISUAL	100%		APPROVED DRG/MANFR STD	APPROVED DRG/MANFR STD	INSPECTION REPORT	P	W	W	
4.8	VERIFICATION OF SINGLE LINE DIAGRAM COMPONENTS AND LEGENDS		MAJOR	VISUAL	100%		APPROVED DRG SLD	APPROVED DRG SLD	INSPECTION REPORT	P	W	W	
4.9	VERIFICATION OF MOUNTING ARRANGEMENT OF COMPONENT , IDENTIFICATION OF COMPONENT AND VERIFICATION OF MAKE, TYPE & RATING (AS PER BOM)		MAJOR	VISUAL	100%		AS PER APPROVED DRG(SCHEME) AND APPROVED BOM	AS PER APPROVED DRG(SCHEME) AND APPROVED BOM	INSPECTION REPORT	P	W	W	

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : FICHTNER & BHEL, C: CUSTOMR: TANGEDCO 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: 1X800MW NORTH CHENNAI TPP-III						
				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
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.10	VERIFICATION OF DOOR INTERLOCK AND DEFEAT INTERLOCK		MAJOR	PHYSICAL	100%		APPROVED GN	APPROVED GN	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.11	VERIFICATION OF DEGREE OF PROTECTION AND FIXING OF GASKETS		MAJOR	PHYSICAL	2-5 SAMPLES AT GASKETED JOINTS PER BOARD		APPROVED GN	NO INSERTION POSSIBLE FROM OPENINGS AND GASKETTED JOINTS	INSPECTIO N REPORT	P	W	W	PAPER INSERTION METHOD FOR IP5X COMPARTMENT AND WIRE INSERTION METHOD FOR IP 4X COMPARTMENT RANDOM CHECK
4.12	ACB OPERATIION TEST AT SERVICE, TEST AND ISOLATION POSITION & CHECK OF MECHANICAL INTERLOCK AND ANTI PUNPING AND TRIP FREE FEATURE		CRITICAL	ELECT	100%		APPROVED DRG/TECH SPEC	APPROVED DRG/TECH SPEC	INSPECTIO N REPORT	P	W	W	10% RANDOM SAMPLE BY CUSTOMER
4.13	VERIFICATION OF INTER CHANGEABILITY OF SIMILAR MODULES AND CHECK FOR ALIGNMENT OF POWER AND CONTROL CONTACTS.		MAJOR	VISUAL & MECH	RANDOM		APPROVED TECH SPEC	APPROVED TECH SPEC	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER
4.14	FUNCTIONAL CHECK / LOGIC CHECK (1. Operation of Instrument & Relays 2. Functional Check of Control Function & Interlock in test & service Position. 3. Relay calibration Tests.)		MAJOR	ELECT	100%		AS PER APPROVED SCHEME	AS PER APPROVED SCHEME	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.15	IR TEST BEFORE HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%		IS 8623	IS 8623	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : FICHTNER & BHEL, C: CUSTOMR: TANGEDCO 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: 1X800MW NORTH CHENNAI TPP-III						
				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.
4.16	HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELCECT	100%		IS 8623	IS8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.17	IR TEST AFTER HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%		IS 8623	IS 8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.18	TYPE TEST		CRITICAL	ELECT	1/ ITEM		PO SPEC, DRG IS 60529 IS 8623	PO SPEC, DRG IS 60529 IS 8623	INSPECTION REPORT	P	V	V	AS PER BELOW NOTE
4.19	CHECK SHROUDING OF ACCECABLE LIVE PARTS		MAJOR	VISUAL	10%		AS PER TECH SPEC	AS PER TECH SPECH	INSPECTION 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	INSPECTION 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)
- C. FUNCTIONAL/ PERFORMANCE CHECKS TO BE CONDUCTED ON ENTIRE BOARD WHILE ALL POWER SUPPLIES SWITCHED ON.

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

PROJECT: 1X800MW NORTH CHENNAI TPS
INPUT DOC: PE-DG-423-565-E001
TITLE OF INPUT DOC: ELECTRICAL SINGLE LINE DIAGRAM FOR AUXILIARY POWER DISTRIBUTION

REV: 01

SL. NO	LOCATION	SWITCHBOARD	DESIGNATION	RATING
1	LV SWITCHGEAR ROOM MAIN POWER HOUSE BUILDING 12M A-B BAY	220V MAIN DCDB	#1FA	
2		415V UNIT TURBINE SERVICE PMCC	#1DA	3000A
3		415V STATION SERVICE PMCC	#0DA	4000A
4		415V UNIT EMERGENCY PMCC	#1DG	3000A
5		415V UNIT TURBINE VALVE ACDB	#1KA	250A
6		415V UNIT SERVICE ACDB	#1QA	630A
7	BOILER SWITCHGEAR ROOM MAIN POWER HOUSE BUILDING 27.5M C- F BAY	415V UNIT BOILER SERVICE PMCC	#1DB	4000A
8		415V WELDING PMCC	#0DD	1000A
9		415V UNIT BOILER VALVE & DAMPER ACDB	#1HA	250A
10		415V UNIT BOILER ACDB	#1HB	630A
11		415V MISCELLANEOUS SERVICE MCC	#0QA	630A
12		415V VENTILATION MCC	#1TA	1000A
13	ESP CONTROL ROOM	415V ESP & ID FAN AREA DB	#1HD	400A
14		415V ESP AC & VENT MCC	#1TB	400A
15	AC PLANT ROOM	415V AIR CONDITIONING MCC	#0TA	1000A
16	AIR WASHER BUILDING	415V AIR WASHER MCC	#1SA	630A
17	AUX BOILER BUILDING	415V AUX. BOILER/ FUEL OIL/ CPU PMCC	#0DB	3000A
18	SERVICE BUILDING	415V SERVICE BUILDING PMCC	#0DC	1000A
19	FUEL OIL PRESSURIZING P/H	415V FUEL OIL PH MCC	#0SA	630A
20	CPU REGENERATION BUILDING	415V CPU MCC	#0SB	630A

SWITCHBOARD NAME: 415V CPU MCC
SWITCHBOARD DESIGNATION: #05B
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 630A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	630A	2
2	ACB BUSCOUPLER	DAE BC	630A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	63A	8
7	SUPPLY OUTGOING	E3	32A	9
8	SUPPLY OUTGOING	E3	16A	42
9	SUPPLY OUTGOING	E1	32A	10
10	SUPPLY OUTGOING	E1	16A	29
11	MOTOR FEEDER	DK2	0.37KW	13
12	MOTOR FEEDER	DK2	0.75KW	4
13	MOTOR FEEDER	DK2	1.1KW	3
14	MOTOR FEEDER	DK2	1.5KW	3
15	MOTOR FEEDER	DK2	2.2KW	9
16	MOTOR FEEDER	DK2	3.7KW	12
17	MOTOR FEEDER	DK2	5.5KW	5
18	MOTOR FEEDER	DK2	11KW	14
19	MOTOR FEEDER	DK2	15KW	5
20	MOTOR FEEDER	DK2	18.5KW	5
21	MOTOR FEEDER	DK21	30KW	11
22	MOTOR FEEDER	DK21	37KW	3
23	HEATER FEEDER	EA3	50KW (160A)	6

SWITCHBOARD NAME: 415V FUEL OIL PH MCC
SWITCHBOARD DESIGNATION: #05A
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 630A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	630A	2
2	ACB BUSCOUPLER	DAE BC	630A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	ACB MOTOR FEEDER	DM	<=132KW	3
7	SUPPLY OUTGOING	E3	250A	2
8	SUPPLY OUTGOING	E3	125A	5
9	SUPPLY OUTGOING	E3	63A	5
10	SUPPLY OUTGOING	E3	32A	6
11	SUPPLY OUTGOING	E3	16A	42
12	SUPPLY OUTGOING	E1	32A	23
13	SUPPLY OUTGOING	E1	16A	26
14	MOTOR FEEDER	DK2	1.1KW	2
15	MOTOR FEEDER	DK2	1.5KW	3
16	MOTOR FEEDER	DK2	2.2KW	4
17	MOTOR FEEDER	DK2	3.7KW	11
18	MOTOR FEEDER	DK2	5.5KW	8
19	MOTOR FEEDER	DK2	9KW	3
20	MOTOR FEEDER	DK2	11KW	3
21	MOTOR FEEDER	DK2	15KW	3
22	MOTOR FEEDER	DK2	18.5KW	3
23	MOTOR FEEDER	DK21	30KW	3
24	MOTOR FEEDER	DK21	37KW	4
25	MOTOR FEEDER	DK21	75KW	4

SWITCHBOARD NAME: 415V AIR CONDITIONING MCC
SWITCHBOARD DESIGNATION: #0TA
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 1000A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	1000A	2
2	ACB BUSCOUPLER	DAE BC	1000A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	400A	3
7	SUPPLY OUTGOING	E3	63A	6
8	SUPPLY OUTGOING	E3	32A	8
9	SUPPLY OUTGOING	E3	16A	17
10	SUPPLY OUTGOING	E1	32A	20
11	SUPPLY OUTGOING	E1	16A	6
12	MOTOR FEEDER	DK2	0.37KW	3
13	MOTOR FEEDER	DK2	0.55KW	2
14	MOTOR FEEDER	DK2	0.75KW	3
15	MOTOR FEEDER	DK2	1.1KW	2
16	MOTOR FEEDER	DK2	1.5KW	3
17	MOTOR FEEDER	DK2	2.2KW	12
18	MOTOR FEEDER	DK2	3.7KW	5
19	MOTOR FEEDER	DK2	5.5KW	12
20	MOTOR FEEDER	DK2	7.5KW	2
21	MOTOR FEEDER	DK2	11KW	3
22	MOTOR FEEDER	DK2	15KW	3
23	MOTOR FEEDER	DK2	18.5KW	2
24	MOTOR FEEDER	DK2	22KW	5
25	MOTOR FEEDER	DK21	37KW	5

SWITCHBOARD NAME: 415V MISCELLANEOUS SERVICE MCC
SWITCHBOARD DESIGNATION: #0QA
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 630A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	630A	2
2	ACB BUSCOUPLER	DAE BC	630A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	200A	3
7	SUPPLY OUTGOING	E3	125A	2
8	SUPPLY OUTGOING	E3	100A	7
9	SUPPLY OUTGOING	E3	63A	33
10	SUPPLY OUTGOING	E3	32A	54
11	SUPPLY OUTGOING	E3	16A	26
12	SUPPLY OUTGOING	E1	32A	17
13	SUPPLY OUTGOING	E1	16A	50
14	MOTOR FEEDER	DK2	0.37KW	17
15	MOTOR FEEDER	DK2	0.55KW	3
16	MOTOR FEEDER	DK2	0.75KW	19
17	MOTOR FEEDER	DK2	2.2KW	10
18	MOTOR FEEDER	DK2	3.7KW	6
19	MOTOR FEEDER	DK2	5.5KW	3
20	MOTOR FEEDER	DK2	18.5KW	3
21	MOTOR FEEDER	DK2	30KW	3
22	MOTOR FEEDER	DN1	0.3KW	15

SWITCHBOARD NAME: 415V WELDING PMCC
SWITCHBOARD DESIGNATION: #0DD
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 1000A
BUSDUCT ENTRY: YES

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAET IC	1000A	2
2	ACB BUSCOUPLER	DAET BC	1000A	1
3	BUS PT	G1	100VA	2
4	SPACE HEATER TRAFO MODULE	SH	2KVA	2
5	SUPPLY OUTGOING	E3	250A	16

SWITCHBOARD NAME: 415V SERVICE BUILDING PMCC
SWITCHBOARD DESIGNATION: #0DC
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 1000A
BUSDUCT ENTRY: YES

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAET IC	1000A	2
2	ACB BUSCOUPLER	DAET BC	1000A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	2KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	250A	3
7	SUPPLY OUTGOING	E3	125A	3
8	SUPPLY OUTGOING	E3	63A	4
9	SUPPLY OUTGOING	E3	32A	6
10	SUPPLY OUTGOING	E3	16A	32
11	SUPPLY OUTGOING	E1	32A	11
12	SUPPLY OUTGOING	E1	16A	10
13	MOTOR FEEDER	DK2	0.37KW	10
14	MOTOR FEEDER	DK2	1.5KW	6
15	MOTOR FEEDER	DK2	3.7KW	10
16	MOTOR FEEDER	DK2	5.5KW	12
17	HEATER FEEDER	EA3	16A	6
18	HEATER FEEDER	EA3	32A	6
19	HEATER FEEDER	EA3	63A	18

SWITCHBOARD NAME: 415V AUX. BOILER/ FUEL OIL/ CPU PMCC
SWITCHBOARD DESIGNATION: #0DB
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 3000A
BUSDUCT ENTRY: YES

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAET IC	3000A	2
2	ACB BUSCOUPLER	DAET BC	3000A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	2KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	ACB OUTGOING	DAE OG	630A	5
7	ACB MOTOR FEEDER	DM	<=132KW	6
8	SUPPLY OUTGOING	E3	200A	2
9	SUPPLY OUTGOING	E3	125A	4
10	SUPPLY OUTGOING	E3	63A	8
11	SUPPLY OUTGOING	E3	32A	7
12	SUPPLY OUTGOING	E3	16A	39
13	SUPPLY OUTGOING	E1	32A	20
14	SUPPLY OUTGOING	E1	16A	17
15	MOTOR FEEDER	DK2	0.09KW	4
16	MOTOR FEEDER	DK21	45KW	2
17	MOTOR FEEDER	DK21	75KW	2
18	MOTOR FEEDER	DN1	0.37KW	15
19	MOTOR FEEDER	DN1	0.45KW	2
20	MOTOR FEEDER	DN1	0.55KW	2

SWITCHBOARD NAME: 415V AIR WASHER MCC
SWITCHBOARD DESIGNATION: #1SA
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 630A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	630A	2
2	ACB BUSCOUPLER	DAE BC	630A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	1KVA	2
6	SUPPLY OUTGOING	E3	32A	4
7	SUPPLY OUTGOING	E3	16A	9
8	MOTOR FEEDER	DK2	1.1KW	15
9	MOTOR FEEDER	DK2	7.5KW	15
10	MOTOR FEEDER	DK21	37KW	8

SWITCHBOARD NAME: 415V ESP & ID FAN AREA DB
SWITCHBOARD DESIGNATION: #1HD
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 400A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	CONTACTOR INCOMER	CC IC	400A	2
2	BUS PT	G1	100VA	2
3	TEST SUPPLY	J2	1KVA	2
4	SPACE HEATER TRAFO MODULE	SH	2KVA	2
5	SUPPLY OUTGOING	E3	125A	2
6	SUPPLY OUTGOING	E3	100A	2
7	SUPPLY OUTGOING	E3	63A	12
8	SUPPLY OUTGOING	E3	32A	22
9	MOTOR FEEDER	DK2	3.7KW	3
10	MOTOR FEEDER	DK2	5.5KW	2
11	MOTOR FEEDER	DK2E	5.5KW	7
12	MOTOR FEEDER	DK2E	7.5KW	10
13	MOTOR FEEDER	DK2	9.3KW	2
14	HEATER FEEDER	EA3/ EA1	3KW (16A)	3

SWITCHBOARD NAME: 415V ESP AC & VENT MCC
SWITCHBOARD DESIGNATION: #1TB
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 400A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	MCCB INCOMER	E3 IC	400A	2
2	MCCB BUSCOUPLER	E3 BC	400A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	100A	6
7	SUPPLY OUTGOING	E3	63A	11
8	SUPPLY OUTGOING	E3	32A	8
9	SUPPLY OUTGOING	E3	16A	17
10	SUPPLY OUTGOING	E1	32A	3
11	SUPPLY OUTGOING	E1	16A	6
12	MOTOR FEEDER	DK2	0.37KW	2
13	MOTOR FEEDER	DK2	0.55KW	2
14	MOTOR FEEDER	DK2	1.1KW	3
15	MOTOR FEEDER	DK2	2.2KW	3
16	MOTOR FEEDER	DK2	3.7KW	9
17	MOTOR FEEDER	DK2	7.5KW	3
18	MOTOR FEEDER	DK2	11KW	4
19	MOTOR FEEDER	DK2	18.5KW	2
20	MOTOR FEEDER	DK2	22KW	2

SWITCHBOARD NAME: 415V VENTILATION MCC
SWITCHBOARD DESIGNATION: #1TA
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 1000A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	1000A	2
2	ACB BUSCOUPLER	DAE BC	1000A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	63A	3
7	SUPPLY OUTGOING	E3	32A	5
8	SUPPLY OUTGOING	E3	16A	49
9	SUPPLY OUTGOING	E3	10A	4
10	SUPPLY OUTGOING	E1	32A	7
11	SUPPLY OUTGOING	E1	16A	5
12	SUPPLY OUTGOING	E1	10A	5
13	MOTOR FEEDER	DK2	0.55KW	3
14	MOTOR FEEDER	DK2	1.1KW	15
15	MOTOR FEEDER	DK2	5.5KW	33
16	MOTOR FEEDER	DK2	7.5KW	15
17	MOTOR FEEDER	DK21	37KW	8
18	MOTOR FEEDER	DK21	55KW	5

SWITCHBOARD NAME: 415V UNIT EMERGENCY PMCC
SWITCHBOARD DESIGNATION: #1DG
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 3000A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAEG IC	3200A	2
2	ACB BUSCOUPLER	DAET BC	3200A	1
3	ACB TIE	DAE TIE	3200A	2
4	BUS PT	G2	100VA	2
5	TEST SUPPLY	J2	1KVA	2
6	SPACE HEATER TRAFO MODULE	SH	5KVA	2
7	ACB MOTOR FEEDER	DM	>132KW	2
8	SUPPLY OUTGOING	E3	500A	4
9	SUPPLY OUTGOING	E3	400A	5
10	SUPPLY OUTGOING	E3	250A	13
11	SUPPLY OUTGOING	E3	125A	10
12	SUPPLY OUTGOING	E3	100A	3
13	SUPPLY OUTGOING	E3	63A	11
14	SUPPLY OUTGOING	E3	32A	12
15	SUPPLY OUTGOING	E3	16A	39
16	MOTOR FEEDER	DK2	0.37KW	6
17	MOTOR FEEDER	DK2	0.75KW	7
18	MOTOR FEEDER	DK2	3KW	2
19	MOTOR FEEDER	DK2	5.5KW	3
20	MOTOR FEEDER	DK21	45KW	3
21	MOTOR FEEDER	DK2E	0.75KW	2
22	MOTOR FEEDER	DK2E	3KW	2
23	MOTOR FEEDER	DK2E	3.7KW	5
24	MOTOR FEEDER	DK2E	5.5KW	3
25	MOTOR FEEDER	DK2E	7.5KW	3
26	MOTOR FEEDER	DK2E	11KW	12
27	MOTOR FEEDER	DK2E	15KW	2
28	MOTOR FEEDER	DK2E	22KW	3
29	MOTOR FEEDER	DK21E	37KW	7
30	MOTOR FEEDER	DK21E	45KW	2
31	MOTOR FEEDER	DK21E	90KW	7

SWITCHBOARD NAME: 415V UNIT SERVICE ACDB
SWITCHBOARD DESIGNATION: #1QA
EXECUTION TYPE: FIXED TYPE AND SINGLE FRONT
RATING: 630A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	630A	2
2	ACB BUSCOUPLER	DAE BC	630A	1
3	BUS PT	G1	100VA	2
4	ESSENTIAL SUPPLY MODULE	J1	2KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	SUPPLY OUTGOING	E3	100A	2
7	SUPPLY OUTGOING	E3	63A	11
8	SUPPLY OUTGOING	E3	32A	13
9	SUPPLY OUTGOING	E3	16A	17
10	SUPPLY OUTGOING	E3	10A	58
11	SUPPLY OUTGOING	E3	6A	31

SWITCHBOARD NAME: 415V UNIT BOILER ACDB
SWITCHBOARD DESIGNATION: #1HB
EXECUTION TYPE: FIXED TYPE AND SINGLE FRONT
RATING: 630A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAE IC	630A	2
2	ACB BUSCOUPLER	DAE BC	630A	1
3	BUS PT	G1	100VA	2
4	ESSENTIAL SUPPLY MODULE	J1	2KVA	2
5	SPACE HEATER TRAFO MODULE	SH	3KVA	2
6	SUPPLY OUTGOING	E3	100A	3
7	SUPPLY OUTGOING	E3	63A	34
8	SUPPLY OUTGOING	E3	32A	28
9	SUPPLY OUTGOING	E3	16A	21
10	SUPPLY OUTGOING	E3	10A	51

SWITCHBOARD NAME: 415V UNIT BOILER VALVE &
SWITCHBOARD DESIGNATION: DAMPER ACDB
EXECUTION TYPE: #1HA
RATING: FIXED TYPE AND SINGLE FRONT
BUSDUCT ENTRY: 250A
NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	CONTACTOR INCOMER	CC IC	250A	2
2	BUS PT	G1	100VA	1
3	ESSENTIAL SUPPLY MODULE	J1	2KVA	1
4	SPACE HEATER TRAFO MODULE	SH	3KVA	1
5	SUPPLY OUTGOING	E3	125A	14
6	SUPPLY OUTGOING	E3	63A	29
7	SUPPLY OUTGOING	E3	32A	47
8	SUPPLY OUTGOING	E3	16A	120

SWITCHBOARD NAME: 415V UNIT TURBINE VALVE ACDB
SWITCHBOARD DESIGNATION: #1KA
EXECUTION TYPE: FIXED TYPE AND SINGLE FRONT
RATING: 250A
BUSDUCT ENTRY: NO

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	CONTACTOR INCOMER	CC IC	250A	2
2	BUS PT	G1	100VA	1
3	ESSENTIAL SUPPLY MODULE	J1	2KVA	1
4	SPACE HEATER TRAFO MODULE	SH	5KVA	1
5	SUPPLY OUTGOING	E3	125A	11
6	SUPPLY OUTGOING	E3	100A	27
7	SUPPLY OUTGOING	E3	63A	35
8	SUPPLY OUTGOING	E3	32A	27
9	SUPPLY OUTGOING	E3	16A	274

SWITCHBOARD NAME: 415V STATION SERVICE PMCC
SWITCHBOARD DESIGNATION: #0DA
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 4000A
BUSDUCT ENTRY: YES

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAET IC	4000A	2
2	ACB BUSCOUPLER	DAET BC	4000A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	2KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	ACB OUTGOING	DAE OG	1000A	5
7	ACB OUTGOING	DAE OG	630A	5
8	ACB MOTOR FEEDER	DM	<=132KW	3
9	SUPPLY OUTGOING	E3	500A	4
10	SUPPLY OUTGOING	E3	400A	3
11	SUPPLY OUTGOING	E3	250A	12
12	SUPPLY OUTGOING	E3	125A	3
13	SUPPLY OUTGOING	E3	63A	3
14	SUPPLY OUTGOING	E3	32A	3

SWITCHBOARD NAME: 415V UNIT BOILER SERVICE PMCC
SWITCHBOARD DESIGNATION: #1DB
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 4000A
BUSDUCT ENTRY: YES

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAET IC	4000A	2
2	ACB BUSCOUPLER	DAET BC	4000A	1
	ACB TIE	DAE TIE	3000A	2
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	2KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	ACB OUTGOING	DAE OG	630A	3
7	ACB MOTOR FEEDER	DM	<=132KW	7
9	SUPPLY OUTGOING	E3	250A	10
10	SUPPLY OUTGOING	E3	125A	11
11	SUPPLY OUTGOING	E3	63A	9
12	SUPPLY OUTGOING	E3	32A	5
15	MOTOR FEEDER	DK2	0.75KW	6
17	MOTOR FEEDER	DK2	2.2KW	6
18	MOTOR FEEDER	DK2	3.7KW	4
	MOTOR FEEDER	DK2	5.5KW	9
19	MOTOR FEEDER	DK2	7.5KW	3
	MOTOR FEEDER	DK2	15KW	3
20	MOTOR FEEDER	DK21	45KW	3
22	MOTOR FEEDER	DK2E	3.7KW	6
	MOTOR FEEDER	DK2E	5.5KW	6
23	MOTOR FEEDER	DK2E	7.5KW	3
25	MOTOR FEEDER	DK2E	11KW	10
28	MOTOR FEEDER	DK21E	37KW	3
29	MOTOR FEEDER	DN1	0.37KW	7
31	HEATER FEEDER	EA3	16A	6
32	HEATER FEEDER	EA3	32A	10

SWITCHBOARD NAME: 415V UNIT TURBINE SERVICE PMCC
SWITCHBOARD DESIGNATION: #1DA
EXECUTION TYPE: DOUBLE FRONT DRAW-OUT TYPE
RATING: 3000A
BUSDUCT ENTRY: YES

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	ACB INCOMER	DAET IC	3200A	2
2	ACB BUSCOUPLER	DAET BC	3200A	1
3	BUS PT	G1	100VA	2
4	TEST SUPPLY	J2	1KVA	2
5	SPACE HEATER TRAFO MODULE	SH	2KVA	2
6	ACB OUTGOING	DAE OG	630A	3
7	ACB MOTOR FEEDER	DM	>132KW	6
8	SUPPLY OUTGOING	E3	400A	3
9	SUPPLY OUTGOING	E3	250A	8
10	SUPPLY OUTGOING	E3	125A	6
11	SUPPLY OUTGOING	E3	63A	6
12	SUPPLY OUTGOING	E3	32A	7
13	SUPPLY OUTGOING	E3	16A	4
14	MOTOR FEEDER	DK2	0.37KW	5
15	MOTOR FEEDER	DK2	0.75KW	4
16	MOTOR FEEDER	DK2	1.5KW	10
17	MOTOR FEEDER	DK2	2.2KW	8
18	MOTOR FEEDER	DK2	3KW	2
19	MOTOR FEEDER	DK2	7.5KW	3
20	MOTOR FEEDER	DK21	45KW	2
21	MOTOR FEEDER	DK2E	0.75KW	2
22	MOTOR FEEDER	DK2E	3KW	2
23	MOTOR FEEDER	DK2E	7.5KW	2
24	MOTOR FEEDER	DK2E	9.3KW	3
25	MOTOR FEEDER	DK2E	11KW	4
26	MOTOR FEEDER	DK2E	15KW	4
27	MOTOR FEEDER	DK2E	22KW	4
28	MOTOR FEEDER	DK21E	45KW	2
29	MOTOR FEEDER	DK21E	82.8KW	2
30	HEATER FEEDER	EA1	16A	6
31	HEATER FEEDER	EA3	16A	11
32	HEATER FEEDER	EA3	32A	5
33	HEATER FEEDER	EA3	63A	2
34	HEATER FEEDER	EA3	125A	2

SWITCHBOARD NAME: 220V MAIN DCDB
SWITCHBOARD DESIGNATION: #1FA
EXECUTION TYPE: DOUBLE FRONT FIXED TYPE
RATING: 1250A

LOAD DATA

SL. NO	FEEDER DESCRIPTION	FEEDER TYPE	RATING	QTY
1	BATTERY INCOMER	DB	1250A	2
2	CHARGER INCOMER	CH	1250A	4
3	BUSCOUPLER	DC	1250A	3
4	DC BUS METERING	S		2
5	SPACE HEATER	DC SH	32A	2
6	DC OUTGOING	X	10A	92
7	DC OUTGOING	X	16A	75
8	DC OUTGOING	X	32A	38
9	DC OUTGOING	X	63A	14
10	DC OUTGOING	X	125A	8
11	DC OUTGOING	X	160A	2
12	DC OUTGOING	X	250A	3
13	DC OUTGOING	X	400A	2
14	DC OUTGOING	X	630A	2

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
ACB incomer fed from transformer (PMCC incomer)						1000A	3000A	4000A							
	ACB		TP, EDO, W/O RELEASES, 4NO+4NC, SERVICE POSITION MICROSWITCH, TEST POSITION MICROSWITCH, SPRING CHARGING MOTOR WITH AUX VOLTAGE: 220V DC	1	EA										
	Numerical relay	Protection	51, 51N, 50, SEF, 27, NEUTRAL DEVIATION RELAY & FUSE FAILURE WITH IEC 61850 COMMUNICATION	1	EA										
	Lock out relay			1	EA										
	Breaker multiplication relay			1	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		7	EA										
	lockout supervision relay			1	EA										
	Multifunction meter			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	CT	REF		3	EA										
	PT	metering & protection		3	EA										
	metrosil			1	EA										
	stabilising resisitor			1	EA										
	Current transducers			3	EA										
	Voltage transducer			3	EA										
	kW transducers			1	EA										
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			1	EA										
	Mushroom type push button	Mechanical trip	WITH 2NO+2NC	1	EA										
	Indicating lamp-Red		220V DC	3	EA										
	Indicating lamp-Green		220V DC	1	EA										
	Indicating lamp-Amber		220V DC	2	EA										
	Indicating lamp-Blue		220V DC	3	EA										
	Indicating lamp-white		220V DC	2	EA										
	Indicating lamp-yellow		220V DC	1	EA										
	interposing relays			2	EA										
	Line PT														
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	PT			3	EA										
	Voltage transducer			3	EA										
	Fuse			3	EA										
	Fuse base			3	EA										
	MCB			1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Buscoupler for PMCC/MCC						1000A	3000A	4000A	630A						
	ACB			1	EA										
	Numerical relay	Protection		1	EA										
	Lock out relay			1	EA										
	Breaker multiplication relay			1	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		7	EA										
	lockout supervision relay			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	Current transducers			3	EA										
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Change-over switch			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			1	EA										
	Mushroom type push button	Mechanical trip		1	EA										
	Indicating lamp-Red		220V DC	2	EA										
	Indicating lamp-Green		220V DC	1	EA										
	Indicating lamp-Amber		220V DC	2	EA										
	Indicating lamp-Blue		220V DC	2	EA										
	Indicating lamp-white		220V DC	2	EA										
	interposing relays			2	EA										
	DC Control supply module (auto-changeover from two-sources)			1	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Bus PT for PMCC/MCC (G1)															
	PT	metering & protection		3	EA										
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	Fuse			6	EA										
	Fuse base			6	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Miscellaneous hardware like TB's, cable ties, ferrules etc			1	LOT										
	ENCLOSURE		800MM	1	EA										
ACB outgoing >=630A(DAE-OG)						630A	1000A								
	ACB			1	EA										
	Numerical relay	Feeder protection Relay		1	EA										
	Lock out relay			1	EA										
	Breaker multiplication relay			1	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		7	EA										
	lockout supervision relay			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	Current transducers			3	EA										
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			1	EA										
	Mushroom type push button	Mechanical trip		1	EA										
	Indicating lamp-Red		220V DC	2	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			2	EA										
	Indicating lamp-Blue			2	EA										
	Indicating lamp-white			2	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motor feeder 90kW & above - ACB (DM)						UPTO 160KW									
	ACB			1	EA										
	Numerical relay	composite motor protection		1	EA										
	Lock out relay			1	EA										
	Breaker multiplication relay			1	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		7	EA										
	lockout supervision relay			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	Current transducers			3	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			2	EA										
	Mushroom type push button	Mechanical trip		1	EA										
	Indicating lamp-Red			2	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			2	EA										
	Indicating lamp-Blue			3	EA										
	Indicating lamp-white			2	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
ACB incomer fed from supply (PMCC/MCC incomer)						630A	1000A								
	ACB			1	EA										
	Numerical relay	Protection		1	EA										
	Lock out relay			1	EA										
	Breaker multiplication relay			1	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		7	EA										
	lockout supervision relay			1	EA										
	Multifunction meter			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	PT	metering & protection		3	EA										
	Current transducers			3	EA										
	Voltage transducer			3	EA										
	kW transducers			1	EA										
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			1	EA										
	Mushroom type push button	Mechanical trip		1	EA										
	Indicating lamp-Red			3	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			2	EA										
	Indicating lamp-Blue			3	EA										
	Indicating lamp-white			2	EA										
	Indicating lamp-yellow			1	EA										
	interposing relays			2	EA										
	Line PT														
	Voltmeter			1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Voltmeter selector switch			1	EA										
	PT			3	EA										
	Voltage transducer			3	EA										
	Fuse			3	EA										
	Fuse base			3	EA										
	MCB			1	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motors rated 30kW & above upto 90kW (DK21)						30KW	37KW	45KW	55KW	75KW					
	MCCB			1	EA										
	Power Contactor			1	EA										
	Intelligent controller	Protection		1	EA										
	Separate single phase preventor	Single phasing protection		1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	MCB 2P			2	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	Current transducers			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			2	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motors rated above 18.5kW & below 30kW (DK2**)						18.5KW	22KW								
	MCCB			1	EA										
	Power Contactor			1	EA										
	Intelligent controller	Protection		1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	MCB 2P			1	EA										
	CT	metering		1	EA										
	CT	protection		3	EA										
	Current transducers			1	EA										
	Ammeter			1	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Push button-black			1	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motors rated above 7.5kW & below 18.5kW (DK2*)						7.5KW	9.3KW	11KW	13KW	15KW					
	MPCB			1	EA										
	Power Contactor			1	EA										
	Intelligent controller	Protection		1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	MCB 2P			1	EA										
	CT	metering		1	EA										
	CT	protection		3	EA										
	Ammeter			1	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motors rated <=7.5kW (DK2)						7.5KW	5.5KW	3.7KW	ELOW 3.7KW						
	MPCB			1	EA										
	Power Contactor			1	EA										
	Intelligent controller	Protection		1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	MCB 2P			1	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motors rated 30kW & above upto 90kW (DK21E)						30KW	37KW	45KW	55KW	75KW					
	MCCB			1	EA										
	Power Contactor			1	EA										
	Intelligent controller	Protection		1	EA										
	Separate single phase preventor	Single phasing protection		1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Aux Contactor			2	EA									
	Control Transformer			1	EA									
	Fuses			2	EA									
	Fuse Base			2	EA									
	MCB 2P			2	EA									
	CT	metering		3	EA									
	CT	protection		3	EA									
	Current transducers			1	EA									
	Ammeter			1	EA									
	Ammeter selector switch			1	EA									
	local/ remote selector switch			1	EA									
	Indicating lamp-Red			1	EA									
	Indicating lamp-Green			1	EA									
	Indicating lamp-Amber			2	EA									
	Push button-black			1	EA									
	interposing relays			2	EA									
	Timer			1	EA									
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT									
	ENCLOSURE			1	EA									
Motors rated above 18.5kW & below 30kW (DK2E**)						18.5KW	22KW							
	MCCB			1	EA									
	Power Contactor			1	EA									
	Intelligent controller	Protection		1	EA									
	Aux Contactor			2	EA									
	Control Transformer			1	EA									
	Fuses			2	EA									
	Fuse Base			2	EA									
	MCB 2P			1	EA									
	CT	metering		1	EA									
	CT	protection		3	EA									
	Current transducers			1	EA									
	Ammeter			1	EA									
	local/ remote selector switch			1	EA									
	Indicating lamp-Red			1	EA									
	Indicating lamp-Green			1	EA									
	Indicating lamp-Amber			1	EA									
	Push button-black			1	EA									
	interposing relays			2	EA									
	Timer			1	EA									
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT									
	ENCLOSURE			1	EA									
Motors rated above 7.5kW & below 18.5kW (DK2E*)						7.5KW	9.3KW	11KW	13KW	15KW				
	MPCB			1	EA									
	Power Contactor			1	EA									
	Intelligent controller	Protection		1	EA									
	Aux Contactor			2	EA									
	Control Transformer			1	EA									
	Fuses			2	EA									

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Fuse Base			2	EA										
	MCB 2P			1	EA										
	CT	protection		3	EA										
	Ammeter			1	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Timer			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motors rated <=7.5kW (DK2E)						7.5KW	5.5KW	3.7KW	ELOW 3.7KW						
	MPCB			1	EA										
	Power Contactor			1	EA										
	Intelligent controller	Protection		1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			4	EA										
	Fuse Base			4	EA										
	MCB 2P			1	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Timer			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Bi-direction motor feeders (DN1)						18.5KW	22KW	7.5KW	9.3KW	11KW	13KW	15KW	5.5KW	3.7KW	BELOW 3.7KW
	MPCB			1	EA										
	Power Contactor			2	EA										
	Intelligent controller	Protection		1	EA										
	Aux Contactor			4	EA										
	Control Transformer			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	MCB 2P			2	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			2	EA										
	interposing relays			3	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
3-Ph Heater feeder (EA3)						16A	32A	63A	100A	160A					
	MCCB			1	EA										
	Power Contactor			1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			4	EA										
	Fuse Base			4	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
1-Ph Heater feeder (EA1)						16A	32A	63A	100A	160A					
	MCCB			1	EA										
	Power Contactor			1	EA										
	Aux Contactor			2	EA										
	Control Transformer			1	EA										
	Fuses			4	EA										
	Fuse Base			4	EA										
	local/ remote selector switch			1	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Push button-black			1	EA										
	interposing relays			2	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
DC outgoing (X)						6A	16A	32A	63A	100A	160A	200A	250A	400A	
	SFU			1	EA										
	Fuse			3	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
DC Bus metering (S)						220V DC									
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Earth-fault protection relay	Earth fault protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	MCB 2P DC			2	EA										
	Source Selector Switch			1	EA										
	Fuse			6	EA										
	Fuse base			6	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules etc			1	LOT										
	ENCLOSURE			1	EA										
Test Supply transformer module (J1)						500VA	1KVA	2KVA							
	Control Transformer			2	EA										
	MPCB			2	EA										
	Power Contactor			2	EA										
	MCB			2	EA										
	Timer			1	EA										
	Indicating lamp-Red			2	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules etc			1	LOT										
	ENCLOSURE			1	EA										
Contactor controlled MCCB incomer (CC)						250A	400A								
	MCCB			1	EA										
	Power Contactor			1	EA										
	Control Transformer			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			2	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	PT	metering & protection		3	EA										
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Current transducer			3	EA										
	kW transducers			1	EA										
	Multifunction meter			1	EA										
	Aux Contactor			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
Contactor controlled Motorised MCCB incomer (CC-M)						250A	400A								
	MCCB motorised			1	EA										
	Power Contactor			1	EA										
	Control Transformer			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			2	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	PT	metering & protection		3	EA										
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Current transducer			3	EA										
	kW transducers			1	EA										
	Multifunction meter			1	EA										
	Aux Contactor			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
MCCB incomer (E3-IC)						250A	400A								
	MCCB			1	EA										
	Control Transformer			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			2	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	PT	metering & protection		3	EA										
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Current transducer			3	EA										
	kW transducers			1	EA										
	Multifunction meter			1	EA										
	Aux Contactor			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Push button-black			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Motorised MCCB incomer (E3M-IC)						250A	400A								
	MCCB			1	EA										
	Control Transformer			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			2	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	PT	metering & protection		3	EA										
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Current transducer			3	EA										
	kW transducers			1	EA										
	Multifunction meter			1	EA										
	Aux Contactor			1	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			1	EA										
	Push button-black			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
DG Incomer (DAEG-IC)						3000A									
	ACB			1	EA										
	Numerical relay	Protection		1	EA										
	Lock out relay			1	EA										
	Breaker multiplication relay			1	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		7	EA										
	lockout supervision relay			1	EA										
	Multifunction meter			1	EA										
	3-phase energy meter			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	CT	REF		3	EA										
	PT	metering & protection		3	EA										
	metrosil			1	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	stabilising resisitor			1	EA										
	Current transducers			3	EA										
	Voltage transducer			3	EA										
	kW transducers			1	EA										
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			1	EA										
	Mushroom type push button	Mechanical trip		1	EA										
	Indicating lamp-Red			3	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			2	EA										
	Indicating lamp-Blue			3	EA										
	Indicating lamp-white			2	EA										
	Indicating lamp-yellow			1	EA										
	interposing relays			2	EA										
	Line PT														
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	PT			3	EA										
	Voltage transducer			3	EA										
	Fuse			3	EA										
	Fuse base			3	EA										
	MCB			1	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
Bus PT for DG (G2)						100VA									
	PT	metering & protection		3	EA										
	Under voltage relay	Under voltage protection		1	EA										
	No voltage relay	No voltage protection		1	EA										
	Fuse failure relay	Fuse failure protection		1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	Voltage transducer			3	EA										
	Fuse			6	EA										
	Fuse base			6	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules etc			1	LOT										
	ENCLOSURE			1	EA										
DG Buscoupler (DAEG-BC)						3000A									
	ACB			1	EA										
	Numerical relay	Protection		1	EA										
	Lock out relay			2	EA										
	Breaker multiplication relay			2	EA										
	Trip circuit supervision relay	Trip coil monitoring		1	EA										
	Auxiliary contact	antipumping, trip annunciation, DC supply failure		10	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	lockout supervision relay			1	EA										
	Multifunction meter			1	EA										
	Ammeter			1	EA										
	Ammeter selector switch			1	EA										
	Voltmeter			1	EA										
	Voltmeter selector switch			1	EA										
	CT	metering		3	EA										
	CT	protection		3	EA										
	Current transducers			3	EA										
	local/ remote selector switch			1	EA										
	TNC switch			1	EA										
	On-off switch DC			1	EA										
	Change-over switch			1	EA										
	Fuse			2	EA										
	Fuse base			2	EA										
	MCB			1	EA										
	Mushroom type push button	Mechanical trip		1	EA										
	Indicating lamp-Red			2	EA										
	Indicating lamp-Green			1	EA										
	Indicating lamp-Amber			2	EA										
	Indicating lamp-Blue			2	EA										
	Indicating lamp-white			2	EA										
	interposing relays			2	EA										
	DC Control supply module (auto-changeover from two-sources)			1	EA										
	Miscellaneous hardware like TB's, cable ties, ferrules, diodes, resistors, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
3-Ph MCCB OUTGOING (E3) DRAW-OUT						16A	32A	63A	100A	160A	200A	250A	320A	400A	500A
	MCCB			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
3-Ph MCCB OUTGOING (E3) FIXED						16A	32A	63A	100A	160A	200A	250A	320A	400A	500A
	MCCB			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
1-Ph MCCB OUTGOING (E1) DRAW-OUT						16A	32A	63A	100A	160A	200A	250A	320A	400A	
	MCCB			1	EA										
	Fuses			2	EA										

MODULE WISE BILL OF MATERIAL

	Feeder	Purpose	Spec	Qty	UOM	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.	Model No.
	Fuse Base			2	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										
1-Ph MCCB OUTGOING (E1) FIXED						16A	32A	63A	100A	160A	200A	250A	320A	400A	
	MCCB			1	EA										
	Fuses			2	EA										
	Fuse Base			2	EA										
	Indicating lamp-Red			1	EA										
	Indicating lamp-Green			1	EA										
	Miscellaneous hardware like TB's, CTTB's, cable ties, ferrules, neutral links etc			1	LOT										
	ENCLOSURE			1	EA										

1X800MW NORTH CHENNAI TPP STAGE-III

MAKE OF COMPONENTS

DOCUMENT NO.: EP-4-MC-16004-001

CUSTOMER : TANGEDCO

CONSULTANT: FICHTNER INDIA

PACKAGE: BTG

REV NO. :01; DATE:22.02.2018

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SL.NO	ITEM CATEGORY	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

R1

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 (VTP)	1.AE 2.PRECISE 3.KAPPA 4.INDCOIL 5.KALPA 6.PRAGATI
9	CONTROL TRANSFORMER (CST)	1.AE 2.PRECISE 3.KAPPA 4.INDCOIL 5.KALPA 6.PRAGATI
10	INTERPOSING COUPLING RELAY	1.YOTI 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

1X800MW NORTH CHENNAI TPP STAGE-III

MAKE OF COMPONENTS

DOCUMENT NO.: EP-4-MC-16004-001

CUSTOMER : TANGEDCO

CONSULTANT: FICHTNER INDIA

PACKAGE: BTG

REV NO. :01; DATE:22.02.2018

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12	ELECTROMECHANICAL PROTECTION RELAY	1.ABB 2.ALSTOM 3.L&T 4.SIEMENS
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/CONFER 5.ELMEASURE
16	ENERGY METER (T/M)	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

R1

R1

1X800MW NORTH CHENNAI TPP STAGE-III

MAKE OF COMPONENTS

DOCUMENT NO.: EP-4-MC-16004-001

CUSTOMER : TANGEDCO

CONSULTANT: FICHTNER INDIA

PACKAGE: BTG

REV NO. :01; DATE:22.02.2018

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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.ALSTOM 3.L&T 4.SIEMENS
22	AMMETER (ANALOG)	1. AE 2.RISHAB 3.IMP
23	VOLTMETER(ANALOG)	1. AE 2.RISHAB 3.IMP

R1

R1

R1

1X800MW NORTH CHENNAI TPP STAGE-III

MAKE OF COMPONENTS

DOCUMENT NO.: EP-4-MC-16004-001

CUSTOMER : TANGEDCO

CONSULTANT: FICHTNER INDIA

PACKAGE: BTG

REV NO. :01; DATE:22.02.2018

Page 2 of 7

24	AMMETER (DIGITAL)	1. AE 2.RISHAB 3.SECURE 4.SCHNEIDER 5.L&T
25	VOLTMETER(DIGITAL)	1. AE 2.RISHAB 3.SECURE 4.SCHNEIDER 5.L&T
26	FUSE BASE WITH HOLDER	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC 4.GE 5.SIEMENS 6.L&T
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 (SALTER) 3.RECOM 4.SWITRON
29		

R1

R1

30	TRANSDUCER	1. AE 2.RISHAB 3.SECURE	R1
31	INDICATION LAMP	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC(RASS) 4.SIEMENS 5.L&T(ESBEE) 6. AISHNO 7.TEKNIC 8.SECO	
32	PUSH BUTTON	1.ABB 2.SCHNEIDER ELECTRIC 3.C&S ELECTRIC(RASS) 4.SIEMENS 5.L&T(ESBEE) 6. AISHNO 7.TEKNIC	
33	CABLE GLANDS	1.HEX 2.COMET 3.DOWELLS 4.3D	R1
34	CABLE LUGS	1.HEX 2.COMET 3.DOWELLS 4.3D	R1
35	TERMINAL BLOCK	1. PHOENIX 2.CONNECTWELL 3.ELEMEX 4.WAGO	

36	INDUSTRIAL SOCKET	1. SCHNEIDER 2. ANCHOR 3. BAJAJ 4. PHILIPS 5. CROMPTON GREENES 6. BCH
37	LOCAL MOTOR STARTER	1. L&T 2. BCH 3. C&S ELECTRIC 4. ABB
38		
39	INSULATING MAT	1. MARVELS VINYL LTD 2. RMG POLYVINYL IND LTD
40	LOCAL PUSH BUTTON STATION	BHEL-EPD APPROVED SOURCE
41	SPACE HEATER	ANY REPUTED MAKE
42	THERMOSTAT	ANY REPUTED MAKE
43	CFL	ANY REPUTED MAKE
44	INTELLIGENT MOTOR CONTROLLER	1. ABB INDIA LTD. 2. GE (ALLEN) 3. SIEMENS LTD. 4. L&T 5. SCHNEIDER ELECTRIC INDIA LTD.

ANNEXURE – VII**DRAWING/DOCUMENT DISTRIBUTION LIST*****All documents & drawings shall be in English and in metric units***

Sl. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS(sets)	NO. OF CD-ROMs (sets)
1.	PLANT DEFINITION MANUAL	-	3 CD-ROMs
2.	Drawings "FOR APPROVAL"	10	Soft copy
3.	Drawings "FOR INFORMATION"	10	Soft copy
4.	Drawings "FINAL APPROVED DRAWING"	8	Soft copy
5.	Drawings "AS BUILT "	8	3 CD-ROMs
6	DATASHEETS, DESIGN CALCULATIONS, PURCHASE SPECIFICATIONS, etc. and Other type of documents:		
	i) For Approval	10	Soft copy
	ii) Final Approved	8	3 CD-ROMs
	iii) Analysis reports of equipments/ piping/ structures components/ systems employing software packages as detailed in the specifications:		
	a) Input	10	Soft copy
	b) Output	10	Soft copy
	c) Drawings / Sketches	10	Soft copy
7	Erection manual "FINAL"	8	3CD ROMS
8	Operation & Maintenance manual	10	3CD ROMS
9	Plant Hand Book "DRAFT"	6	Soft copy
10	Plant Hand Book "FINAL"	15	3CD ROMS
11	Commissioning and Performance Procedure manual	10	3CD ROMS
12	Performance and Functional Guarantees test report	6	3CD ROMS
13	Progress Reports	6	3CD ROMS
14	Project completion report	10	3CD ROMS.
15	QA programme including Organization for implementation and QA system manual (with revision-servicing)	1	3CD ROMS.
S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS(sets)	NO. OF CD-ROMs (sets)
16	Vendor details in respect of proposed vendors including Bidder's evaluation report	2	--

17	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc.:		
	(i) For review/comment	3	
	(ii) For final approval	4	1 set CD ROM.
18	Welding Manual, Heat Treatment Manuals,	4	
	Storage & preservation manuals Final	4	
19	Monthly Vendor Approval and QP approval status	2	1 CD ROM
20	QA Documentation Package for items / equipment manufactured and dispatched to site	2	2 CD ROMs
21	QA Documentation Package for field activities on equipment/systems at site	2	2 CD ROMs

Note: Sl. No. 2,3,4,5,6,7 & 8 - Additional two copies apart from mentioned above shall be sent to BHEL-EPD for RECORDS.

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

TENTATIVE

FOR TENDER PURPOSE ONLY

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	JOB NO.
02	01.08.17	-ST-	AKR/KK	RG	01	22.04.17	-ST- -Sd-	AKR/KK -Sd-	RG -Sd-	423
1. Revised inline with the Lr. No. SE/E/ THP/EE5/AEE-2/F.NCTPP, St.-III(BTG)/ D.500 /17 dt.18.07.17.					1. Revised inline with the Lr. No. SE/E/ THP/EE5/AEE/F.NCTPP, St.-III(BTG)/ D.184/17 dt.12.04.17.					STATUS CONTRACT
										DISTRIBUTION
										TO
										NO.

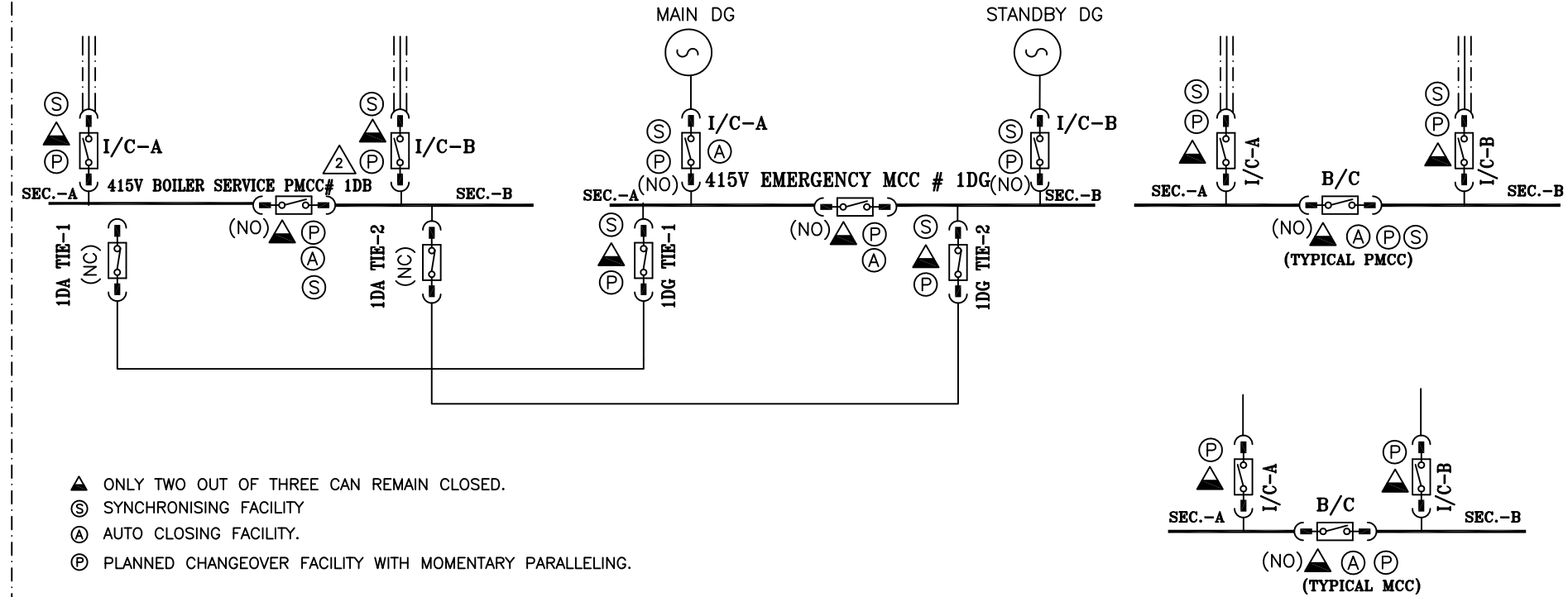
		TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED																						
		FICHTNER CONSULTING ENGINEERS (INDIA) PRIVATE LIMITED																						
		BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA		<table><tr><td>DEPT CODE</td><td>DRN</td><td>NAME ST</td><td>SIGN -Sd-</td><td>DATE 17-01-17</td></tr><tr><td>E</td><td>DSGN</td><td>ST</td><td>-Sd-</td><td>17-01-17</td></tr><tr><td></td><td>CHD</td><td>KK / AKR</td><td>-Sd-</td><td>18-01-17</td></tr><tr><td></td><td>APPD</td><td>RG</td><td>-Sd-</td><td>18-01-17</td></tr></table>	DEPT CODE	DRN	NAME ST	SIGN -Sd-	DATE 17-01-17	E	DSGN	ST	-Sd-	17-01-17		CHD	KK / AKR	-Sd-	18-01-17		APPD	RG	-Sd-	18-01-17
DEPT CODE	DRN	NAME ST	SIGN -Sd-	DATE 17-01-17																				
E	DSGN	ST	-Sd-	17-01-17																				
	CHD	KK / AKR	-Sd-	18-01-17																				
	APPD	RG	-Sd-	18-01-17																				
TITLE LOGIC DIAGRAM FOR 415V SWITCHGEAR		DRAWING NO. PE-DG-423-506-E004																						
		SHEET 1 OF 21 REV. 02																						

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REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	 BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	1X 800 MW NORTH CHENNAI TPS							
																TITLE	LOGIC DIAGRAM FOR 415V SWITCHGEAR			DRAWING NO.		PE-DG-423-506-E004	
																SHEET 2 OF 21			REV. 02				

**LOGIC DIAGRAM FOR 415V
SWITCHGEAR**



KEY DIAGRAM

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

DRAWING NO. **PE-DG-423-506-E004**

SHEET 3 OF 21 REV. 02

PE-DG-423-506-E004

DRAWING NO.

NOTES:

1 THE OPERATIONAL LOGIC FOR DIFFERENT TYPE OF FEEDERS IS DESCRIBED BELOW FEEDER WISE:

A) INCOMER BREAKER AT PMCC/MCC

- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
- b) MANUAL PLANNED CLOSING IN MOMENTARY PARALLELING MODE FROM REMOTE.
- c) MANUAL TRIPPING FROM REMOTE.

B) BUS COUPLER BREAKER AT PMCC/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.

C) DG INCOMER BREAKER AT EMERGENCY SWITCHBOARD

- a) MANUAL DEAD BUS CLOSING FROM REMOTE.
- b) MANUAL PLANNED CLOSING IN MOMENTARY PARALLELING MODE FROM REMOTE.
- c) AUTO CLOSING OF THE EMERGENCY INCOMER BREAKER CONSEQUENT UPON LOSS OF NORMAL SUPPLY & FULLFILLMENT OF OTHER CLOSING PERMISSIVES BUILT.
- d) MANUAL TRIPPING FROM REMOTE.

C) OUTGOING FEEDER FROM PMCC

- a) MANUAL CLOSING FROM REMOTE.
- b) MANUAL TRIPPING FROM REMOTE.
- c) INTER TRIPPING WHEN UPSTREAM BREAKER IS OPEN.

D) OUTGOING FEEDER TO MOTOR
AS PER DRIVE CONTROL PHILOSOPHY.

- 2 UNLESS OTHERWISE INDICATED, ALL COMPONENTS REQUIRED TO MEET THE FUNCTIONAL REQUIREMENTS AS PER THE LOGIC DIAGRAMS ARE LOCATED IN RESPECTIVE SWITCHGEAR.
- 3 THE INTERPOSING RELAYS FOR ON/OFF COMMAND (K12/K11) SHALL BE LOCATED IN RESPECTIVE SWITCHGEAR.
- 4 FOR EDMS/ECP CONTROL LOGICS, REFER DOC.NO.PE-DG-423-510-E153 (LOGIC DIAGRAM FOR ELECTRICAL CONTROL PANEL & ASSOCIATED EDMS LOGIC) & PE-DG-423-510-E154 (LOGIC DIAGRAM FOR CKT BREAKER CONTROLLED FROM EDMS ONLY)

TABLE-1

S. NO	DESCRIPTION	BOARD NO.	NON-MOTOR BKR CONTROL (I/C AND B/C)
1	BOILER SERV. PMCCs	1DB	ECP & EDMS
2	TURBINE SERV. PMCCs	1DA	ECP & EDMS
3	STATION PMCCs	0DA	ECP & EDMS
4	EMERGENCY MCCs	1DG	ECP & EDMS

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

REFERENCE : 1) ELECTRICAL SINGLE LINE DIAGRAM FOR AUX POWER DISTRIBUTION (PE-DG-423-565-E001)

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDATITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR****1X 800 MW NORTH
CHENNAI TPS**DRAWING NO. **PE-DG-423-506-E004**
SHEET 4 OF 21 REV. 02

TABLE-2

S. NO	DESCRIPTION	BOARD NO.	NON-MOTOR BKR CONTROL (I/C & B/C)
1	UNIT SERVICE ACDB	1QA	EDMS
2	WELDING PMCC	ODD	EDMS
3	MISC SERVICE MCC	0QA	EDMS
4	VENTILATION MCC	1TA	EDMS
5	ESP LTMSBs	1DC,1DD,1DE,1DF,1DH & 1DI	EDMS
6	UNIT BOILER ACDB	1HB	EDMS
7	CCR AIR CONDITIONING MCC	0TA	EDMS
8	AIR WASHER MCC	1SA	EDMS
9	AUX. BOILER/FUEL OIL./CPU MCC	0DB	EDMS
10	SERVICE BUILDING PMCC	0DC	EDMS

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



**CLOSING SCHEME FOR 1DG I/C-A FROM MAIN DG
(SIMILAR LOGIC SHALL BE APPLICABLE FOR 1DG I/C-B)**

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE	LOGIC DIAGRAM FOR 415V SWITCHGEAR
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1X 800 MW NORTH CHENNAI TPS

DRAWING NO.	PE-DG-423-506-E004
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SHEET	5	OF	21	REV.	02
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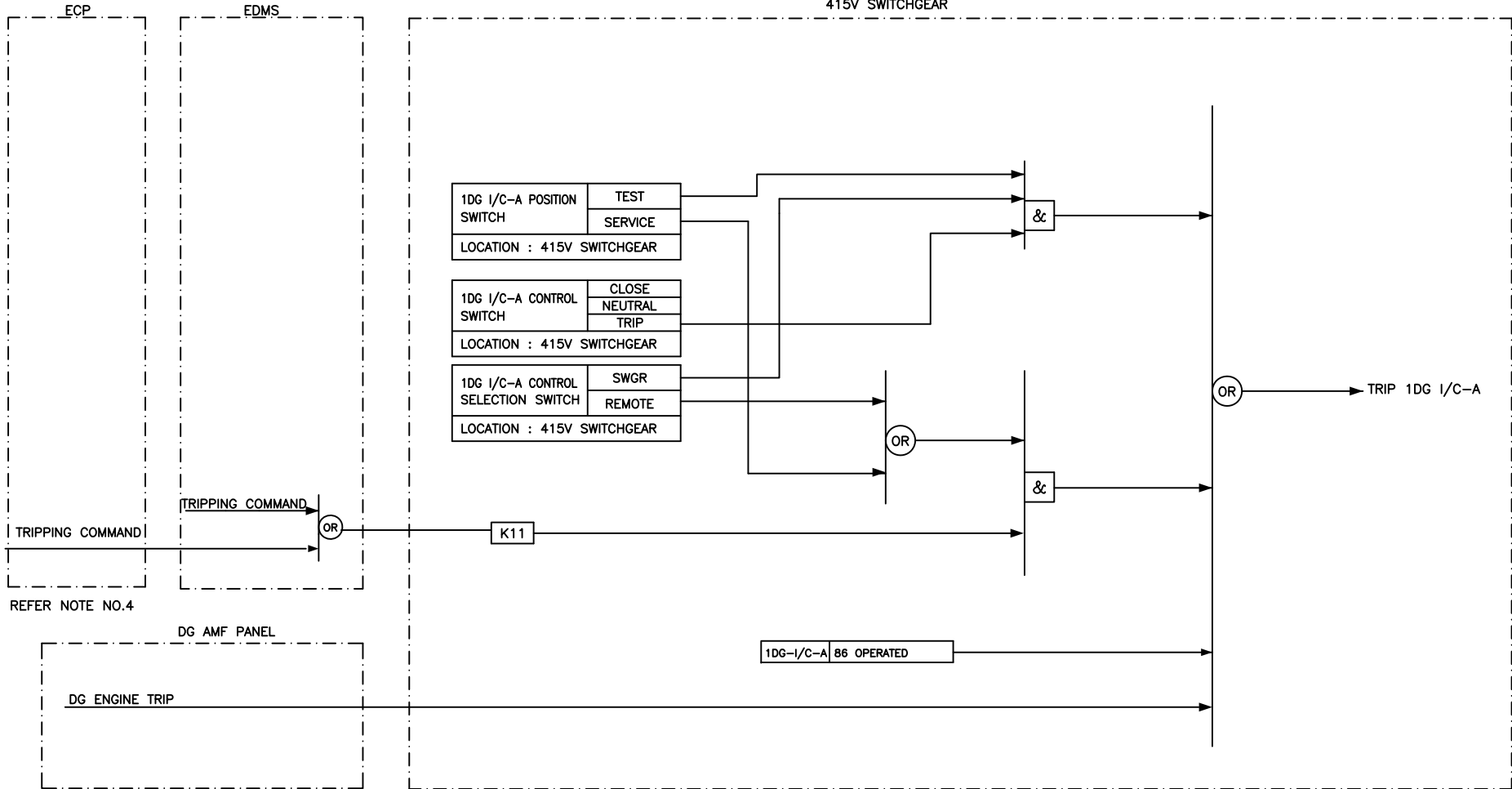
CUSTOMER'S DRAWING NO.

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



TRIPPING SCHEME FOR 1DG I/C-A
(SIMILAR LOGIC SHALL BE APPLICABLE FOR 1DG I/C-B)

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



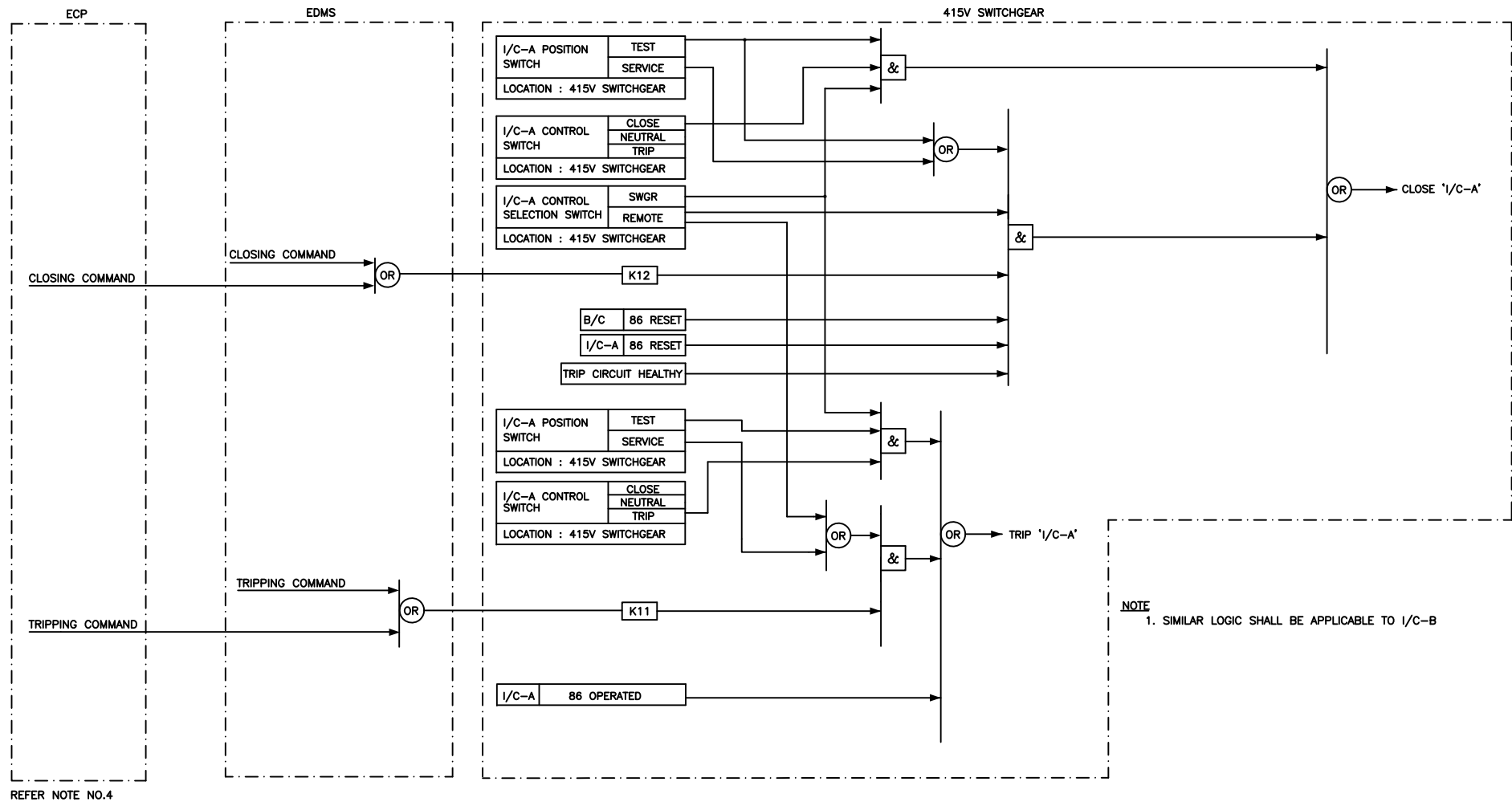
BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

SHEET 6 OF 21 REV. 02



CLOSING & TRIPPING SCHEME FOR INCOMER TO SWITCHBOARDS CONTROLLED FROM ECP AS WELL AS EDMS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	 BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	1X 800 MW NORTH CHENNAI TPS			
										TITLE LOGIC DIAGRAM FOR 415V SWITCHGEAR						DRAWING NO. PE-DG-423-506-E004			
										SHEET 7 OF 21				REV. 02					

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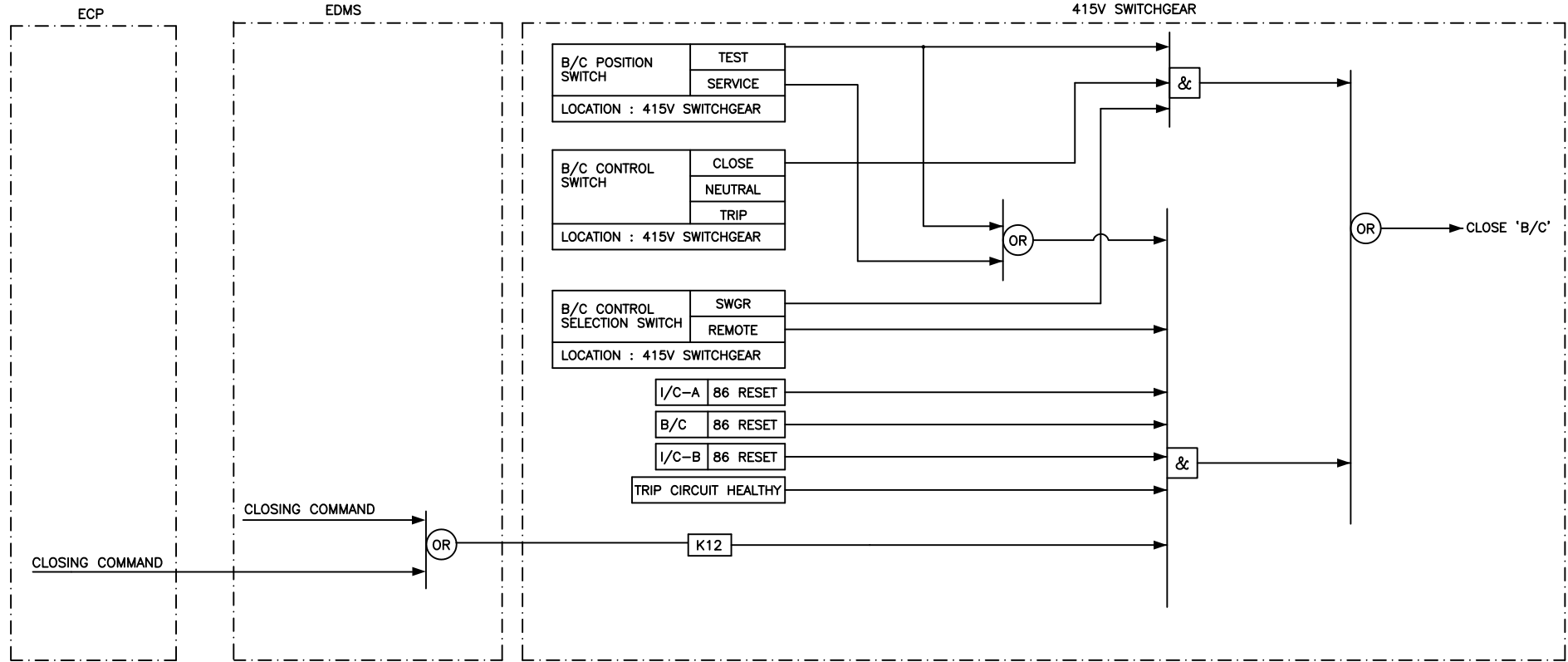
CUSTOMER'S DRAWING NO.

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



REFER NOTE NO.4

CLOSING SCHEME FOR BUSCOUPLER OF SWITCHBOARDS CONTROLLED ECP AS WELL AS EDMS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

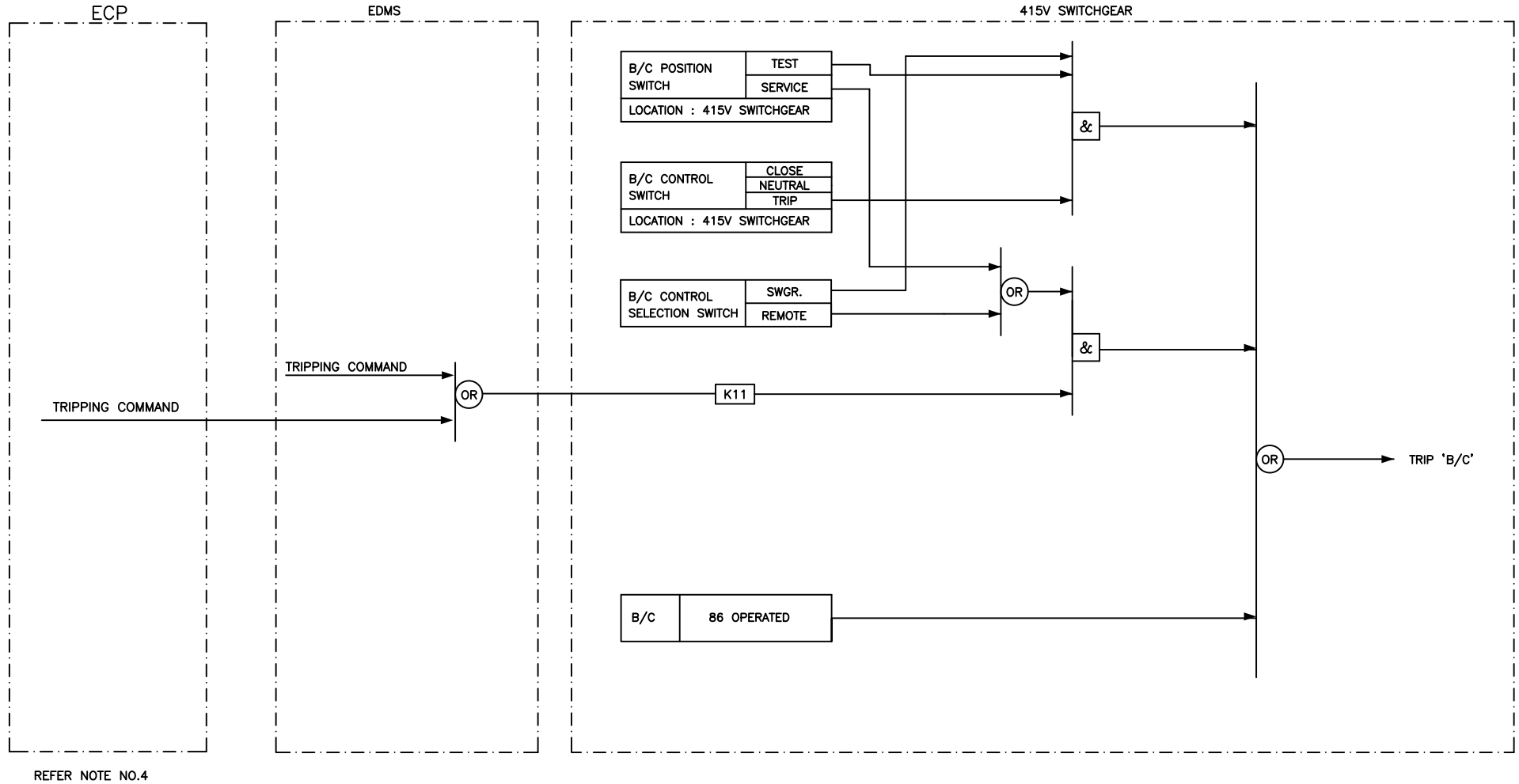
SHEET 8 OF 21 REV. 02

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



TRIPPING SCHEME FOR BUSCOUPLER OF SWITCHBOARDS CONTROLLED FROM ECP AS WELL AS EDMS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

DRAWING NO. **PE-DG-423-506-E004**

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PE-DG-423-506-E004

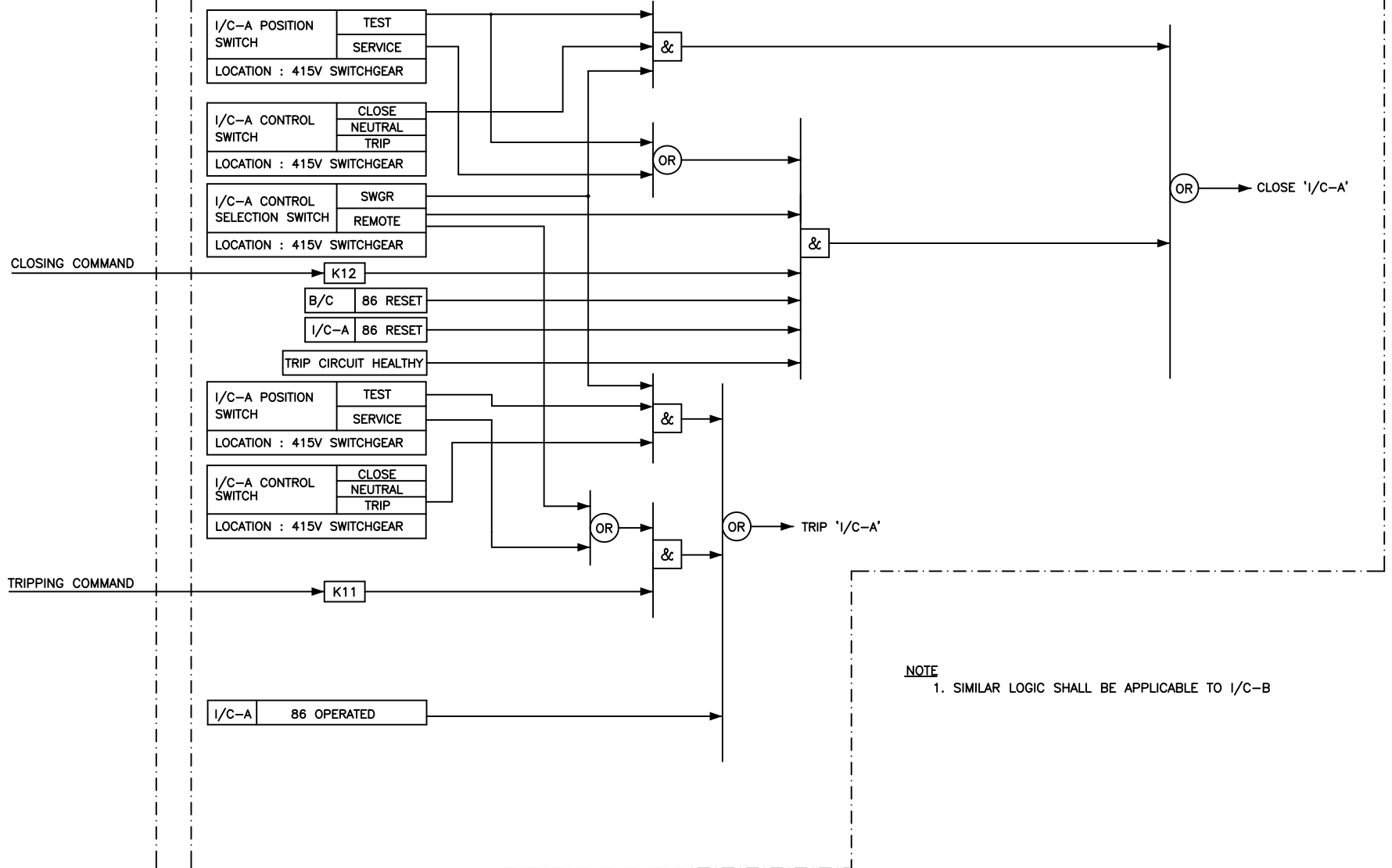
DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004

EDMS

415V SWITCHGEAR



NOTE

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

REFER NOTE NO.4

CLOSING & TRIPPING SCHEME FOR INCOMER TO SWITCHBOARDS CONTROLLED FROM EDMS/DDCMIS ONLY

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

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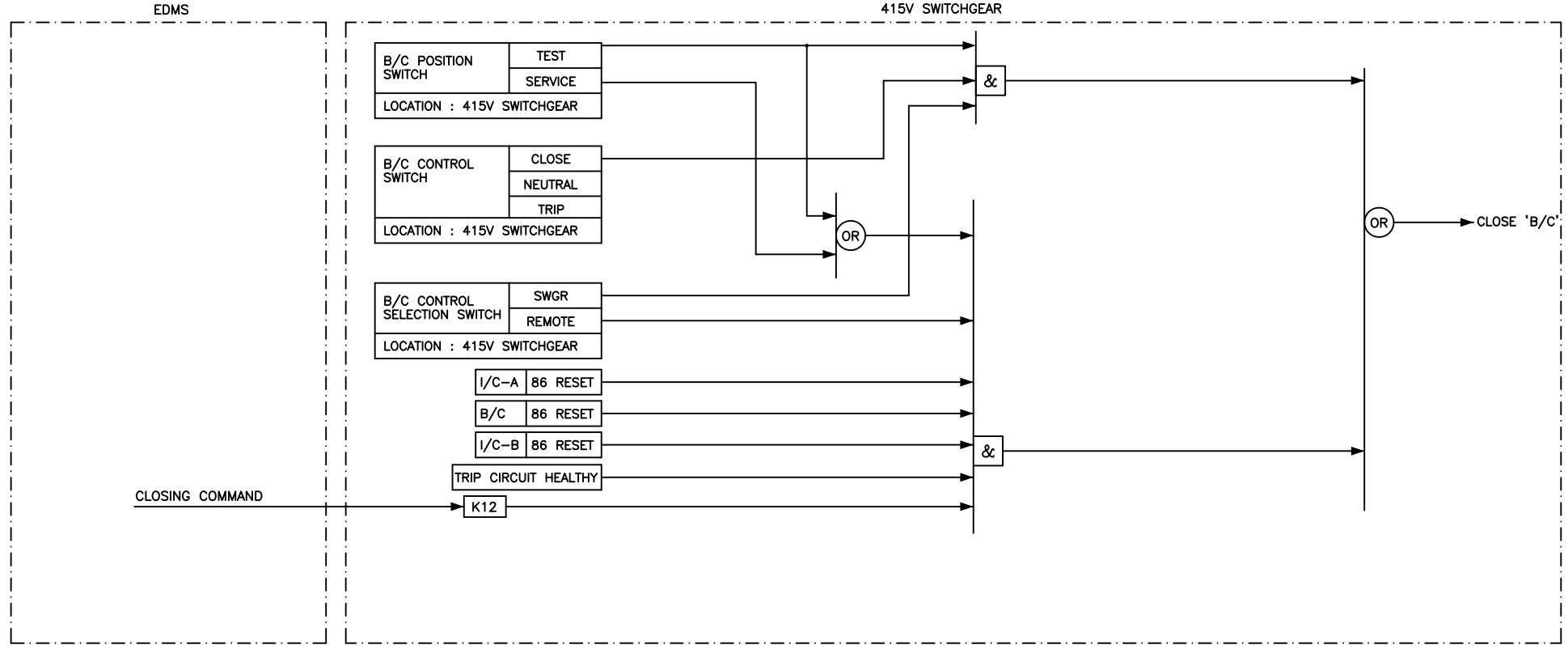
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PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



REFER NOTE NO.4

CLOSING SCHEME FOR BUSCOUPLER OF SWITCHBOARDS CONTROLLED FROM EDMS/DDCMIS ONLY

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

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PE-DG-423-506-E004

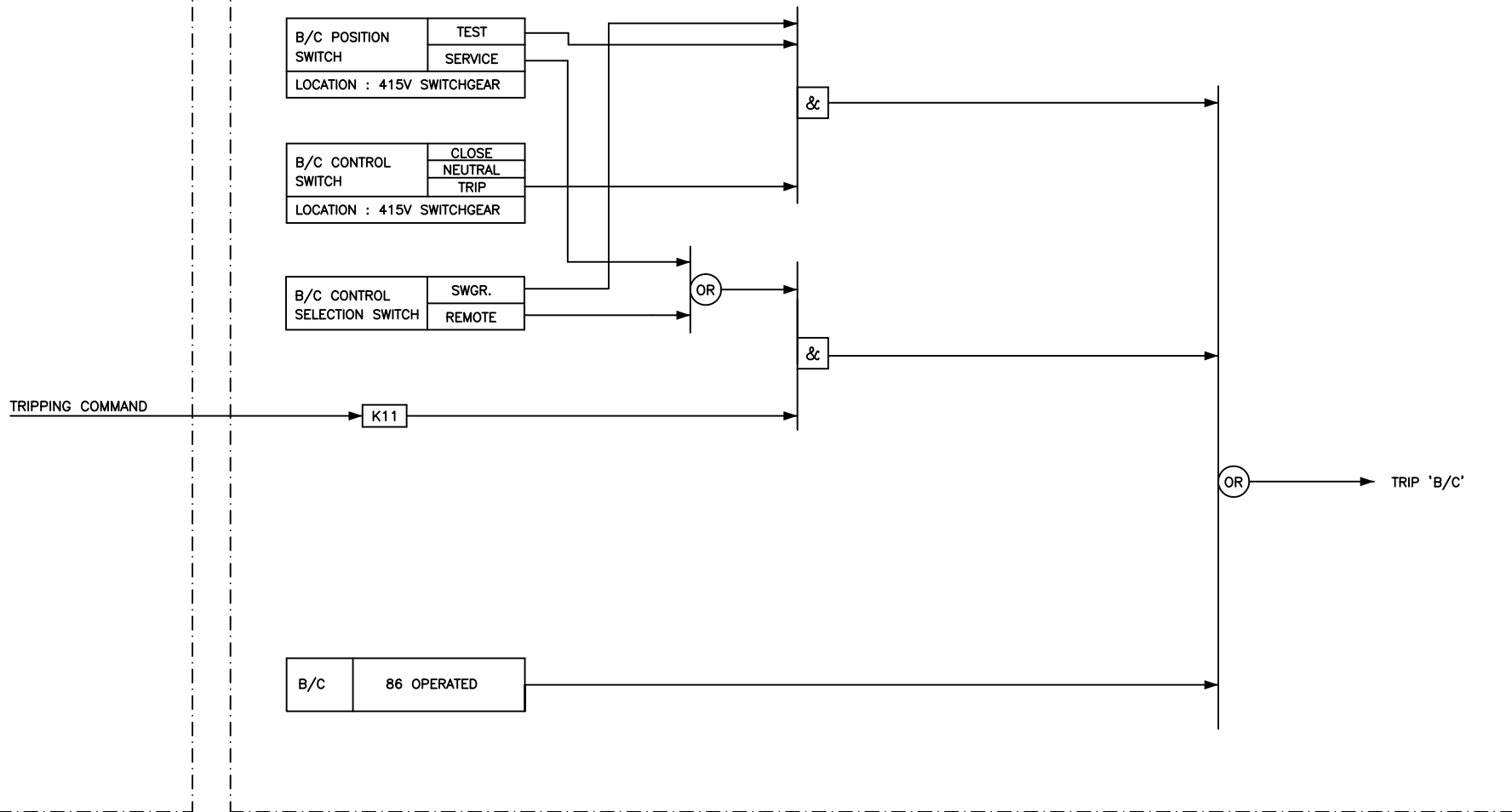
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ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004

EDMS

415V SWITCHGEAR



REFER NOTE NO.4

TRIPPING SCHEME FOR BUSCOUPLER OF SWITCHBOARDS CONTROLLED FROM EDMS/DDCMIS ONLY

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

DRAWING NO. **PE-DG-423-506-E004**

SHEET 12 OF 21 REV. 02

PE-DG-423-506-E004

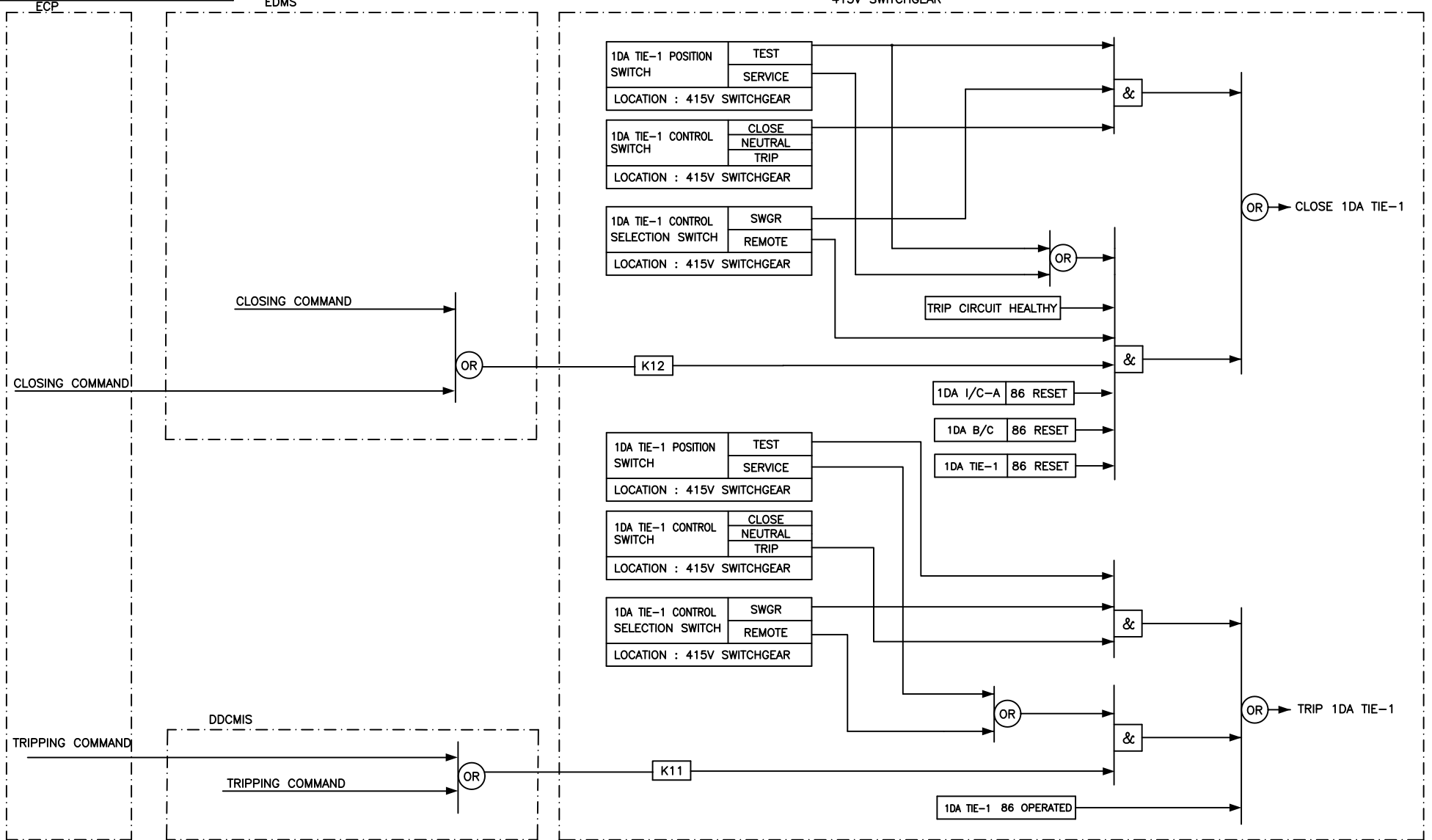
DRAWING NO.

EDMS

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004

415V SWITCHGEAR



REFER NOTE NO.4

CLOSING & TRIPPING SCHEME FOR 1DA TIE-1 BREAKER BETWEEN EMERGENCY MCC # 1DG AND BOILER SERVICE PMCC #1DA AT 1DA BOARD

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
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PROJECT ENGINEERING MANAGEMENT
Noida

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

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PE-DG-423-506-E004

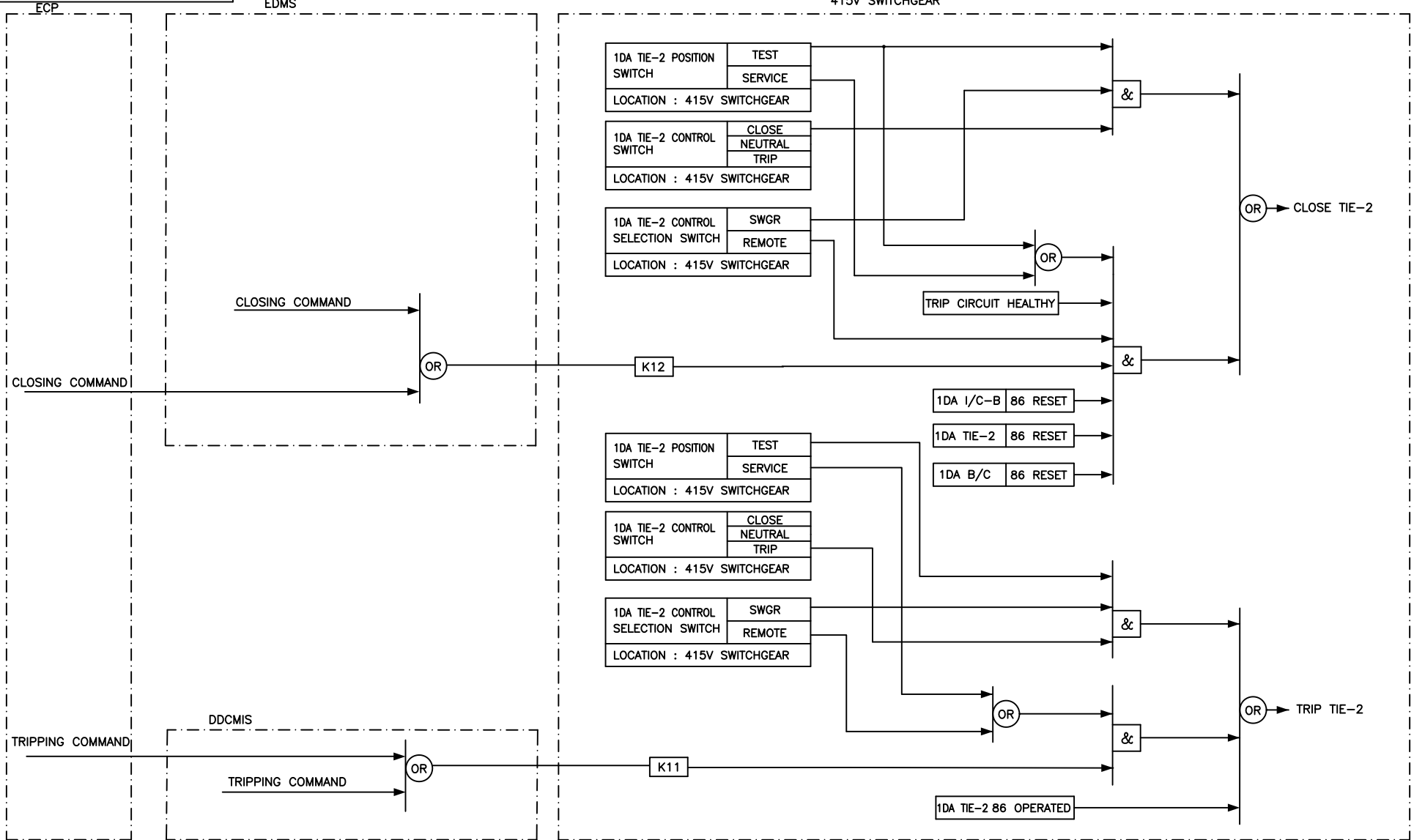
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EDMS

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004

415V SWITCHGEAR



REFER NOTE NO.4

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



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POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
Noida

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

SHEET 14 OF 21 REV. 02

PE-DG-423-506-E004

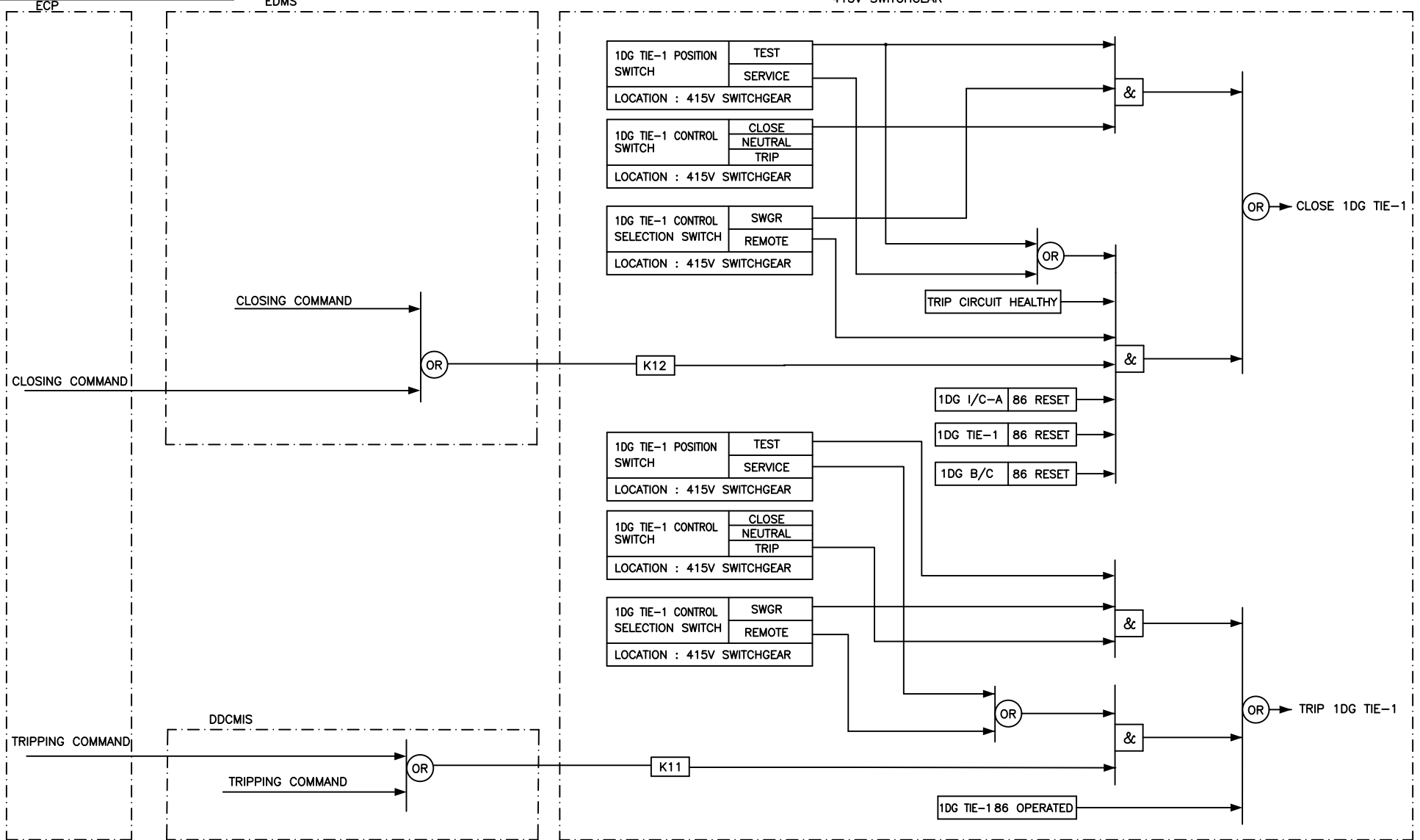
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EDMS

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004

415V SWITCHGEAR



REFER NOTE NO.4

CLOSING & TRIPPING SCHEME FOR 1DG TIE-1 BREAKER BETWEEN EMERGENCY MCC # 1DG AND BOILER SERVICE PMCC # 1DA AT 1DG BOARD

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



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Noida

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

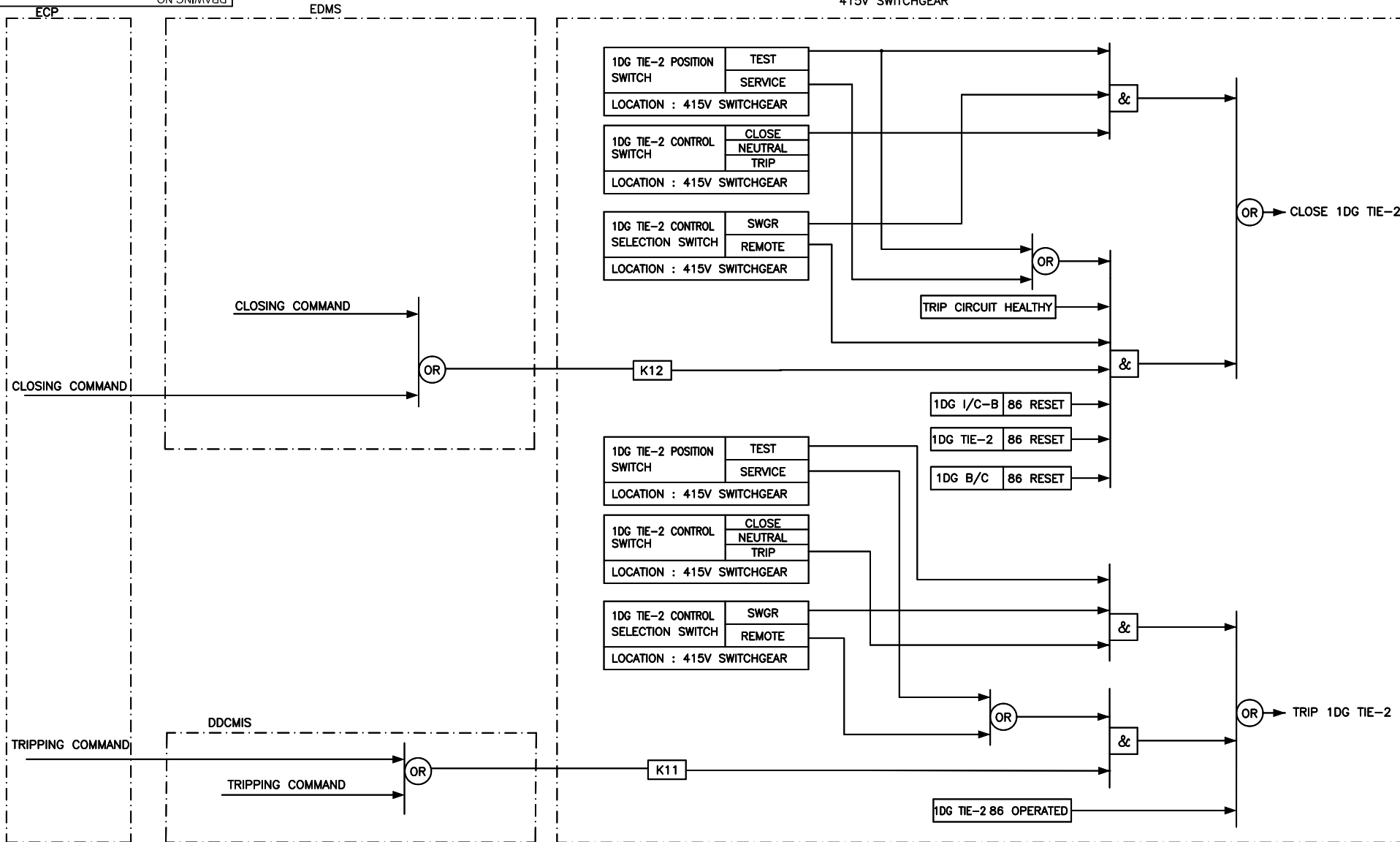
SHEET 15 OF 21 REV. 02

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



REFER NOTE NO.4

CLOSING & TRIPPING SCHEME FOR 1DG TIE-2 BREAKER BETWEEN EMERGENCY MCC # 1DG AND BOILER SERVICE PMCC # 1DA AT 1DG BOARD

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



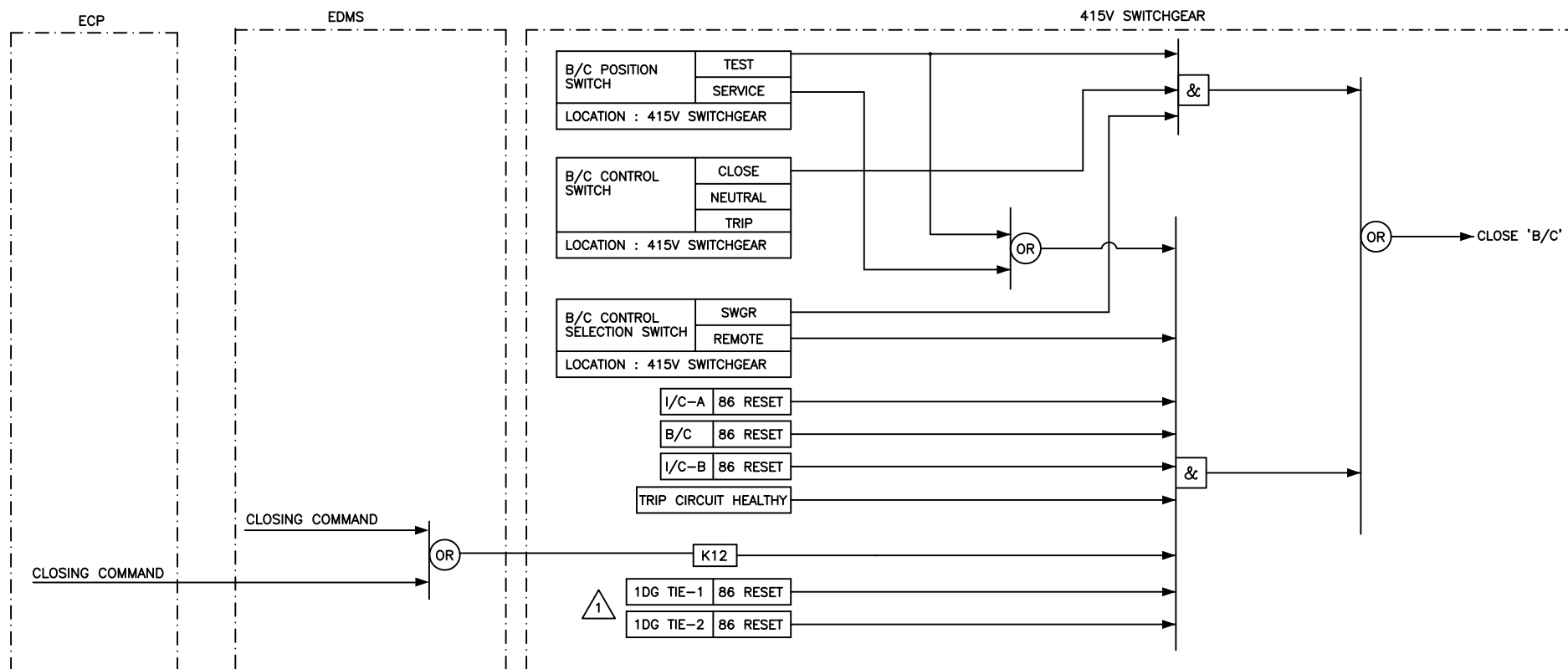
BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NODA

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

SHEET 16 OF 21 REV. 02



REFER NOTE NO.4

CLOSING SCHEME FOR BUSCOUPLER OF EMERGENCY SERVICE SWITCHBOARDS CONTROLLED ECP AS WELL AS EDMS

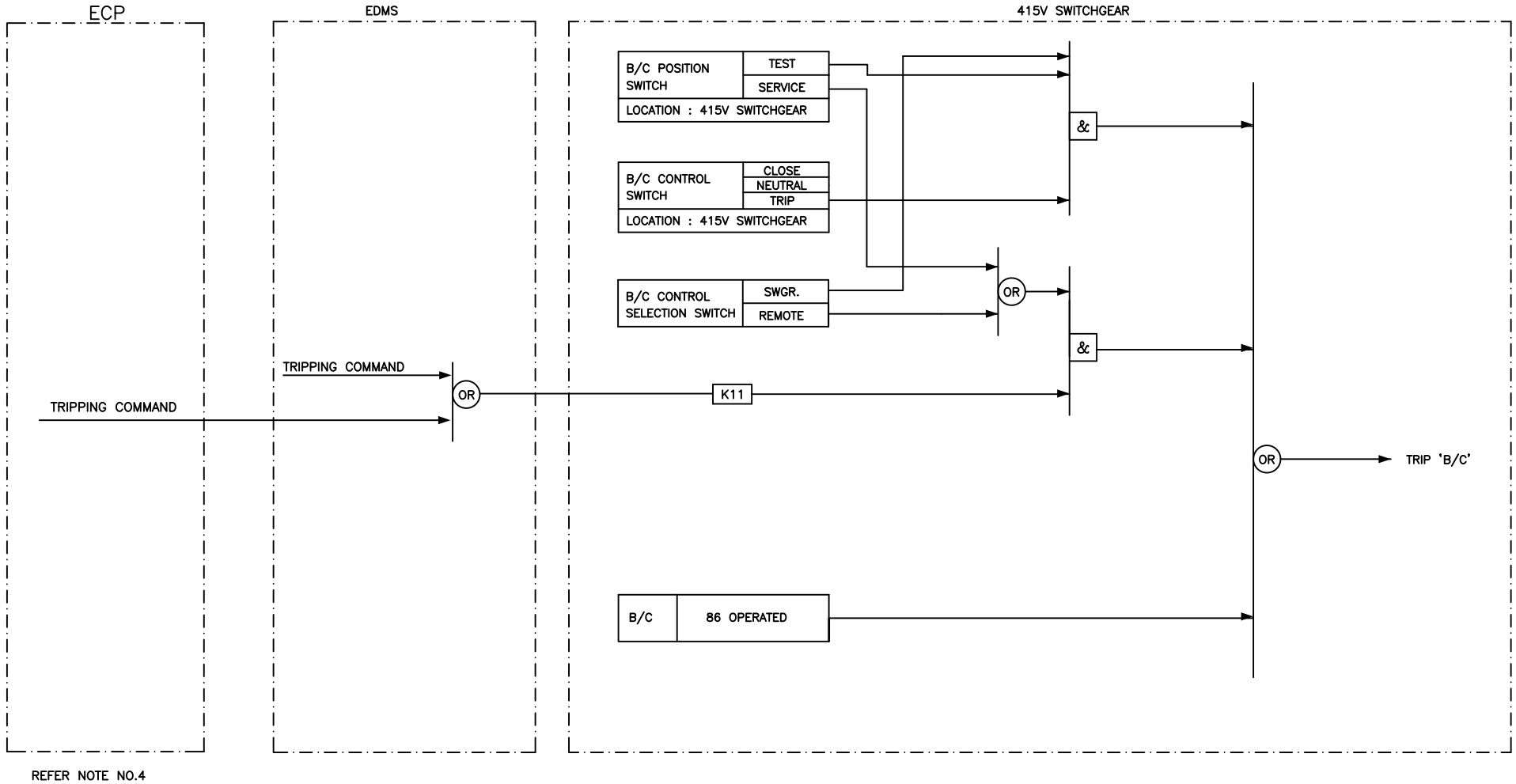
REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	 BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	1X 800 MW NORTH CHENNAI TPS			
										TITLE LOGIC DIAGRAM FOR 415V SWITCHGEAR						DRAWING NO. PE-DG-423-506-E004			
																SHEET 17 OF 21			

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



TRIPPING SCHEME FOR BUSCOUPLER OF EMERGENCY SERVICE SWITCHBOARDS CONTROLLED ECP AS WELL AS EDMS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

DRAWING NO. **PE-DG-423-506-E004**

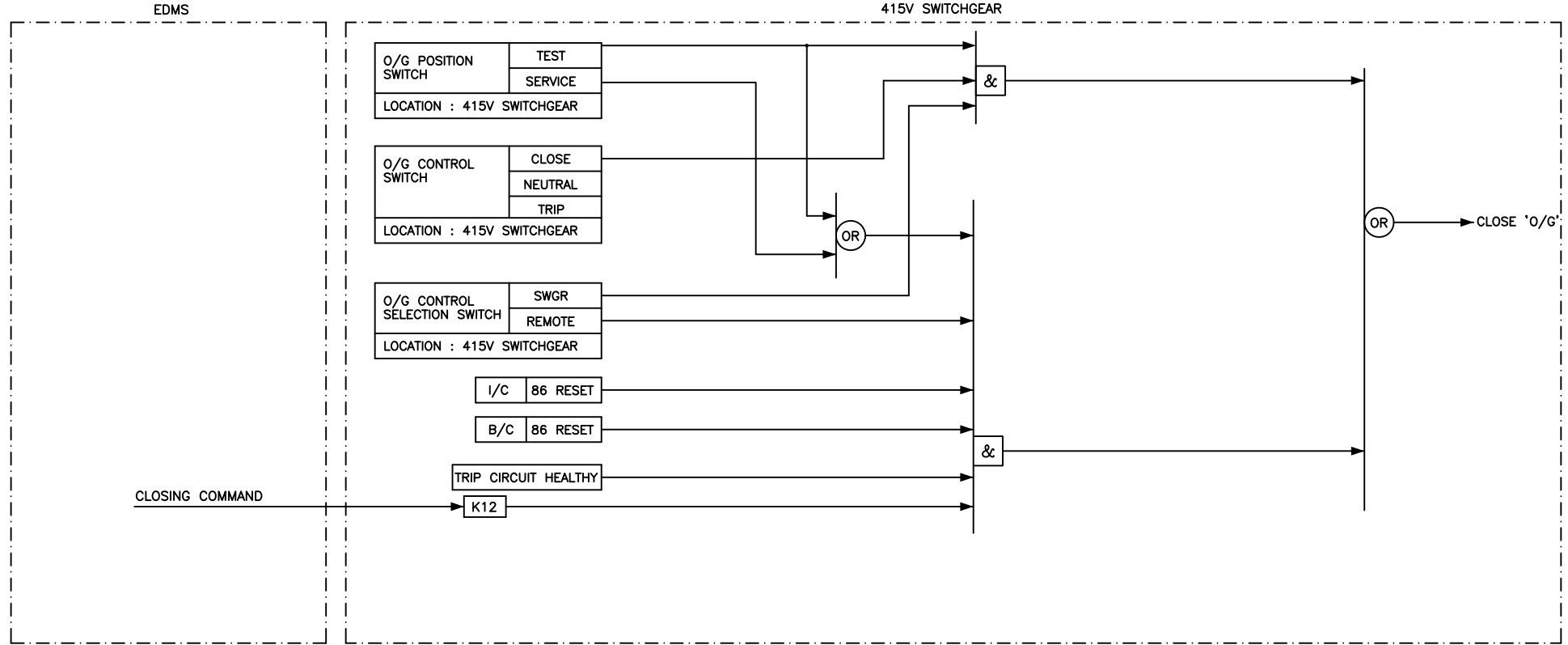
SHEET 18 OF 21 REV. 02

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



CLOSING SCHEME FOR OUTGOING FEEDERS CONTROLLED FROM EDMS/DDCMIS ONLY

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

DRAWING NO. **PE-DG-423-506-E004**

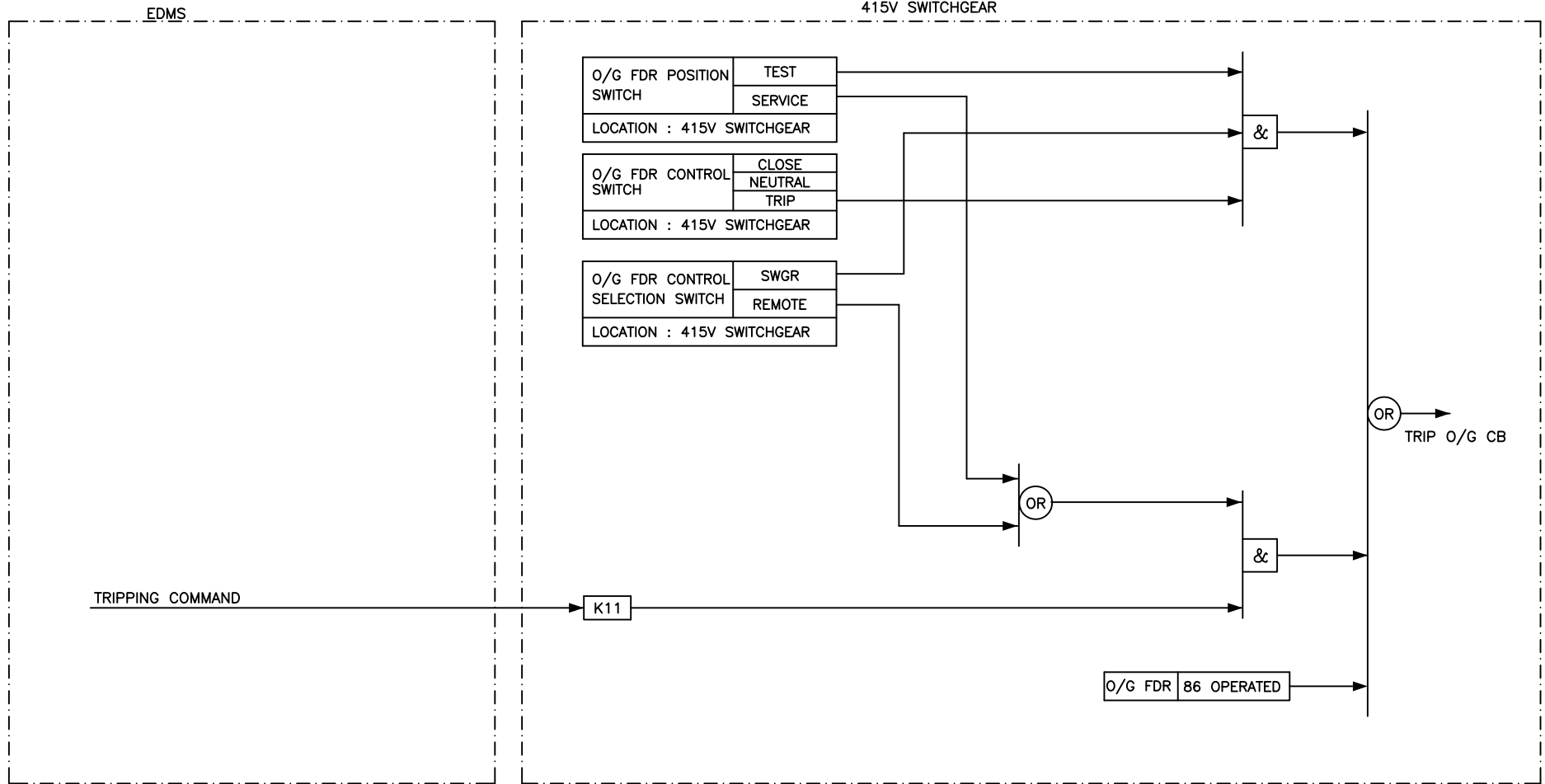
SHEET 19 OF 21 REV. 02

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



REFER NOTE NO.4

TRIPPING SCHEME FOR OUTGOING FEEDER CONTROLLED FROM EDMS/DDCMIS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

TITLE **LOGIC DIAGRAM FOR 415V SWITCHGEAR**

1X 800 MW NORTH CHENNAI TPS

DRAWING NO. **PE-DG-423-506-E004**

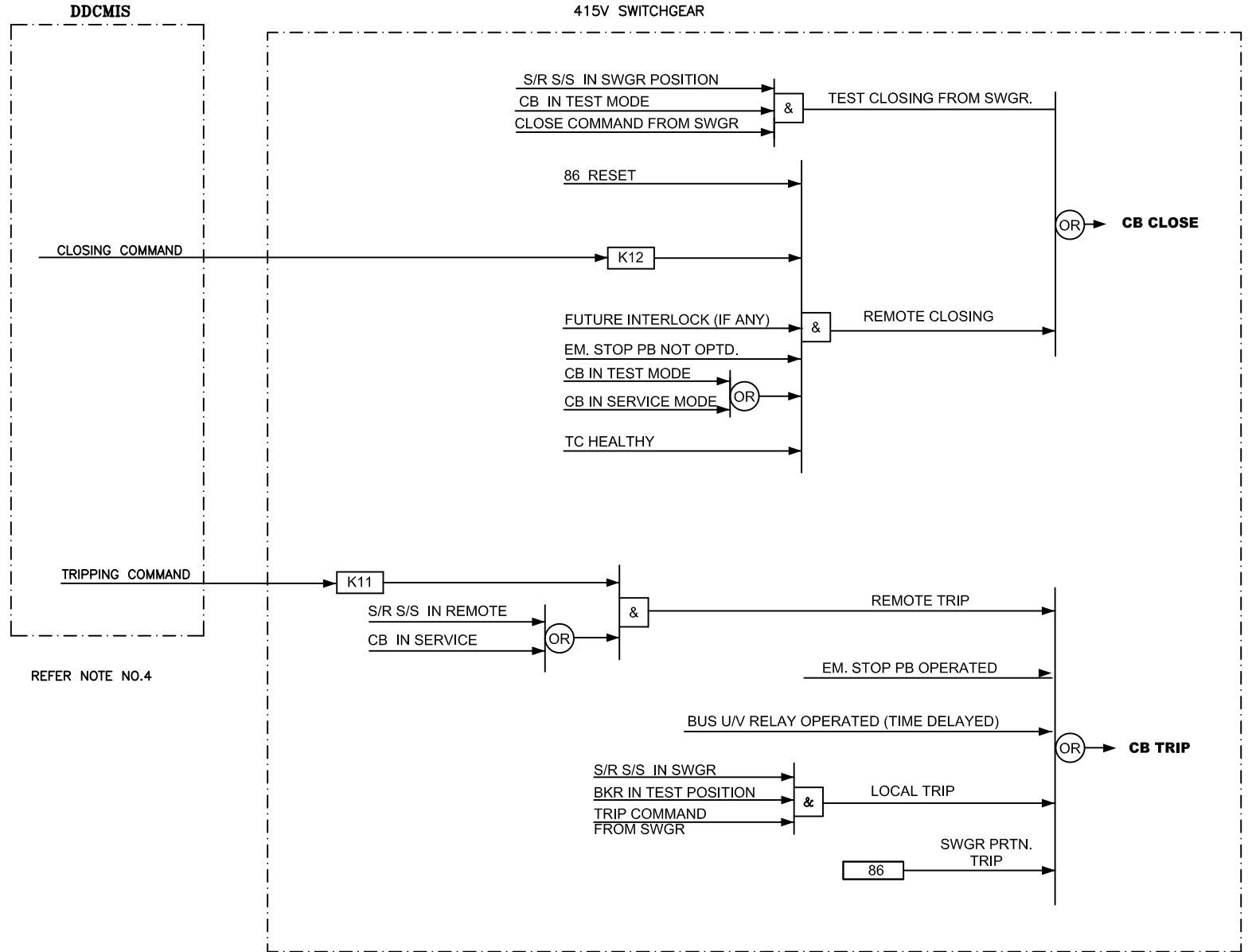
SHEET 20 OF 21 REV. 02

PE-DG-423-506-E004

DRAWING NO.

ANNEXURE-A

DOC NO: EPD-TS-CPBG-16004



CLOSING & TRIPPING SCHEME FOR OUTGOING BREAKER MOTOR FEEDER CONTROLLED FROM DDCMIS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NODA

TITLE **LOGIC DIAGRAM FOR 415V
SWITCHGEAR**

**1X 800 MW NORTH
CHENNAI TPS**

DRAWING NO. **PE-DG-423-506-E004**

SHEET 21 OF 21 REV. 02

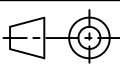
DRIVE CONTROL PHILOSOPHY (STATION C&I)

REV.	DATE	ALTD	CHD	APPD	DH	REV.	DATE	ALTD	CHD	APPD	DH
04	09.05.17	SK	SCS	SCS	DP	06	31.10.17	SK	SCS	SCS	DP
1.	REVISED IN LINE WITH CUSTOMER /CONSULTANT COMMENTS RECVD VIDE LTR NO. D172/17 DTD:07.04.17.					1.	REVISED IN LINE WITH CUSTOMER COMMENTS RECEIVED VIDE LTR No. D.770/17 dt.30.10.17.				
REV.	DATE	ALTD	CHD	APPD	DH	REV.	DATE	ALTD	CHD	APPD	DH
03	15.03.17	SK	SCS	SCS	DP	05	23.08.17	SK	SCS	SCS	DP
1.	REVISED IN LINE WITH DISCUSSION WITH CUSTOMER/CONSULTANT ON 17.02.2017 & 18.02.2017 AT TANGEDCO H.O.					1.	REVISED IN LINE WITH CUSTOMER /CONSULTANT COMMENTS RECVD VIDE LTR NO. 0612 DTD:07.06.17.				

TENTATIVE

FOR TENDER PURPOSE ONLY

ALL DIMENSIONS ARE IN mm

CUSTOMER						CUSTOMER:  TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD. 5TH FLOOR, WESTERN WING, NPKRR MAALIGAI, 144, ANNA SALAI, CHENNAI-600002					
CUSTOMER'S CONSULTANT						CONSULTANT: FICHTNER INDIA FICHTNER CONSULTING ENGINEERS (INDIA) PVT LTD. MENON ETERNITY, 9TH FLOOR, NO.165, ST. MARY'S ROAD, ALWARPET, CHENNAI-600018					
JOB NO. 423											
STATUS CONTRACT						PROJECT:- 1X800 MW TANGEDCO NORTH CHENNAI TPP					
DISTRIBUTION						STAGE III-BTG					
REV.	DATE	ALTD	CHD	APPD	DH	 BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	DEPT CODE I	NAME	SIGN	DATE	
02	22.12.16	SK	SCS	SCS	DP			DESN	SK	-sd-	11.04.2016
1.	DOCUMENT NOT REVISED AS NO NEW COMMENTS WERE RECEIVED.							CHD	SCS	-sd-	11.04.2016
								APPD	DP	-sd-	11.04.2016
						TITLE DRIVE CONTROL PHILOSOPHY(STATION C&I)					
REV.	DATE	ALTD	CHD	APPD	DH	DEPT.	SCALE 1:1	DRAWING NO.			
01	05.09.16	SK	SCS	DP	SKG	SIGN		PE-DM-423-145-I002			
1.	REVISED IN LINE WITH OBSERVATIONS RECEIVED FROM INTERNAL DEPARTMENTS WITHIN BHEL.					DATE		SHEET 1 OF 11 REV. 06			

	DOCUMENT TITLE		DOCUMENT NUMBER		PE-DM-423-145-I002	
	DRIVE CONTROL PHILOSOPHY(STATION C&I)		REVISION NUMBER		06	DATE 31.10.2017
	PROJECT: 1 X 800 MW NORTH CHENNAI TPP STAGE-III		SHEET		2	OF 11

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).
- 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, start & stop command shall be latched at integral starter end, except for inching duty bi-directional drives where latching is not required. Unlatching shall be done after receiving limit switch feedback.
- 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.

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.
- 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

	DOCUMENT TITLE	DOCUMENT NUMBER	PE-DM-423-145-I002
	DRIVE CONTROL PHILOSOPHY(STATION C&I)	REVISION NUMBER	06 DATE 31.10.2017
	PROJECT: 1 X 800 MW NORTH CHENNAI TPP STAGE-III	SHEET	3 OF 11

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. Local start command shall be processed in DDCMIS to ensure interlock & protection.



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
- v. Local start shall be wired to the DDCMIS via MCC

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. Backup operation from UCP shall be provided for some essential drives for safe shutdown of Plant.

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

3 Solenoid Operated Drives

- 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 NUMBER	PE-DM-423-145-I002
	DRIVE CONTROL PHILOSOPHY(STATION C&I)	REVISION NUMBER	06 DATE 31.10.2017
	PROJECT: 1 X 800 MW NORTH CHENNAI TPP STAGE-III	SHEET	4 OF 11

- 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.

The above signal exchanges are diagrammatically represented in sh. no. 9A for single coil & 9 for dual coil.

4 HT/LT Unidirectional Drives (Breaker operated)

- a. Remote manual operation of Breaker operated drives shall be normally from remote i.e. DDCMIS in main Control Room through OWS/LVS and Local/remote selection of drives shall also be done in DDCMIS.
- b. Remote/Switchgear (SWGR) 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/SWGR) 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 'SWGR' 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 soft 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 button shall be wired to the DDCMIS. Local start command shall be processed in DDCMIS to ensure interlock & protection.
- f. Necessary electrical protections for the drive shall be realised at Switchgear, whereas process interlocks and protections are realized in DDCMIS.

	DOCUMENT TITLE		DOCUMENT NUMBER		PE-DM-423-145-I002	
	DRIVE CONTROL PHILOSOPHY(STATION C&I)		REVISION NUMBER		06	DATE 31.10.2017
	PROJECT: 1 X 800 MW NORTH CHENNAI TPP STAGE-III		SHEET		5	OF 11

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/Overload 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 shall be wired to the DDCMIS via SWGR/MCC.



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. Backup operation from UCP shall be provided for some essential drives for safe shutdown of Plant.

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.
- 1.4 Analog Displays have following functionality:
 - Auto/Manual selection with control device “Raise/Lower Buttons”
 - Set point indication with “Raise/Lower Buttons”
 - Indication for deviation between set point and measured value
 - Measured value indication
 - Final control element portion indicators

	DOCUMENT TITLE		DOCUMENT NUMBER		PE-DM-423-145-I002	
	DRIVE CONTROL PHILOSOPHY(STATION C&I)		REVISION NUMBER		06	DATE 31.10.2017
	PROJECT: 1 X 800 MW NORTH CHENNAI TPP STAGE-III		SHEET		6	OF 11

The above signal exchanges with DDCMIS are diagrammatically represented in sh.no. 11.

C. CABLE

For interconnection of analog signals (4-20mA) to DDCMIS, in general “armoured” 0.5sq mm color coded individually and over all screened twisted pair shall be used (F Type).

For interconnection of binary signals (24V DC) to DDCMIS, “armoured” 0.5sq mm color coded over all screened twisted pair cable shall be used (G Type).

Notes: - 1) IO redundancy shall be considered for drives in line with specification requirement.

2) Intimation through message & E-mail shall be provided for tripping of critical HT drives.

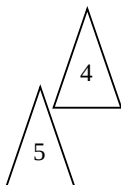
3) Redundancy of signals from/to MCC & SWGR shall be provided as per technical specification.

4) Backup operation from UCP shall be envisaged for critical Drives.

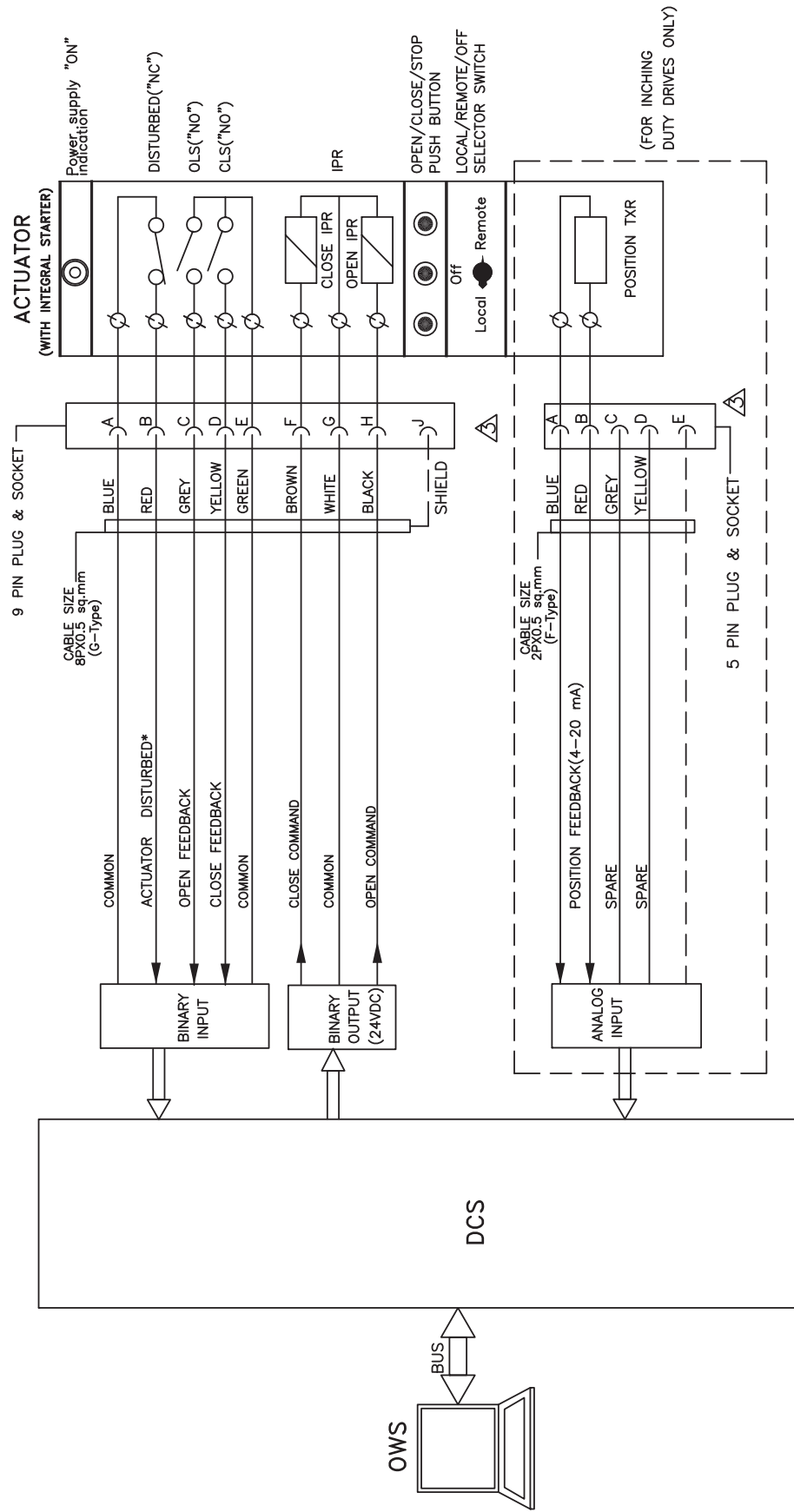
5) Changeover contacts has been provided for ON-OFF feedbacks, for non-coincidence monitoring of HT/LT Drives.

3

6



DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



NOTE:

1. * 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.
2. POSITION FEEDBACK OF BIDIRECTIONAL INCHING DUTY DRIVES IN VICINITY MAY BE GROUPED TOGETHER IN THE FIELD DURING CABLE ENGG. USING JUNCTION BOXES & SINGLE TRUNK CABLE OF HIGHER SIZE MAY BE USED TO CONNECT.



**PROJECT: 1X800 MW TANGEDCO NORTH CHENNAI TPP
STAGE III-BTG**

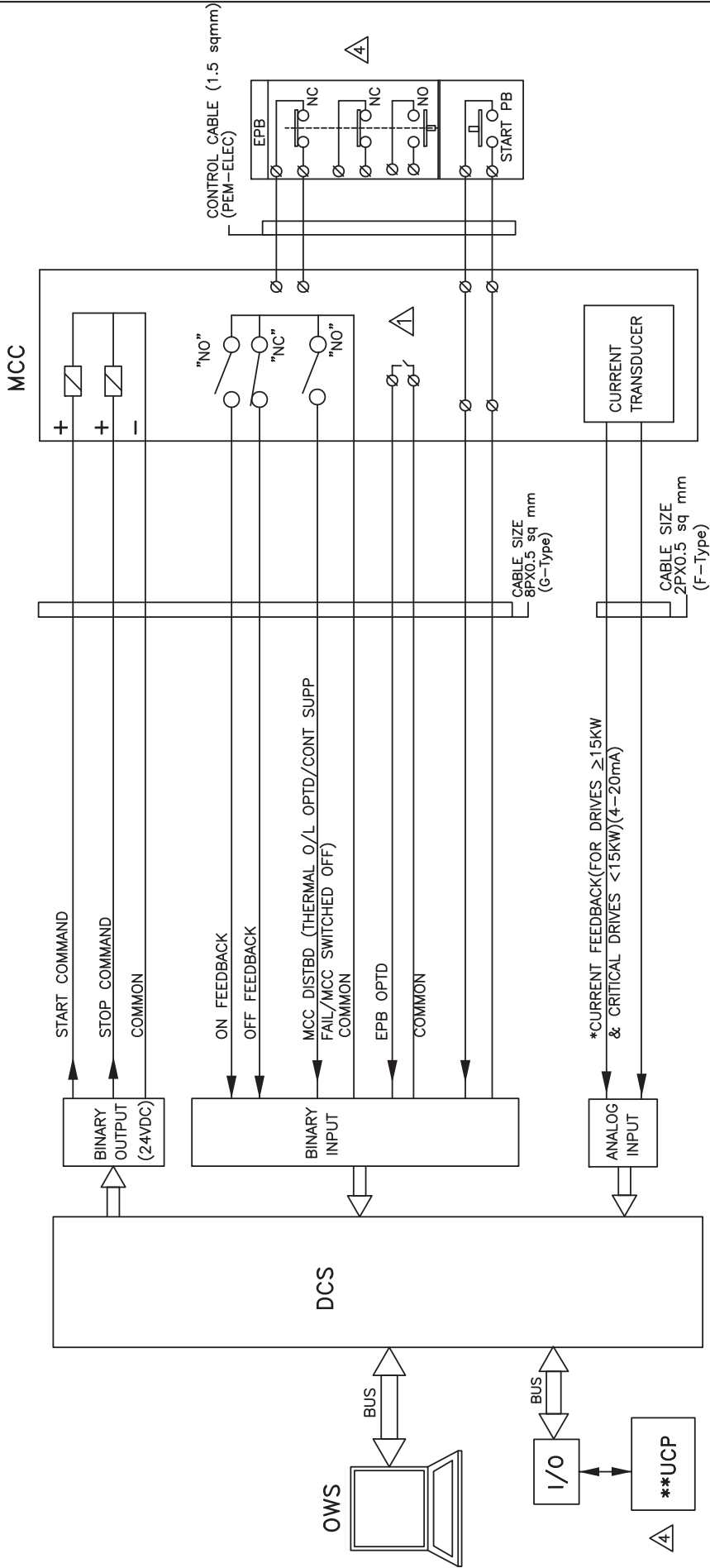
DRG.NO.	:PE-DM-423-145-I002
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DATE	31.10.2017
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REV.NO.	06
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SHT 7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE(CONTACTOR OPERATED)



NOTE:

* FOR LTUD DRIVES, 4-20mA CURRENT TRANSDUCER SHALL BE CONSIDERED FOR BARRING GEARINGMOTOR, JOP, AIR HEATER MOTOR, LUBE OIL PUMPS, SCANNER AIR FANS, SEAL AIR FANS as applicable.

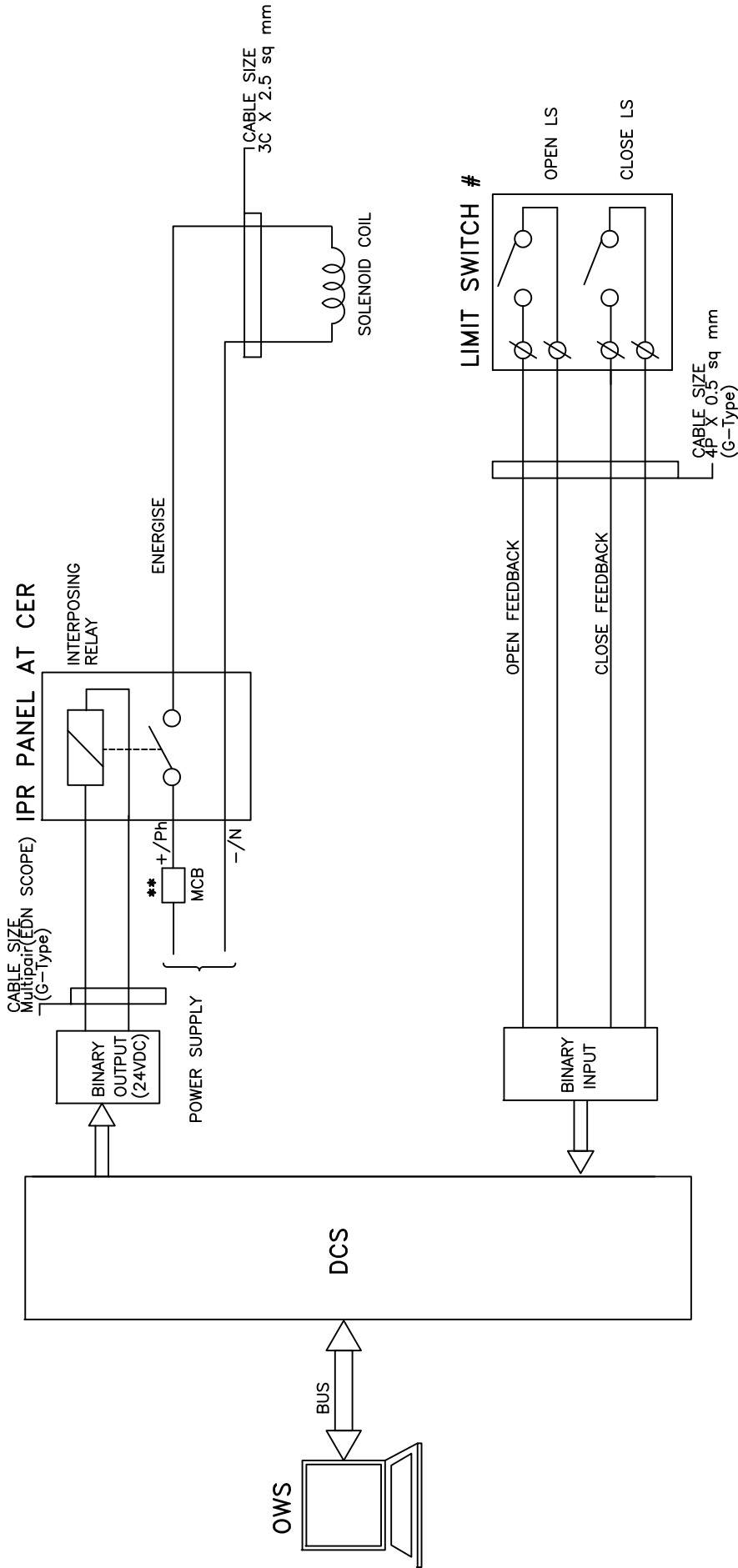
** FOR ESSENTIAL DRIVES FOR SAFE SHUT DOWN OF PLANT.



PROJECT:	1X800 MW TANGEDCO NORTH CHENNAI TPP
STAGE	III-BTG
TITLE	DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE

DRG.NO.	:PE-DM-423-145-I002
DATE	31.10.2017
REV.NO.	06
SHT	8 OF 11

DDCMIS INTERFACE FOR SOLENOID DRIVE
(24V DC / 240V AC UPS)



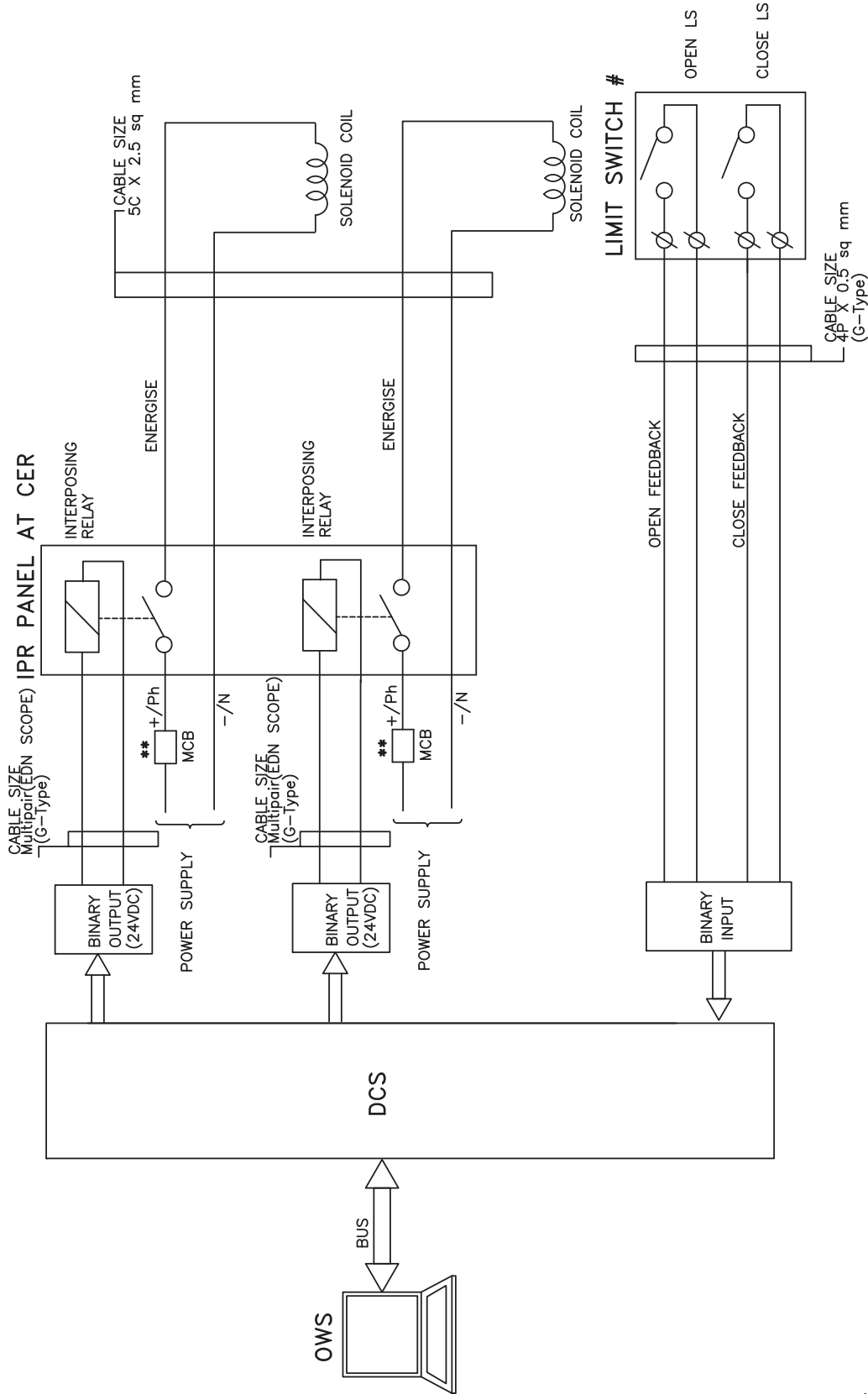
NOTES:

1. ** MCB SHALL BE PROVIDED FOR EACH SOLENOID
2. # FOR ON/OFF TYPE, SOLENOID ACTUATED VALVE. RELAY CONTACTS SHALL BE WIRED AS FEEDBACK WHEREVER LIMIT SWITCH FEEDBACKS ARE NOT AVAILABLE.
3. FEEDBACK OF SOLENOID DRIVES IN VICINITY MAY BE GROUPED TOGETHER IN THE FIELD USING JUNCTION BOXES & SINGLE TRUNK CABLE OF HIGHER SIZE MAY BE USED TO CONNECT TO THE DCS.



	PROJECT: 1X800 MW TANGEDCO NORTH CHENNAI TPP		DRG.NO.	:PE-DM-423-145-I002
	STAGE III-BTG		DATE	31.10.2017
	TITLE DDCMIS INTERFACE FOR		REV.NO.	06
	SOLENOID DRIVE (SINGLE COIL)		SHT	9A OF 11

DDCMS INTERFACE FOR SOLENOID DRIVE (DUAL COIL)
(24V DC / 240V AC UPS)



NOTES:

1. ** MCB SHALL BE PROVIDED FOR EACH SOLENOID
2. # FOR ON/OFF TYPE, SOLENOID ACTUATED VALVE. RELAY CONTACTS SHALL BE WIRED AS FEEDBACK WHEREVER LIMIT SWITCH FEEDBACKS ARE NOT AVAILABLE.
3. FEEDBACK OF SOLENOID DRIVES IN VICINITY MAY BE GROUPED TOGETHER IN THE FIELD USING JUNCTION BOXES & SINGLE TRUNK CABLE OF HIGHER SIZE MAY BE USED TO CONNECT TO THE DCS.



PROJECT: 1X800 MW TANGEDCO NORTH CHENNAI TPP
STAGE III-BTG

TITLE DDCMS INTERFACE FOR
SOLENOID DRIVE (DUAL COIL)

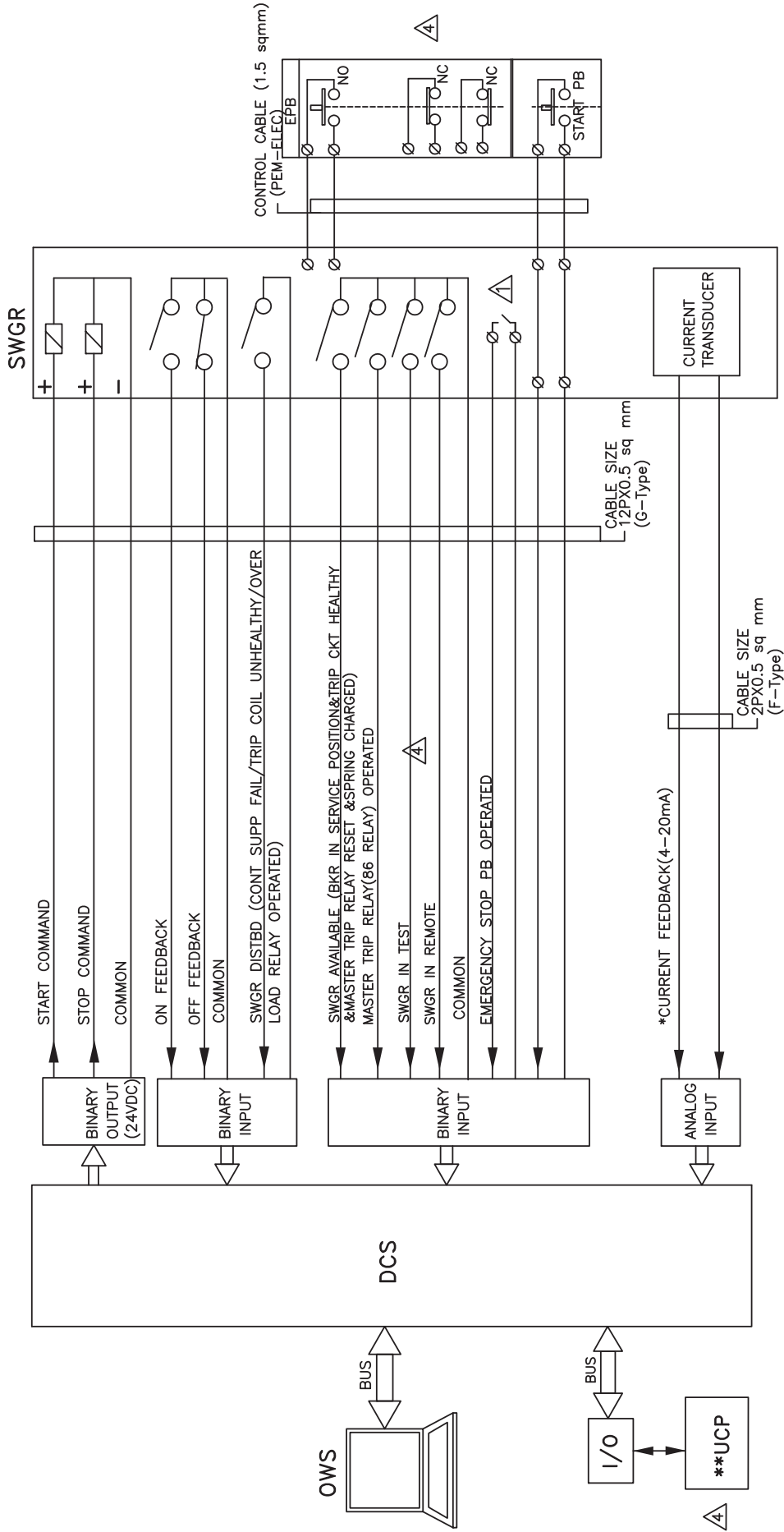
DRG.NO.: PE-DM-423-145-I002

DATE 31.10.2017

REV.NO. 06

SHT 9 OF 11

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

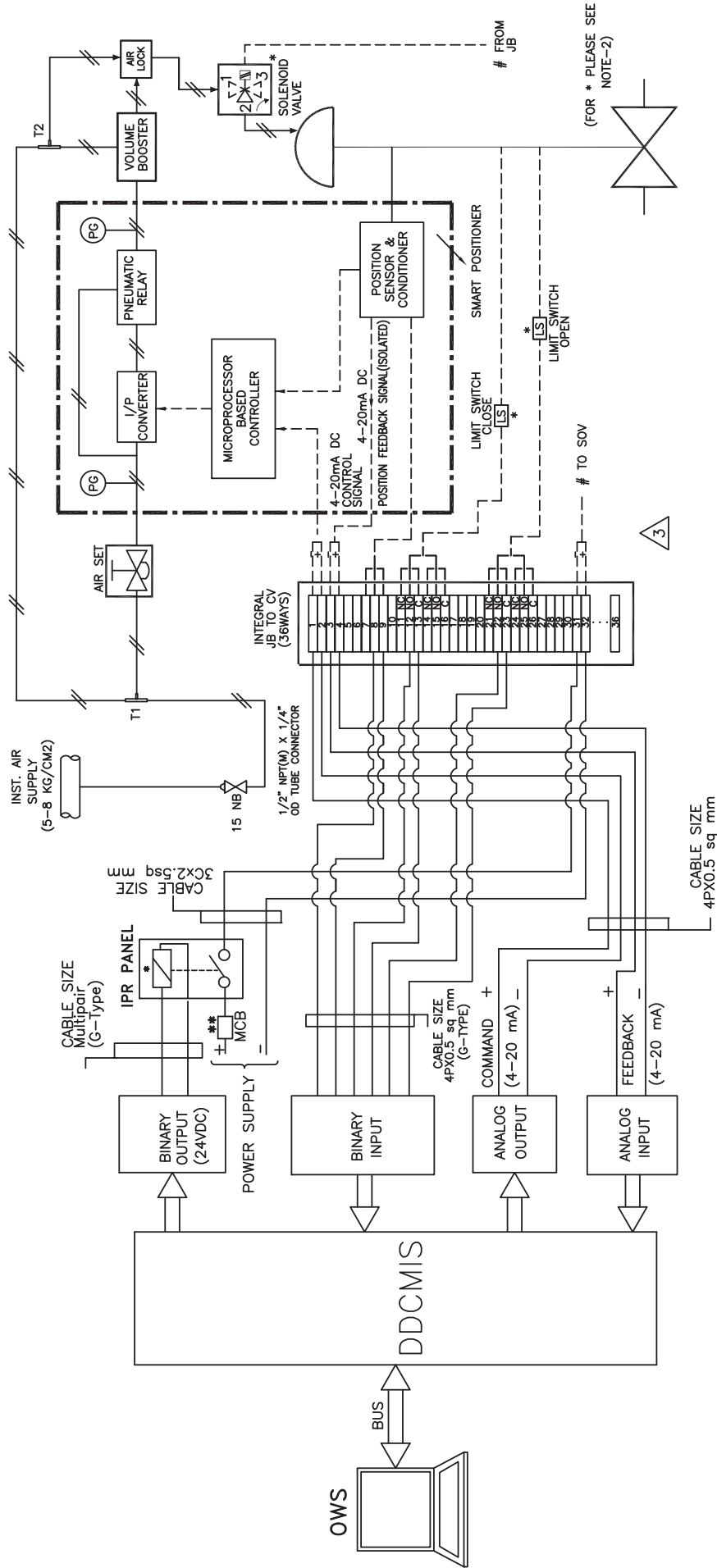


NOTE:

- * FOR LTUD DRIVES, 4-20mA CURRENT TRANSDUCER SHALL BE CONSIDERED FOR BARRING GEARINGMOTOR, JOP, AIR HEATER MOTOR, LUBE OIL PUMPS, SCANNER AIR FANS, SEAL AIR FANS as applicable.
- ** FOR ESSENTIAL DRIVES FOR SAFE SHUT DOWN OF PLANT.

		PROJECT: 1X800 MW TANGEDCO NORTH CHENNAI TPP		DRG.NO. :PE-DM-423-145-I002
TITLE		DDCMIS INTERFACE FOR UNIDIRECTIONAL HT DRIVE		DATE 31.10.2017
				REV.NO. 06
				SHT 10 OF 11

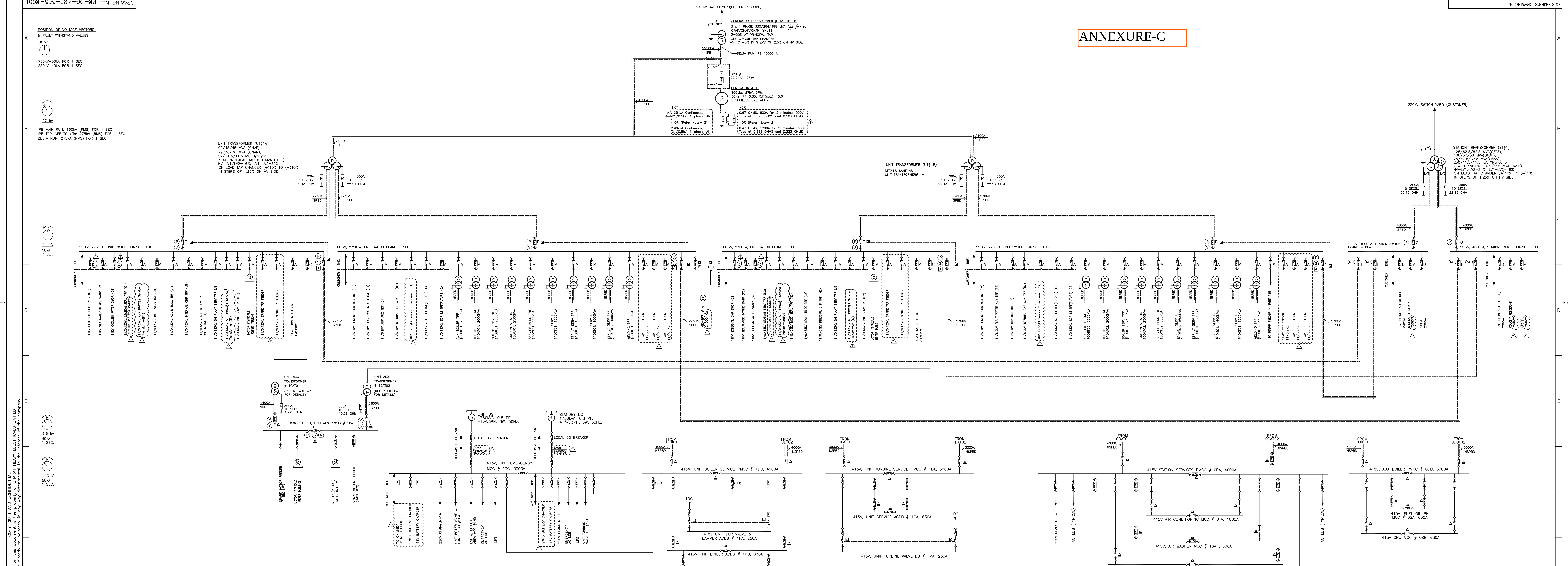
DDCMIS INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



NOTES:

- * APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.
- ** MCB SHALL BE PROVIDED FOR EACH SOLENOID
- CONTROL VALVES IN VICINITY MAY BE GROUPED TOGETHER IN THE FIELD USING JUNCTION BOXES AND SINGLE TRUNK CABLE OF HIGHER SIZE MAY BE USED TO CONNECT TO THE DCS.
- DI FOR FAULT SIGNAL OF THE SMART POSITIONER SHALL BE PROVIDED.

	PROJECT: 1X800 MW TANGEDCO NORTH CHENNAI TPP			DRG.NO.	:PE-DM-423-145-I002
	STAGE III-BTG			DATE	31.10.2017
	TITLE TYPICAL HOOK-UP DIAGRAM			REV.NO.	06
	ANALOG DRIVE (WITH SMART POSITIONER)			SHT	11 OF 11



ANNEXURE-C

Produced by an Autodesk Educational Product

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Produced by an Autodesk Educational Product



1X800MW NORTH CHENNAI TPP-III

TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-D)

SPECIFICATION NO. EPD-TS-CPBG-16004

VOLUME

SECTION

REV NO. 00

DATE :21/03/2018

SHEET 1 OF 1

ANNEXURE-D

SITE MODIFICATION CHARGES

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)
- 3) THESE PRICSE SHALL BE VALID FOR A PERIOD OF TWO YEARS FROM THE DATE OF PURCHASE ORDER.

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		
8	Ammeter (of each type and rating)	Set	5		
9	FUSE				
	16A	No	2		
	32A	No	2		
	100A	No	2		
	160A	No	2		
	250A	No	2		
	400A	No	2		
	630A	No	2		

**1X800MW NORTH CHENNAI TPP-III**

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

SPECIFICATION NO.
EPD-TS-CPBG-16004

VOLUME NO. :

SECTION :

REV NO. : **00** DATE 21/03/2018

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 ⁰		
2	MODULE RACKING HANDLE FOR BREAKERS	12 NO ⁰		
3	MODULE RACKING HANDLE FOR MCC MODULES	20 NO ⁰		
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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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)		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		
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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		
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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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 (O/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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-H

SL.NO.	ITEM DESCRIPTION	MODEL NO. / ITEM DESCRIPTION	UNIT PRICE (Rs.)
h)	Test supply module		
i)	240 V AC Panel Space hetaing 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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		
	UPTO 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		

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SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		
	MOTPRO		
	VAA21		
	VTT12		
	VTIG		
	VTU21		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, 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, LOGIC, 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 FOR PROTECTION, T/C SUPERVISION, LOGIC, 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 O/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 DCDB on IEC-61850 protocol		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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, 1NO+1NC S/R		
	UNDER VOLTAGE RELAY, NOMINAL VOLTAGE-220V DC, U/V SETTING-80%, AUX..-240V AC, 1/2NH, 1NO+2NC S/R		
	JAMING RELAY - CAG17		
	q) Bimetal Thermal O/L Relays		
	i) Thermal O/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		
	ii) Heavy Duty Thermal O/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 CONTROL 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		

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SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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 3POLE 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		

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SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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-YELLOW		
	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		
	800/1A		
	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		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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, VoltageTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 240V AC, VoltageTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 110V AC, VoltageTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 220V DC, FrequencyTransducer, 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 HOLDER		
ao)	NEUTRAL LINK		
	20A FOR CONTROL CKT. & POWER CKT. UPTO 25A MCCB RATING		
	32A FOR 50A MCCB RATING		
	63A FOR 100A & 125A MCCB RATING		

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SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

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SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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.		

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SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-H

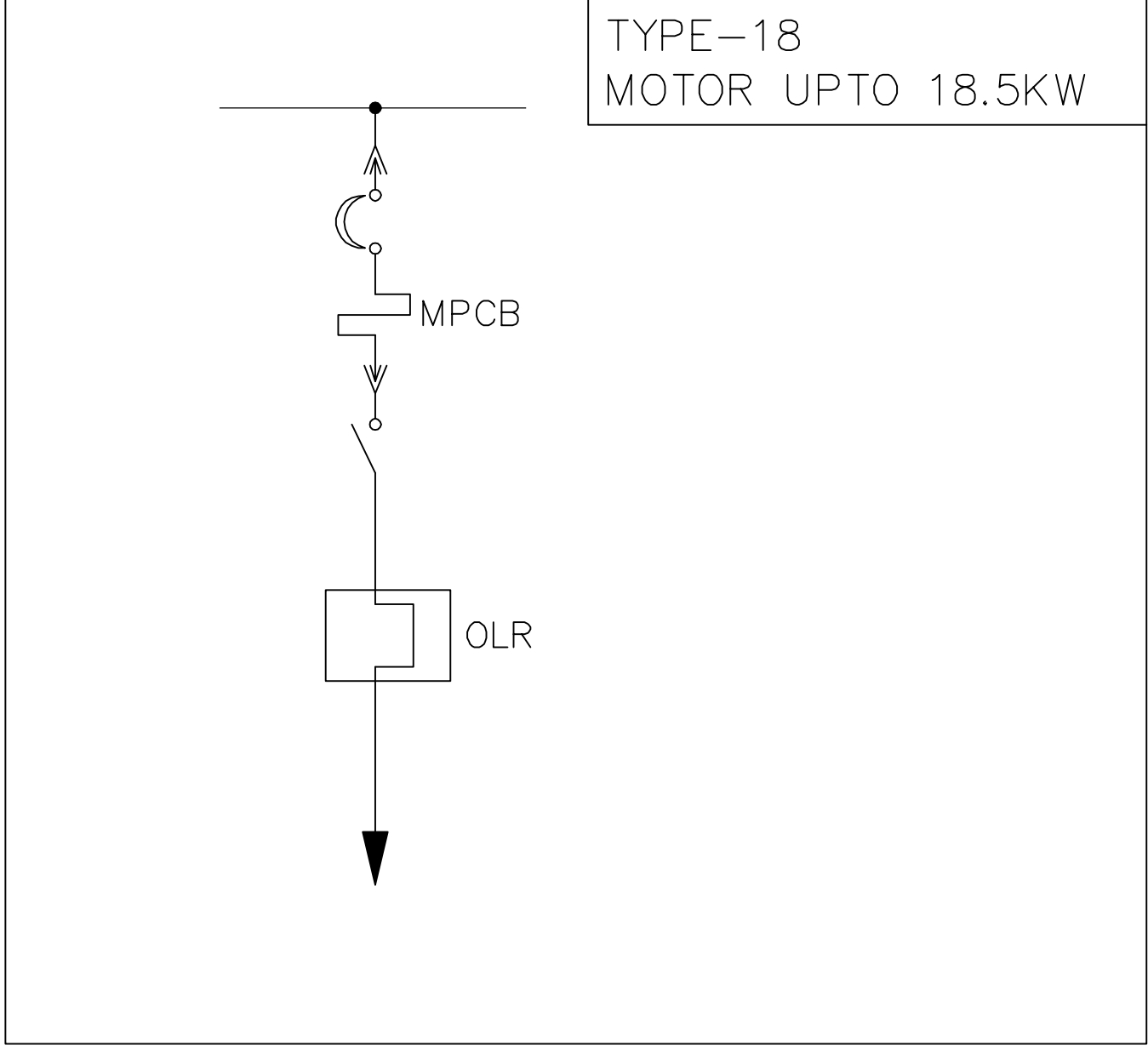
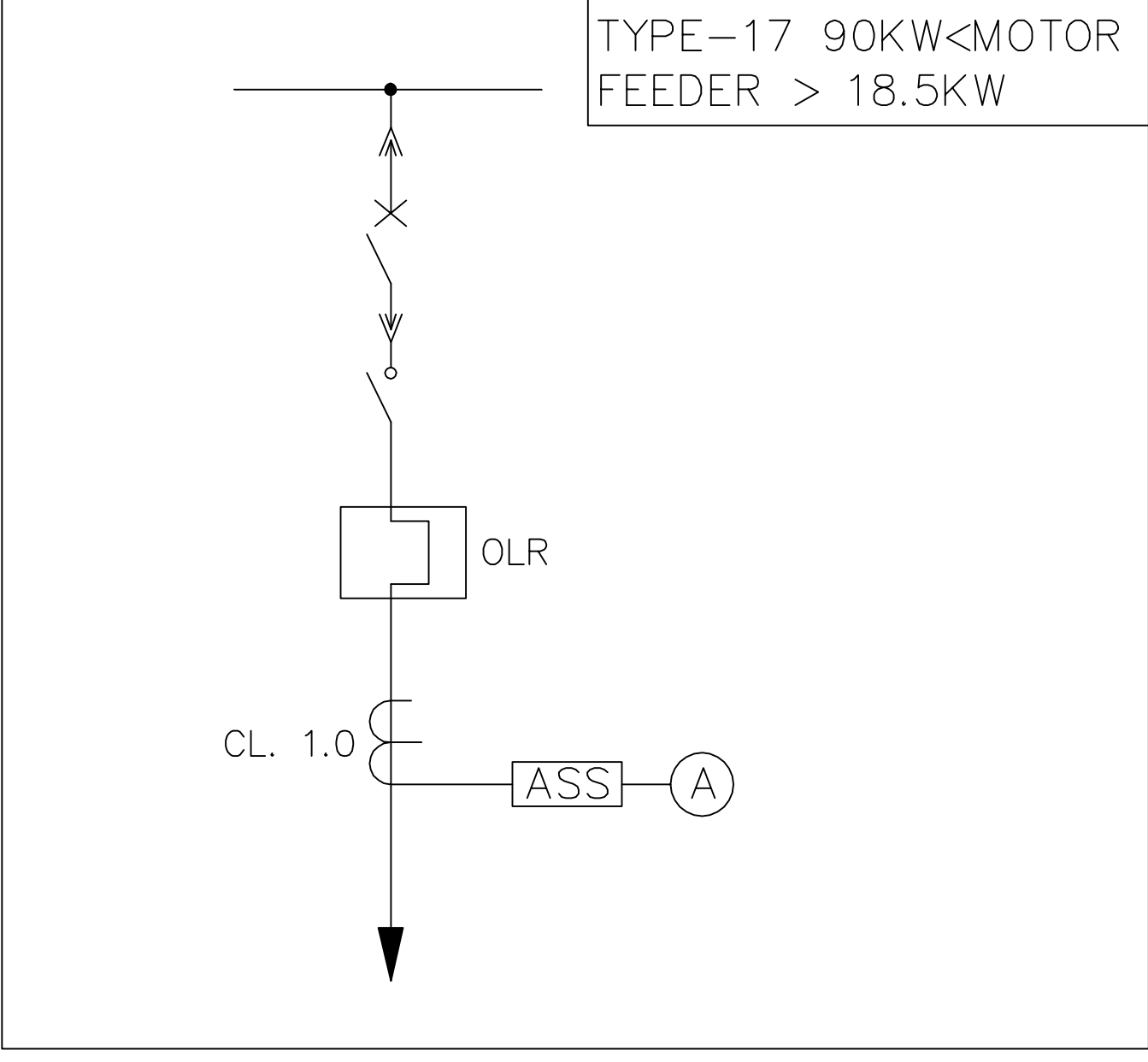
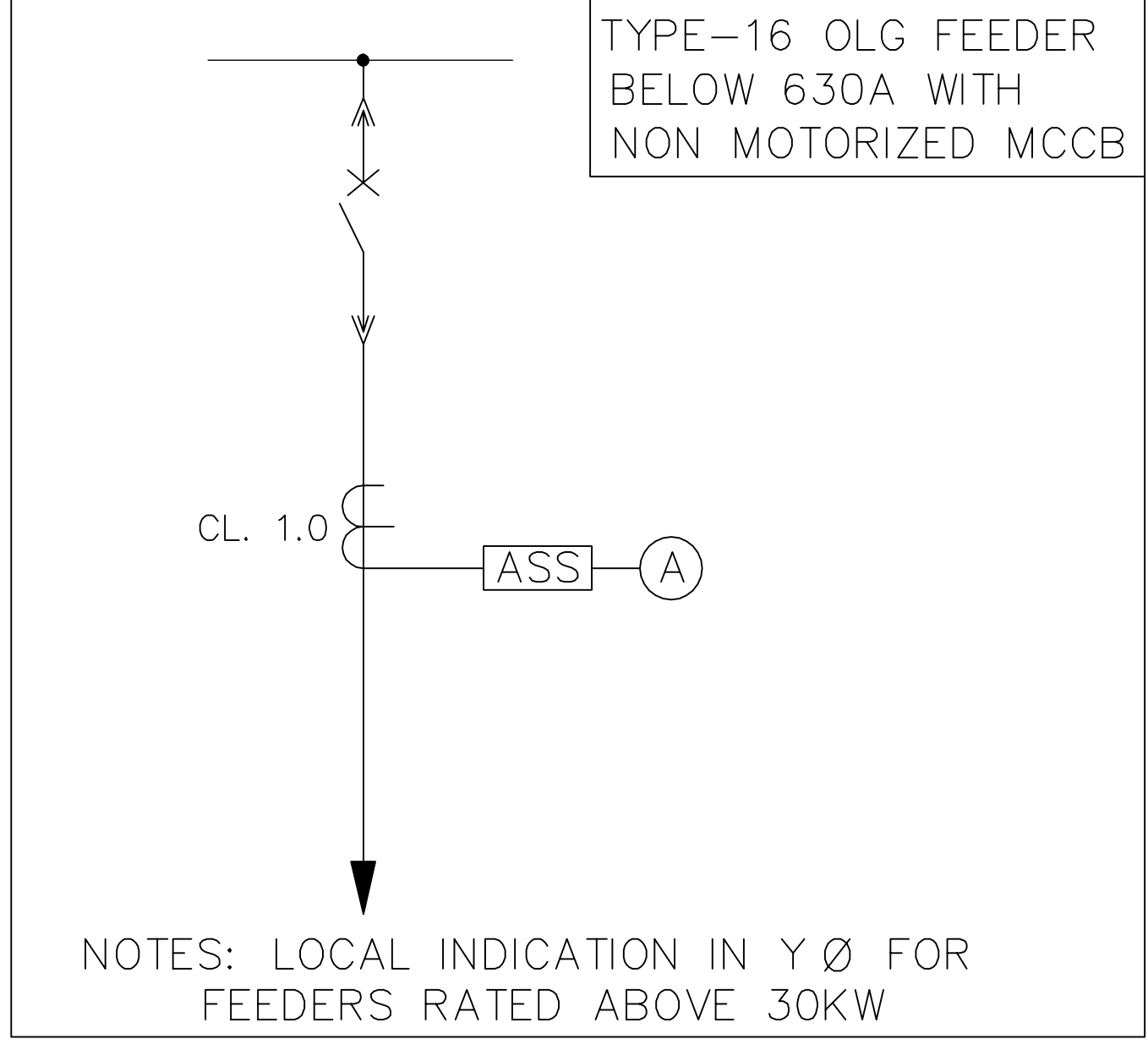
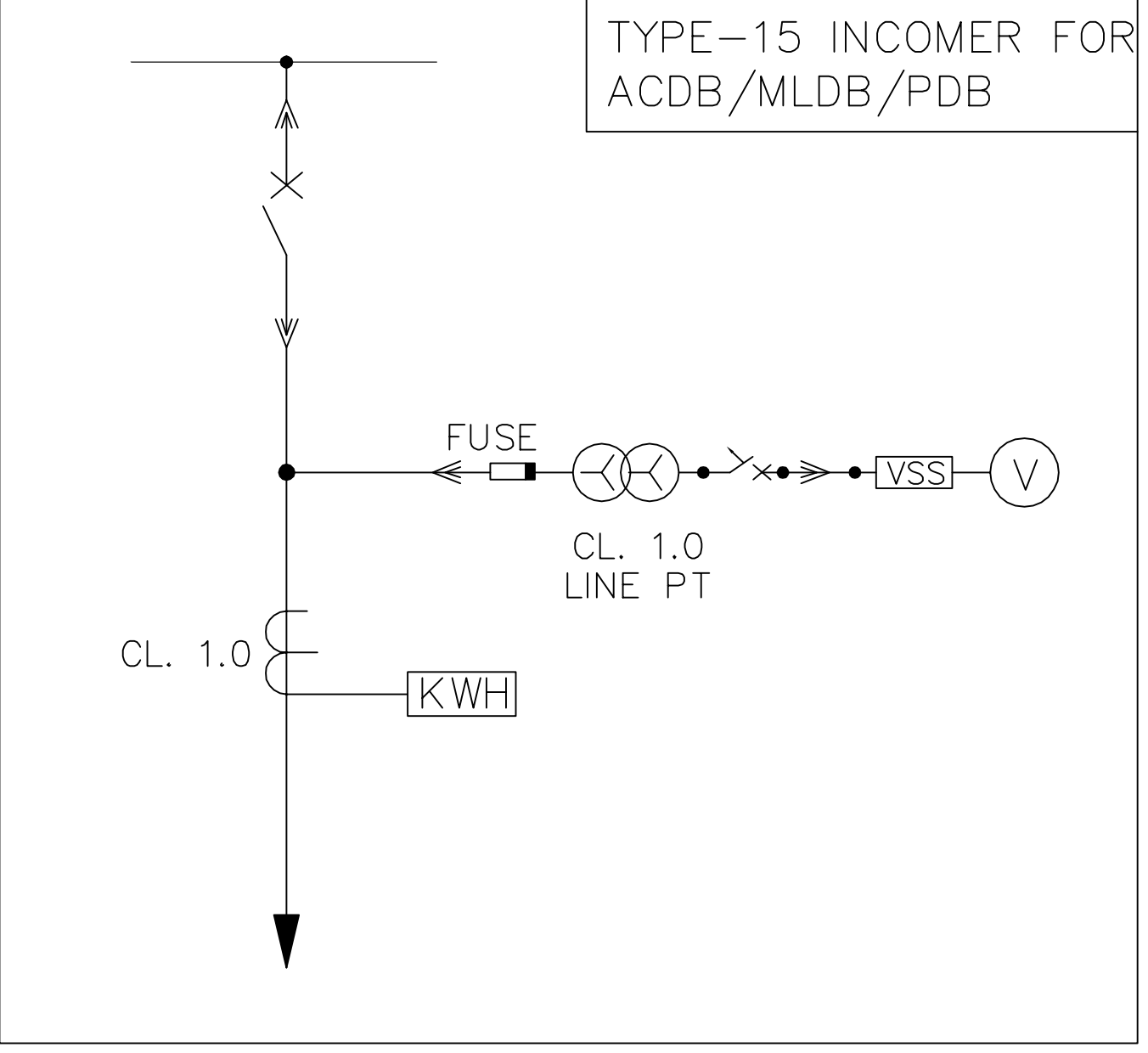
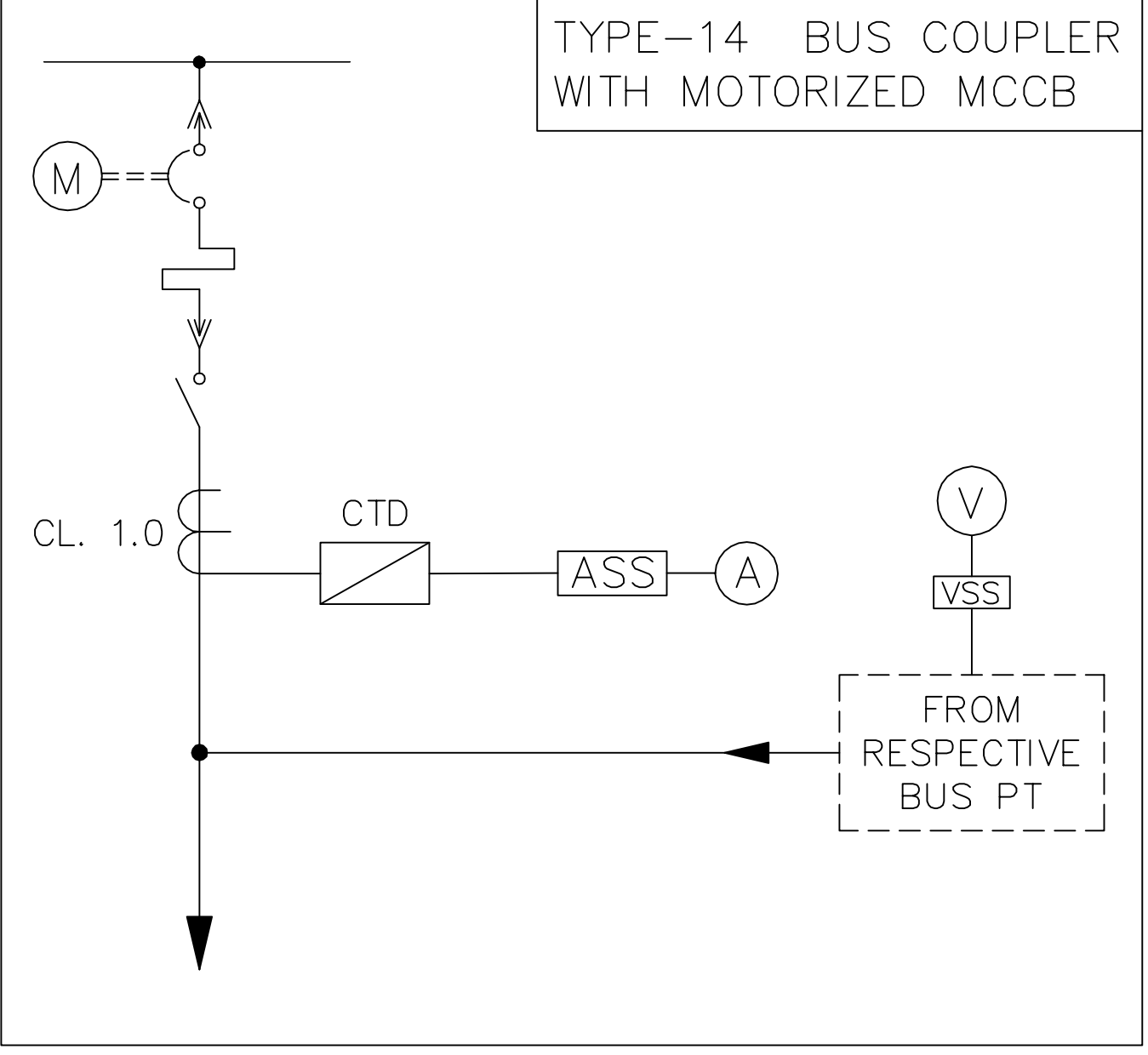
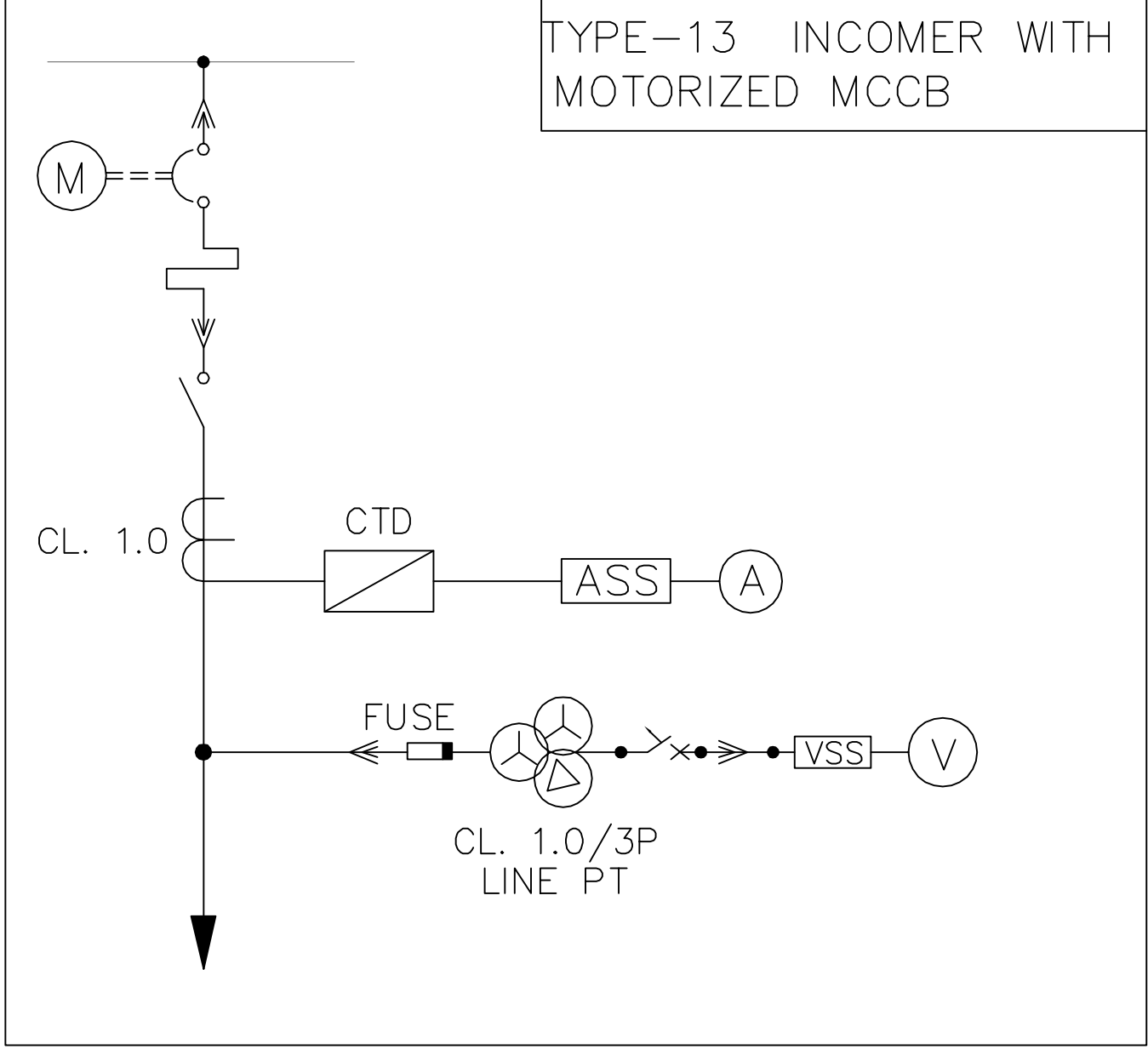
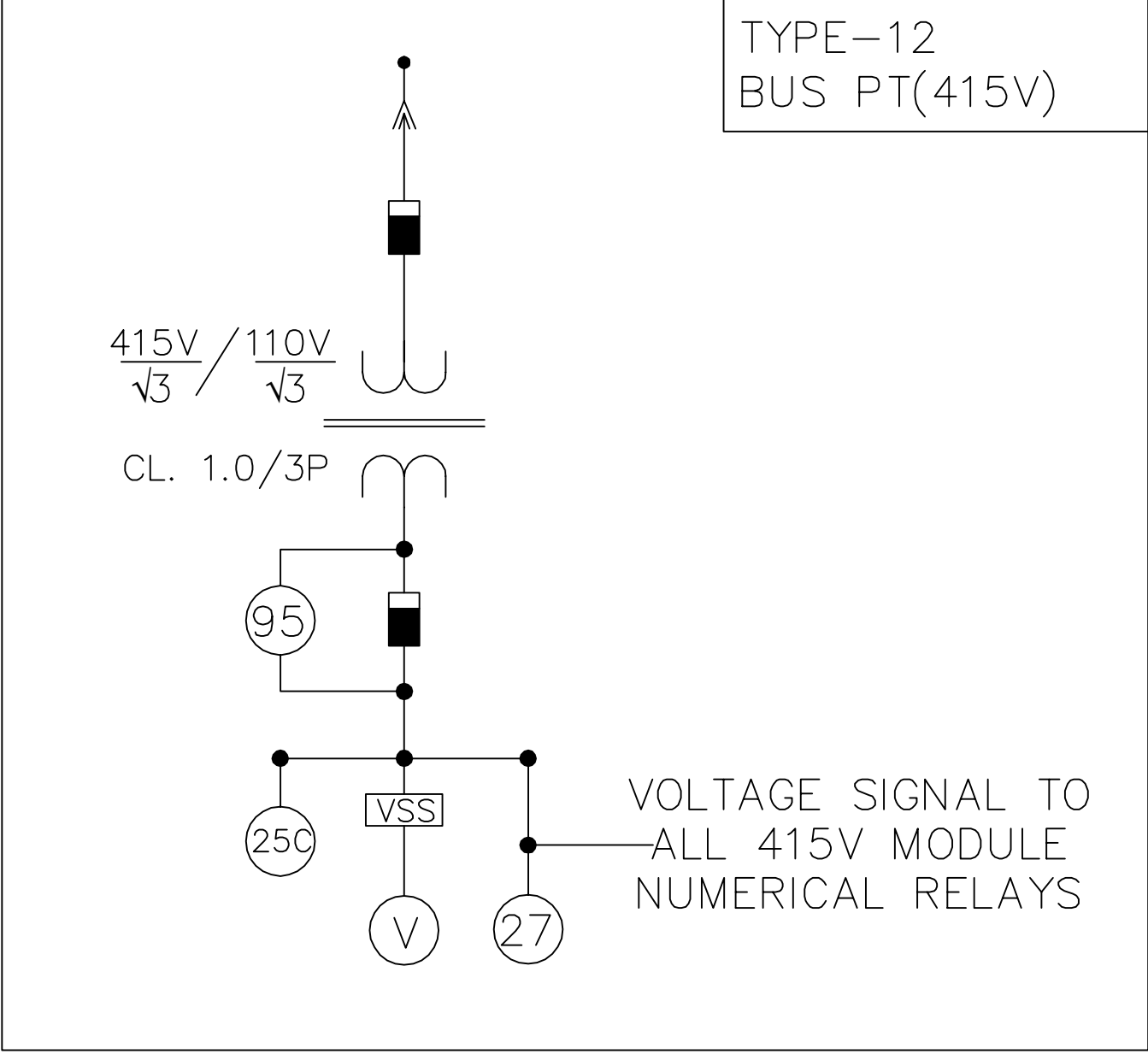
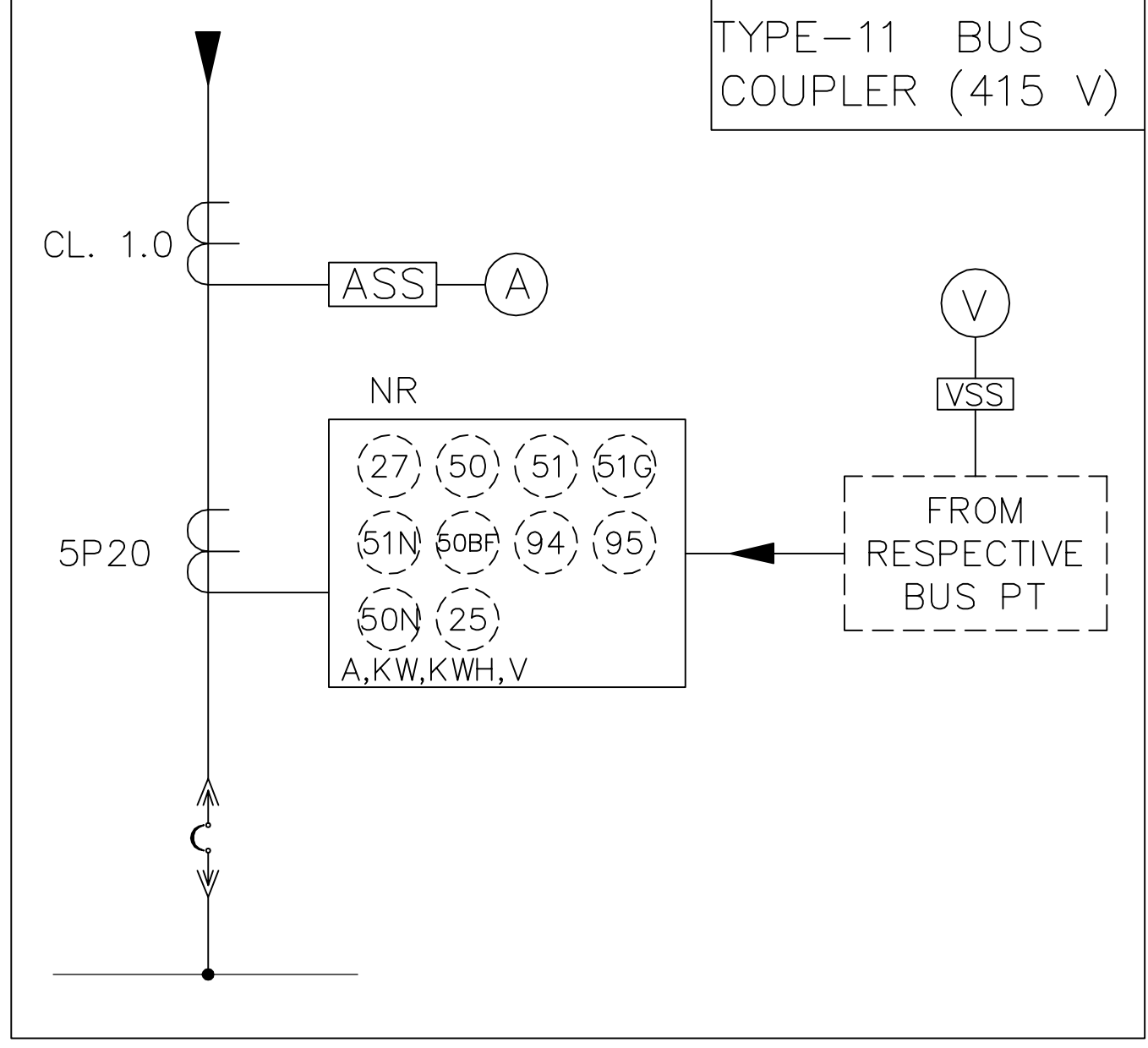
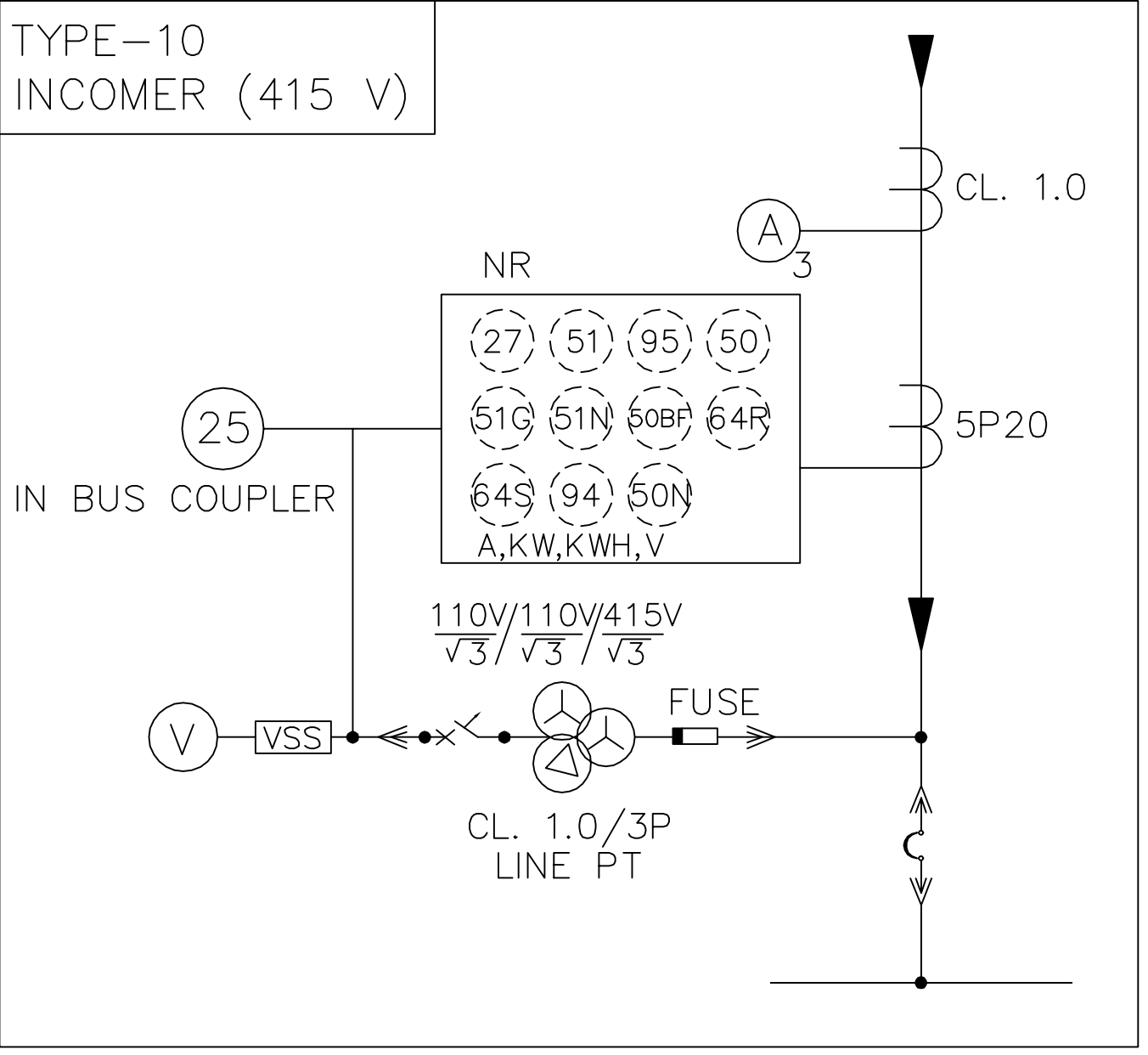
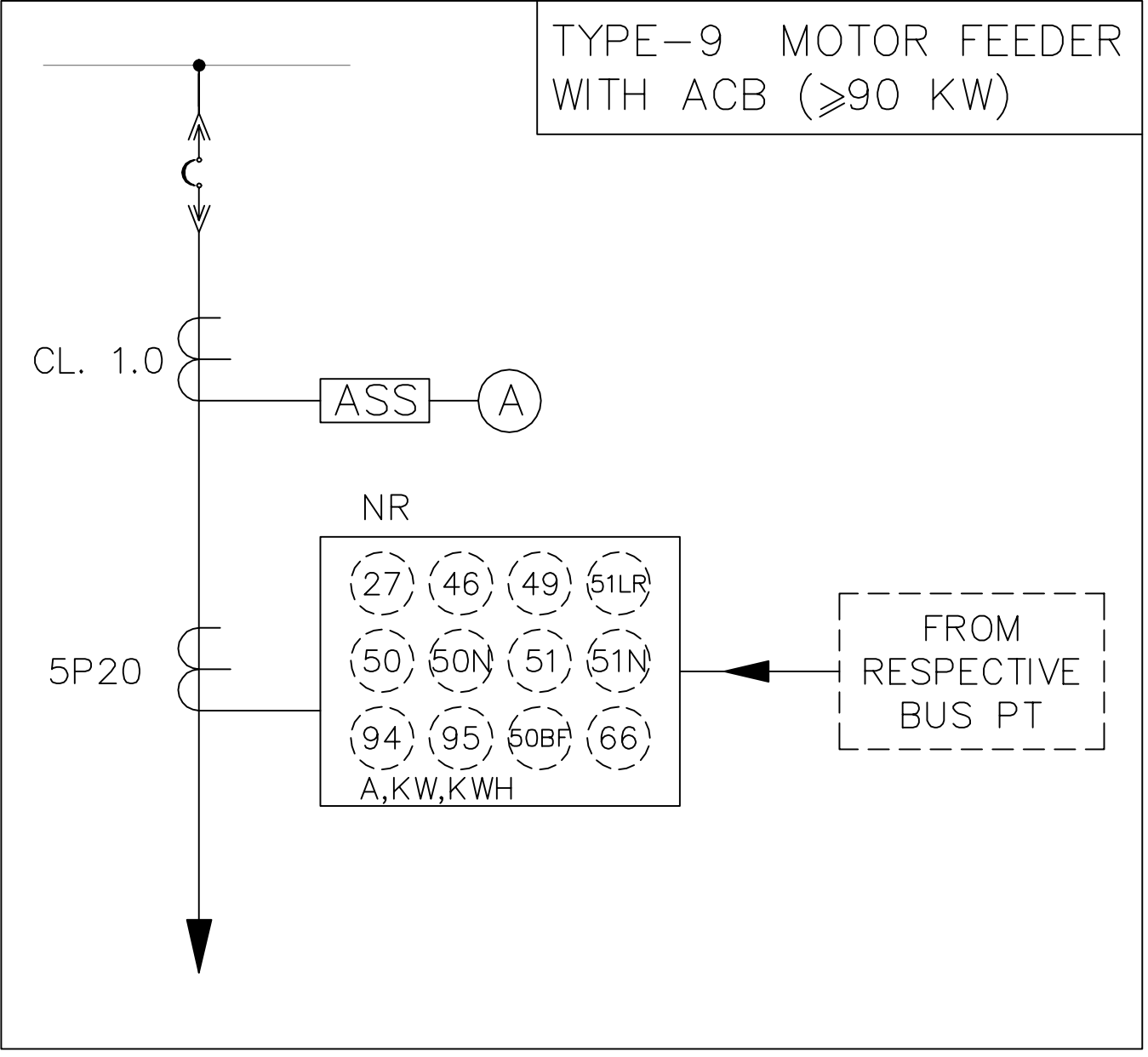
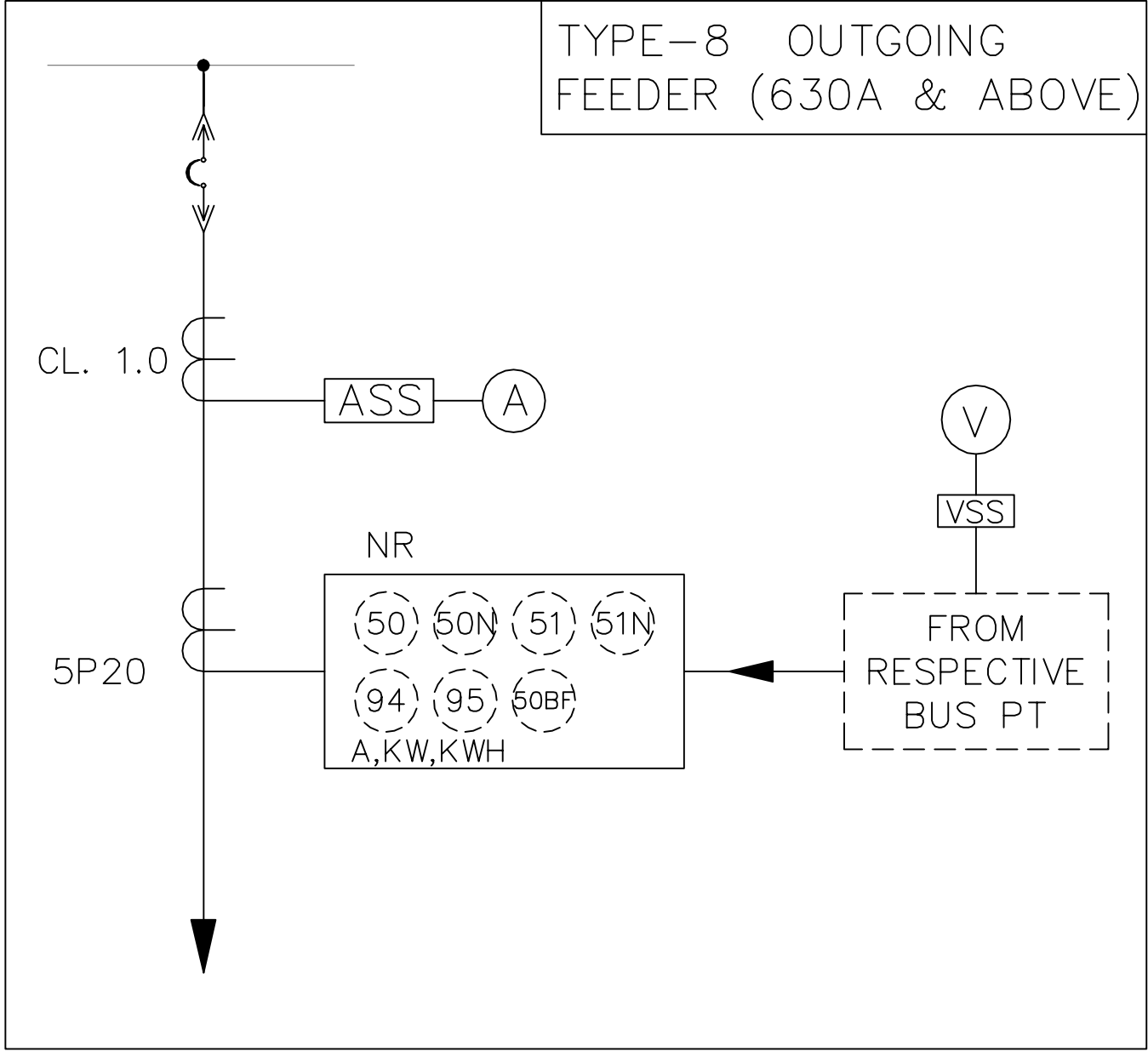
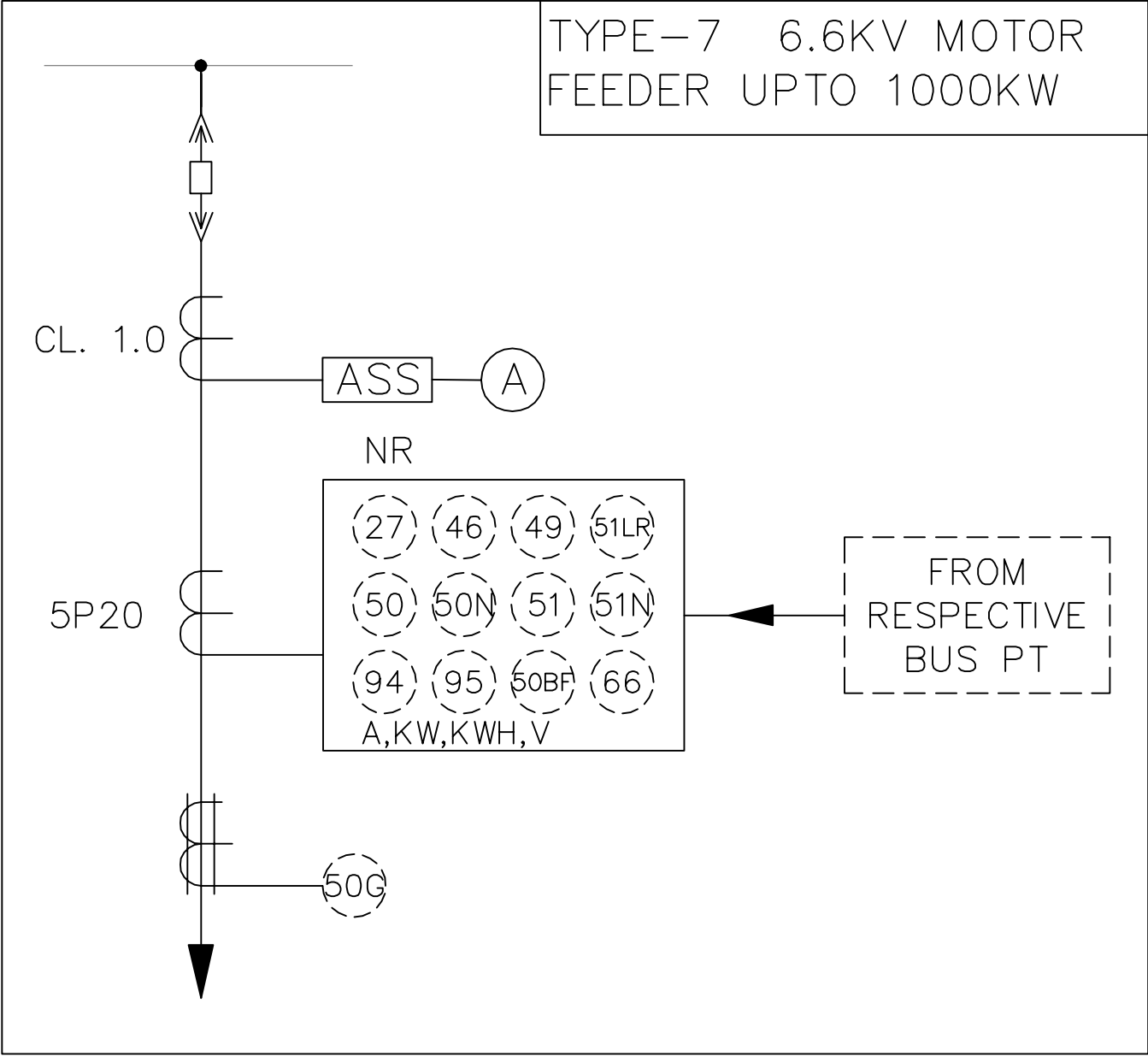
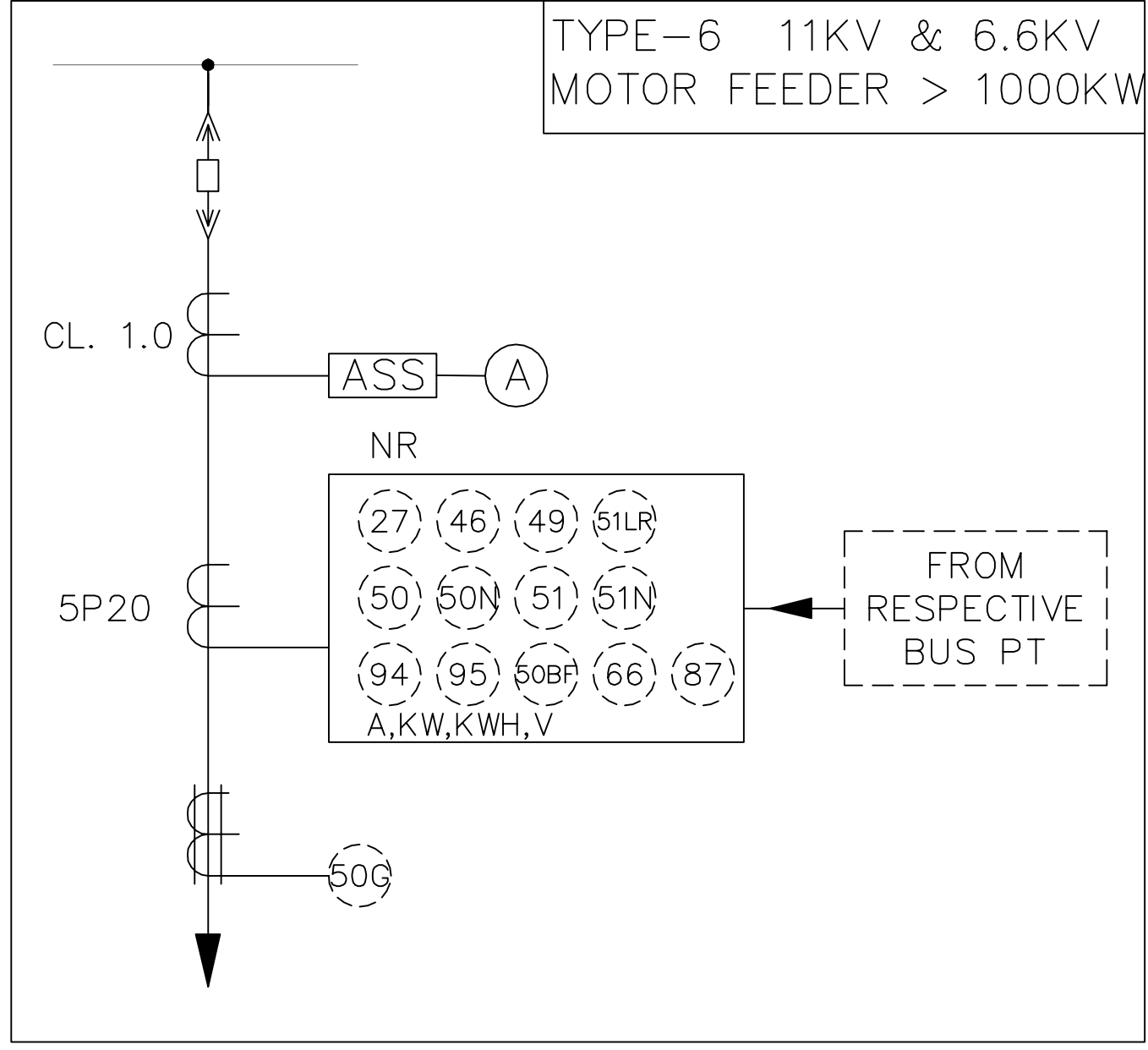
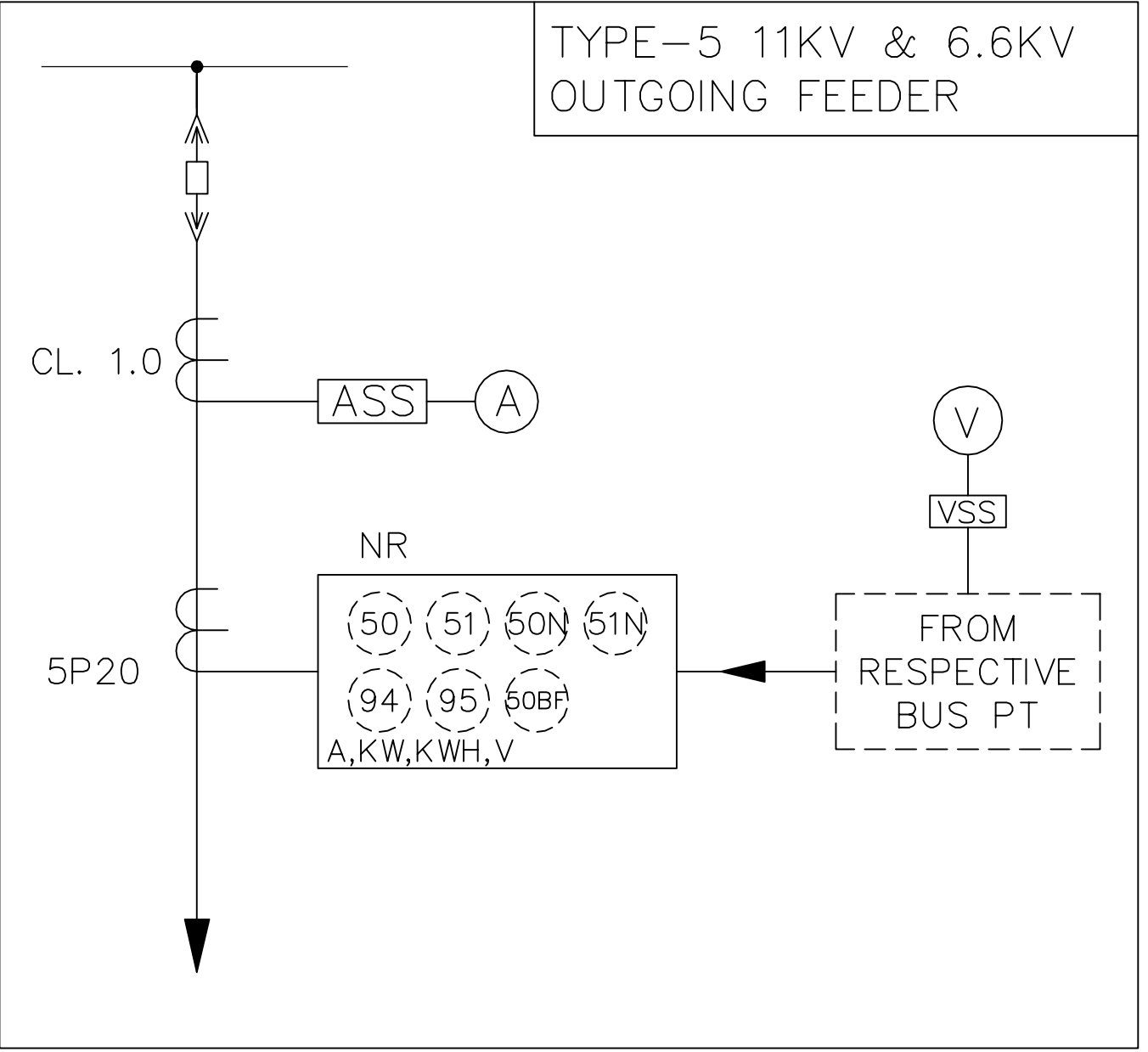
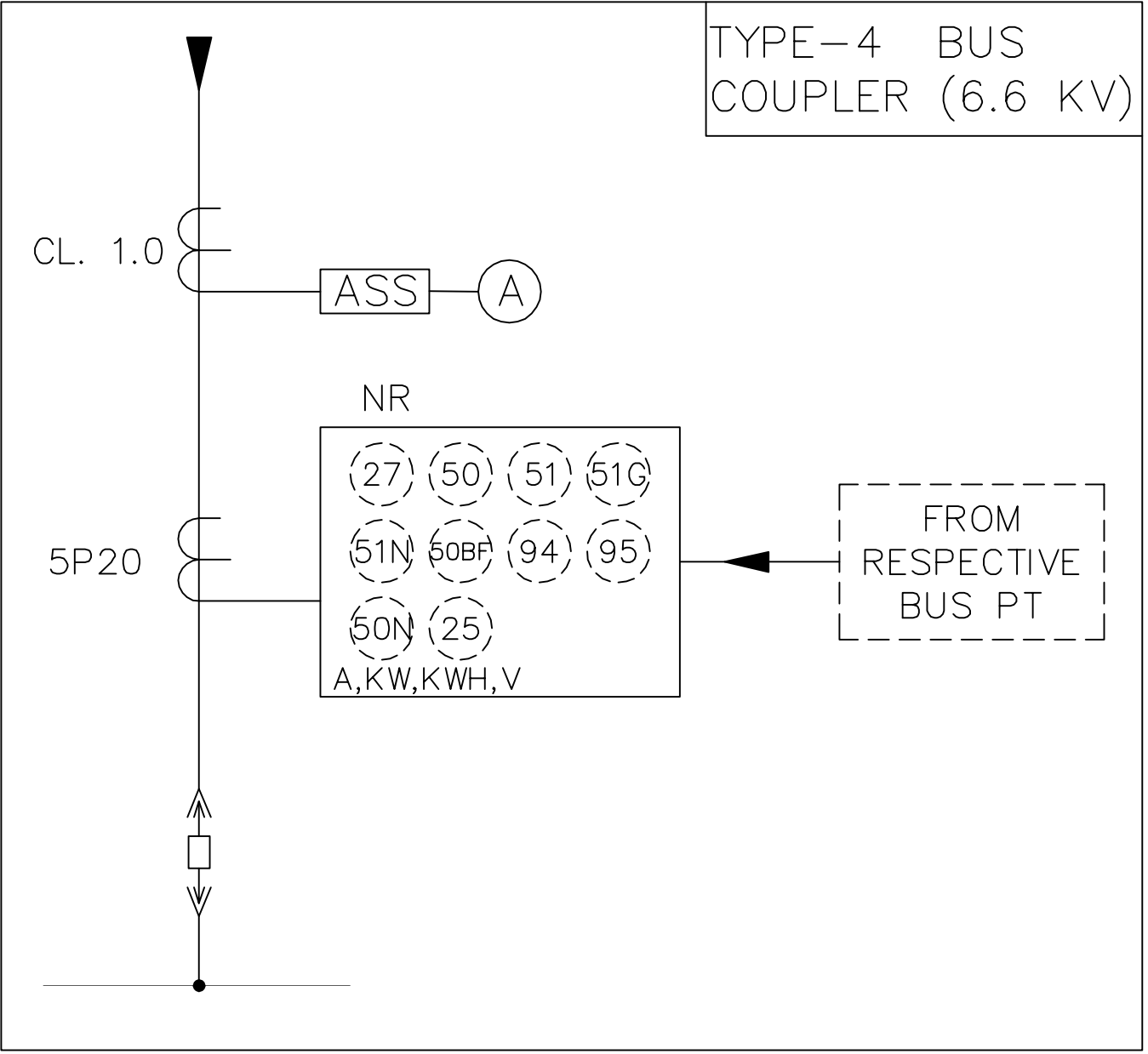
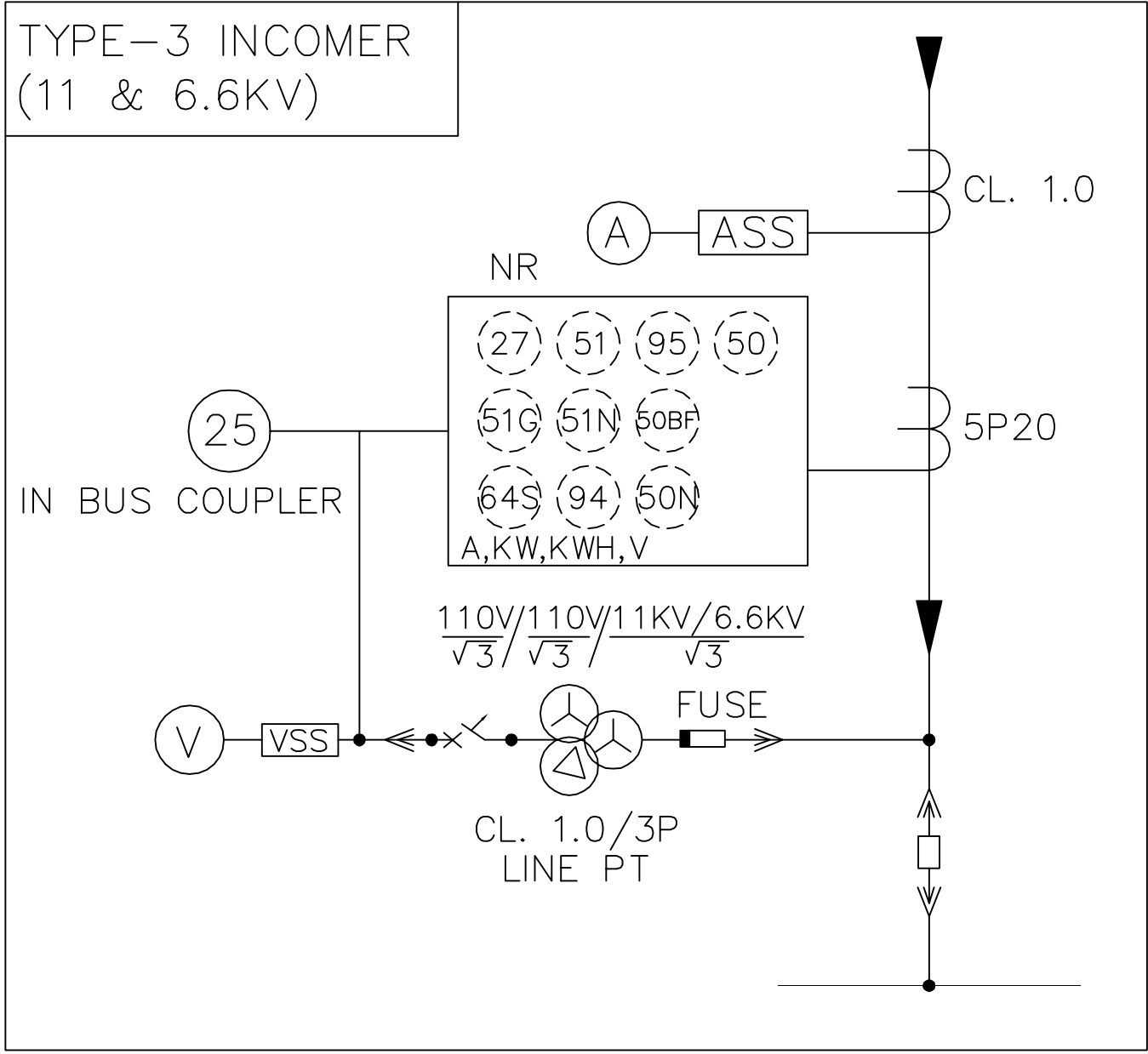
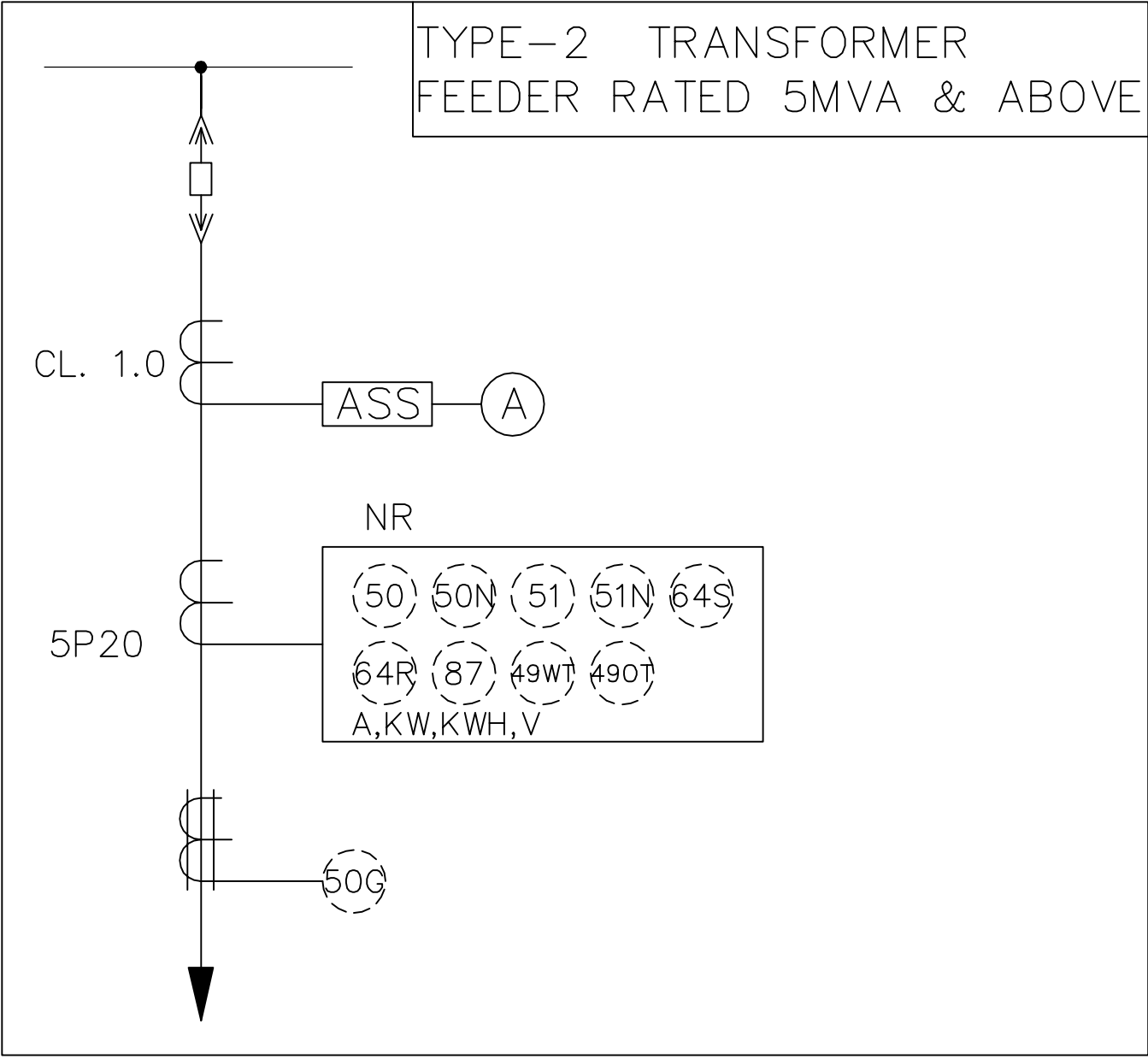
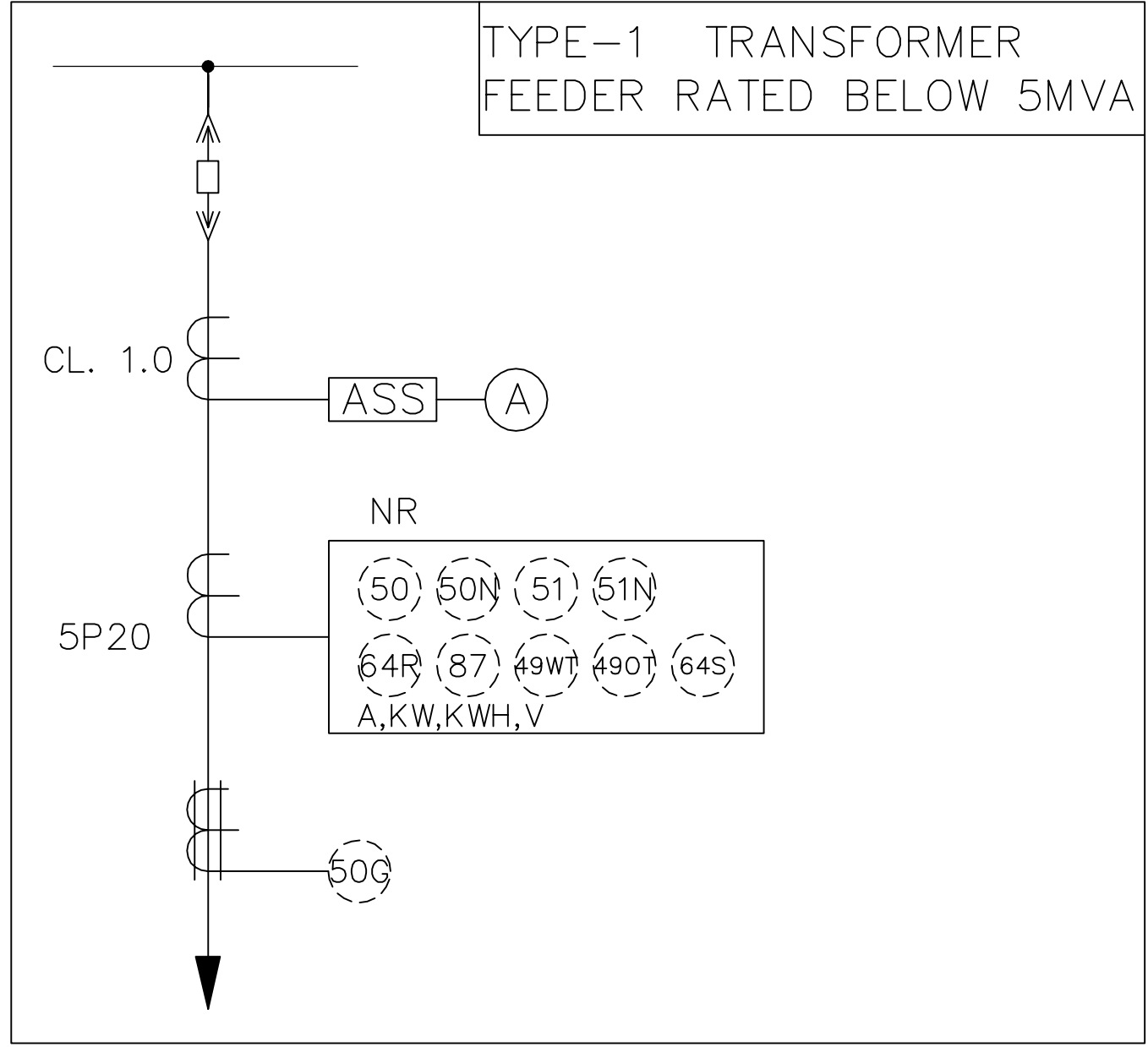
SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	3C X 185 Sq. mm.		
	3C X 240 Sq. mm.		
	3.5C X 25 Sq. mm.		
	3.5C X 50 Sq. mm.		

1X800MW NCTPS-III
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

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		

PROTECTION DETAILS



RELAY DETAILS:

- 25 - CHECK SYNCHRONIZING RELAY
- 27 - UNDER VOLTAGE RELAY
- 46 - NEGATIVE PHASE CURRENT PROTECTION
- 49 - THERMAL OVER LOAD
- 49WT - WINDING TEMPERATURE PROTECTION
- 49OT - OIL TEMPERATURE PROTECTION
- 50 - INSTANTANEOUS OVER CURRENT RELAY
- 51 - IDMT OVER CURRENT RELAY
- 50N - IDMT EARTH FAULT RELAY
- 51N - INSTANTANEOUS EARTH FAULT OVER CURRENT PROTECTION
- 50G - EARTH FAULT RELAY
- 51G - GROUND TIME OVER CURRENT PROTECTION
- 50BF - HIGH SPEED BREAKER FAIL
- 51LR - LOCKED ROTOR PROTECTION
- 51LR - NUMBER OF STARTS PER HOUR
- 64R - RESTRICTED EARTH FAULT RELAY
- 64S - BACKUP (STANDBY) EARTH FAULT PROTECTION
- 87 - DIFFERENTIAL RELAY
- 94 - ANTI PUMPING RELAY
- 95 - TRIP CIRCUIT SUPERVISION RELAY

LEGENDS

- LINE PT
- CURRENT TRANSFORMER
- VACCUM CIRCUIT BREAKER
- AIR CIRCUIT BREAKER
- MOTORIZED MOULDED CASE CIRCUIT BREAKER
- MOULDED CASE CIRCUIT BREAKER
- CORE BALANCING CURRENT TRANSFORMER
- CURRENT TRANSDUCER
- CONTACTORS
- OVER LOAD RELAY
- AMMETER
- VOLT METER
- VSS - VOLTMETER SELECTOR SWITCH
- ASS - AMMETER SELECTOR SWITCH



1X800MW NORTH CHENNAI TPP-III
TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR

SPECIFICATION NO. : EPD-TS-CPBG-16004

VOLUME NO. :

SECTION :

REV NO. : **00** DATE: 22/03/2018

SHEET : 1 OF 1

LIST OF DOCUMENTS TO BE SUBMITTED

In the event of Order, following documents shall be submitted by the bidder:

- General Notes
- Data sheets
- Busbar sizing calculation
- Type Tests
- Schematics
- Internal General Arrangements of Modules
- General arrangement of Switchboard
- Single Line Diagram of Switchboard
- Heat loss calculations of Switchboard
- Burden calculations
- Glands & lugs calculations/Switchboard
- Detailed Module wise bill of material including Model Nos
- Detailed Board wise bill of material
- O&M Manual
- Any other documents, if requested by BHEL, which are necessary for project execution.

Painting



CHAPTER 8

PAINTING

1.0 SCOPE

This section defines the technical requirements for surface preparation, selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The bidder shall submit a detailed painting procedure for approval of owner/ owner's representative after the award of contract.

The following surface and material shall require painting:

- a. All un-insulated carbon steel and alloy steel equipment like columns, vessels, storage tanks, pumps, heat exchangers etc.
- b. All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks).
- c. All pipe structural steel supports, walkways, platforms, handrails, ladders etc.

The following surfaces and materials shall not require painting:

- a. Non-ferrous materials
- b. Austenitic stainless steel
- c. Plastic and / or plastic coated materials
- d. Insulated surface of equipment and pipes except colour coating wherever required.
- e. Painted equipment like blowers, pumps, valves etc. with finishing coats in good condition and with matching colour code.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job:

IS:5	Colours for ready mixed paints and enamel
IS:1303	Glossary of terms relating to paints
IS:2379	Colour code for identification of pipelines
IS:1477	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524 :	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:2338	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS:2074	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	Ready mixed paint, brushing, Zinc Chrome, priming



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IS:2932	Enamel Synthetic exterior (a) Undercoating (b) finishing
IS:4682	Code of practice for lining of vessels & equipment
SIS 559000	Swedish standard for blasting
ISO 8504-2	Preparation of steel substrates before application of paints and related products. Surface preparation methods Part 2 Abrasive blast cleaning
ISO 8501-1	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
SIS 05 5800	Surface preparation by acid pickling
SSPC SP08	Surface preparation by acid pickling
IS 2629	Recommended practice for hot dip galvanizing of iron and steel
ASTM A780	Standard practice for repair of damaged galvanized coatings
SSPC	Steel structures painting council
NACE	National association of Corrosion Engineers
DIN	Deutshes Institute for Normung
BS	British Standard
ASTM	American Society for Testing material
AWWA	American Water works association

3.0 SURFACE PREPARATION

The surface shall be prepared in a manner suitable for coatings. Chemical derusters or rust converters shall not be applied. Acid cleaning is subject to approval of Purchaser/ Purchaser's representative.

3.1 BLASTING

The surface of the part/ component shall be blasted before the coating material is applied. Compressed air supply for blast cleaning shall be free of water and oil. Air compressors shall not be allowed to deliver air above 1100 C. Blasting activity shall be performed at temperatures 30 C above dew point and substrata temperature between 50 C & 500 C and relative humidity not exceeding 85 shall be maintained during painting. Necessary safety precautions for equipment and operator shall be adhered to and shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work. Abrasive used for blast cleaning carbon steel and alloy steel shall be as per ISO 8504-2 and SSPC painting manual. Suggested abrasives are chilled iron grit, shot steel, malleable iron grit and shots of non-metallic abrasive (aluminium oxide, copper slag, garnet etc.).

The grade of blasting shall be performed in line with the approved painting scheme. The nature, quality and grain size of abrasives and the parameter of their use are to be chosen to obtain the required surface profile depth and cleanliness. Surfaces prepared for coating shall be coated the same day and before any visible rusting occurs (the time elapsed between blast cleaning and



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commencement of painting shall under no circumstances exceed 4 hours, but in any case must commence before signs of degradation occur).

The grades of surface finish

	ISO 8501-1	SIS 055900	SSPC	NACE
White metal	Sa3	Sa3	SP5	1
Near White metal	Sa 2	Sa 2	SP10	2
Commercial Blast	Sa2	Sa2	SP6	3
Brush off blast	Sa1	Sa1	SP7	4

Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting

- Blasting according to SIS 055900, Grade Sa 2
- Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer coat shall be 15-25 m.

3.2 Manual Rust Removal

Manual rust removal shall be allowed for welded zones and for touching up installed components.

3.3 Cleaning

Removal of impurity

Impurity	Removal
Dust, Loose deposits	Vacuum cleaning, brushing
Adhesive deposits	Power brushing
Oils, greasy impurities	Wet Blasting, Use of Detergent Additives by agreement
Salt deposits	Rinsing
Markings (eg felt up pen)	Organic solvents to manufacturer's specifications eg Trichloro trifluoro ethane and solvents containing acetone (renew solvent and rag frequently)

3.4 Acid Pickling

Prior to galvanizing the surface preparation shall be done by acid pickling as per SSPC-SP-08.

4.0 PROCESSING

4.1. General Application Conditions

The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature 0C shall be + 5 and the relative humidity shall not exceed 80 . The temperature of 0 the work piece shall be at least 3C above dew point.



4.2. Application Procedure

The primer shall be applied by means of brush or by spary. The top coats shall be applied by means of brush, roller or spray.

At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed.

4.3. Touching Up

Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning according coating manufacturer's specification. The final top shall be reapplies completely.

4.4. Uncoated Surfaces

Moving parts of machines (e.g stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating up to a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.

4.5. Bond Strength

The pill off stress determined using the pull off test method for adhesion shall not be less than 1.5 N/mm², according to ISO 4624.

5.0 SURFACE CONDITIONS OF COATING SURFACES

The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.

6.0 COATING SYSTEMS

6.1 General Re uirements for Coating Systems

Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating this specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

The colour and gloss of top coats shall be in accordance with sub clause suggested colour codes for painting (Sub Clause 6.8)

6.2 Standard Coating System (E ternal Coatings)

(a) Steel Surfaces

- i. All steel structures shall receive two primer coats and two sandwich coat of MIO Epoxy paint and one finish coat of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two intermediate coats and one finished coat shall also be applied after erection.
- ii. Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The



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surface shall be abrasive blasted as explained in clause 3.1 to Sa 2 finish as per SIS05-5900. Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer shall be 60 microns.

- iii. Two intermediate MIO Epoxy paint, and one top polyurethane coating of approved brand shall be applied. Dry film thickness of each intermediate coat shall be 90 microns and top polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 330 microns. All paints shall be of approved brand and shade as per owner's requirement.
- iv. Joints to be site welded shall have weldable primer applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used removable anti corrosive coating shall be provided. On completion of the joint the surfaces shall receive the paint as specified.
- v. Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams, supporting gratings or chequered plate shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded/ to be encased in concrete shall not be painted.

(b) Gratings and Step Threads

- i. Surface Preparation
Gratings and step threads shall be cleared by acid pickling as per SSPC-SP-08
- ii. Hot Dip galvanizing
The hot dip galvanizing shall be done as per IS 2629. The average mass of coating shall be 610 gm/m²
- iii. Post Treatment
Immediately after galvanizing post treatment such as chromating shall be applied to retard white rust attack.
- iv. Touch up mechanical damages
The repair of damages coatings shall be done as per the recommended practice ASTM A780.

6.3 Painting of Indoor components such as valves, pumps, motors, electrical parts, tanks etc.

At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 μm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75 μm.



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At Site

Thorough cleaning to remove oil, grease, dirt and any other contaminants. Derusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 μ m.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.

Remarks

Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.

6.4 Painting of Outdoor equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.

Weather exposure, weather resistance, temperature up to 120 $^{\circ}$ C as per clause 6.1 & 6.3.

Surface Preparation

Blasting according to SIS 055900 grade Sa 2 $\frac{1}{2}$. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 μ m may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75 μ m.

Intermediate Coat

One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100 μ m.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.

6.5 Special Coating

(a) Parts exposed to temperatures above 120 $^{\circ}$ C, up to 200 $^{\circ}$ C, not insulated

i. **At Works**

Surface Preparation

Blasting according to SIS 055900 grade Sa 2 $\frac{1}{2}$ and ISO 8501-1:1958. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 μ m may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75 μ m.

ii. **At Site**

Pre-treatment

Derusting of all mechanical damages, according to ISO 8501-1:1989, grade St 3 touch up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50 μ m.



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Intermediate Coat

1 pack silicon acrylic dry film thickness 35 m.

Final Coat

1 pack silicon acrylic, dry film thickness as 35 m. Total system dry film thickness 145 m. Final coat according to colour code

(b) Parts exposed to temperatures above 200 C, up to 400 C, not insulated

i. **At Works**

Surface Preparation

Blasting according to ISO 8501-1:1958 grade Sa-2 . Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 m may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75 m.

ii. **At Site**

Pre-treatment

Derusting of all mechanical damages, according to standard Sa 2 to ISO 8501-1:1988. Touch up with coating system according to manufacturer's recommendations.

(c) Insulated parts continuously exposed to condensing water or parts exposed to temperatures For parts that are provided with insulation on site.

i. **Insulated parts exposed to condensing water**

At Works

Surface Preparation

Blasting according to Sa 2 to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 m shall be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75 m

ii. **Insulated parts exposed to temperatures**

Parts exposed to temperatures up to < 400 C

Surface Preparation

Blasting according to Sa 2 to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 m shall be used. Parts exposed to temperature above 400 C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and superheaters, reheaters etc)

Temporary Primer

Varnish



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(d) Intermittent exposure due to condensing water/ chemicals (Indoors)

(i) **At Works**

Surface Preparation

Blasting according to Sa 2 and ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 μm may be used.

Prime Coat

Two layers of Zinc phosphate primer, total dry film thickness 75 μm.

(ii) **At Site**

Pre-treatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85 %, 75 μm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 μm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 50 μm. Total system dry film thickness 205 μm. When exposed o weathering, weather resistance finish coat shall be applied.

(e) Water Exposure

i. **At Site/ Works**

Pre-treatment

Removal of all welding pearls. Blasting according to Sa 3 to ISO 8501-1:1988

Coat

4 coats 2 pack coal tar epoxy, dry film thickness 125 μm each. Total system dry film thickness 500 μm Touch up after erection as required.

6.6 Painting of Pipes

6.6.1. Buried Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note: All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.



Tests to be carried out after application : Bond/ Adhesion test, Holiday test

E ternal surfaces

- i. Surface cleaning by Sand Blasting.
- ii. Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- iii. Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type I to IS: 7193-1974 will be applied in the same way confirming to Table 10 of IS 10221 1982. The total thickness of the coating will not be less than 4.0 mm
- iv. Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm. Tests to be carried out after application: Bond/ Adhesion test, Holiday test

6.6.2. Overground Piping

Internal surfaces

- i. Surface cleaning by sand blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns. The total dry film thickness of 150 microns.
Note: All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

E ternal surfaces

- i. Surface cleaning by Sand Blasting.
- ii. Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- iii. Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

6.7 Internal Coatings

6.7.1. Tanks (Internal surfaces) as specified in relevant sections of specification

Industrial deionised, demineralised and potable water up to 60 C pH range 4.5-9.5 Blasting according to Sa 2 and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry film thickness >75 m.

Pre-treatment



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Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501- 1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85 , 75 m.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 m.

Finish Coat

2 pack silicon acrylic, dry film thickness of 150 m per coat. In case of service or potable water tanks, the coating material selected shall not taint the water. The paint system shall confirm to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work. QA/ QC Procedure including pinhole inspection, shall be submitted for approval by Owner/ Owner's representative.

6.7.2. Rubber Lining of Pipes, Valves and Tanks for DM Water

Pre-treatment

Blasting according to Sa 2 and ISO 8501-1:1988

Rubber Lining

Hard rubber 5 mm for DM water applications as IS 4682

6.8 Painting for Electrical items

6.8.1. All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and swarf by pickling, emulsion cleaning etc. The sheet steel shall be phosphate/ oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing epoxy paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5/ RAL 7032 for all switchboard/ MCC/ Distribution boards, control panels etc.

6.8.2. All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.

6.8.3. Painting of I & C equipment: Epoxy coating required for all I & C equipment.

6.9 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2	Boiler casing, ducting	Nut Brown	413	-	-
3	Crane				
3.1	Crane structure	Golden Yellow	356	Black	-
3.2	Trolley & hook	Crimson	540	-	-



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SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
4	Fans, pumps, motors, compressors	Light Grey	631	-	-
5	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7	Switchgear	Light grey (Powder coated)		-	-
8	Control & relay panels	Light grey (Powder coated)	631/7078 of IS 1650	-	-
9	Turbines	Light grey	631	-	-
10	Generators & Exciter	Light grey	631	-	-
11	Transformers	Aluminium	-	-	-
12	Machinery guards	Signal red	537	-	-
13	Piping (without insulation and cladding)				
13.1	Water System				
a	Boiler feed	Sea Green	217	-	-
b	Condensate	Sea Green	217	Light Brown	410
c	DM Water	Sea Green	217	Light Orange	557
d	Soft Water	Sea Green	217	French Blue	166
e	Bearing Cooling Water	Sea Green	217	French Blue	166
f	Potable & filtered Water	Sea Green	217	French Blue	166
g	Service and clarified water	Sea Green	217	French Blue	166
h	Cooling water	Sea Green	217	French Blue	166
i	Sea Water	Sea Green	217	White	-
14	Ash Transmitting Vessels and pipe lines	Aluminium	-	-	
15	Air System				
15.1	Station air	Sky blue	101	-	-
15.2	Control air	Sky blue	101	White	-



**1X800 MW COAL BASED NORTH CHENNAI THERMAL
POWER PROJECT STAGE III**



EPC TENDER SPECIFICATION FOR BTG PACKAGE

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
16	Oil system				
16.1	Fuel oil	Light brown	410	French	166
16.2	Light oil (HSD)	Light brown	410	Brilliant green	221
16.3	Lubricating oil	Light brown	410	Light grey	631
16.4	Transformer oil	Light brown	410	Light orange	557
17	Gas System				
17.1	Carbon dioxide	Canary yellow	309	Light grey	631
17.2	Hydrogen	Canary yellow	309	Signal red	537
18	Fire services	Fire red	536	-	-
19	Effluent pipes	Black	-	-	-
20	Vacuum pipes	Sky blue	101	Black	-

Notes:

1. This colour code basically refers to IS: 2379 for piping with necessary modifications
2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

Bidder shall furnish his painting specification to suit corrosive atmosphere of coastal area along with the bid. The specification shall in general be in line with the above requirements.



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16.0 PACKAGING AND TRANSPORTATION

All the equipment & spares shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. Each spare shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packaged in a single case, a general description of the contents shall be shown on the outside of such a case and other packages must be suitably marked and numbered for the purpose of identification..

