PROCUREMENT PROCEDURE OF CPRI (NON WORKS)

Revision No. : 04 | **Issue No : 2**
Dt of Revision : 27.08.2020 | **Issue Dt. : 30.06.2003**
Page No. : 1 of 4 | **Issued by : P A**
Section : Formats | **Documents : PPM**
Topic : Technical Specifications format | **FORMAT NO.:CPRI/PUR/eTBID/GTP**

Section IV T -Technical Specification

CENTRAL POWER RESEARCH INSTITUTE, BENGALURU/BHOPAL Web: www.cpri.in, www.tenderwizard.com/CPRI

Tender Enquiry No : CPRIBLR21HPL06C861

Description of the Equipment/Goods/Services : MV and LV Switchgear Panels, SPBD, Power Cables and its interconnection for ESTABLISHMENT OF 40,000A TEMPERATURE RISE TEST FACILITY AT HIGH POWER LABORATORY, CPRI, BENGALURU

Note : 1) The technical bid submitted in other than this format is liable to be rejected.

2) All blue fields are mandatorily to be filled in.

Name and address of the bidder	
Quotation Number and Date	

Sl.No.	Parameters	CPRI Technical Specification / Requirements	Qty	To be completed by the Bidder		
				Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
1	Place where equipment /service to be supplied /provided	High Power Laboratory, CPRI, Bangalore.	1			
2	Scope	Scope covers the supply, design, engineering, manufacture, assembly, Inspection, testing at manufacturer's works, Type and Routine tests, mandatory spares, packing and transportation, insurance, loading, unloading, handling, storage, erection, installation, commissioning of MV and LV Switchgear Panels, SPBD, Power Cables and its interconnection : 1) 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel (One No.), 2) 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Metal clad Switchgear Panel (One No.) and 3) 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad switchgear Panel(One No.), SPBD, Busduct , Interface between the panels and other equipment as per the SLD with cables and its termination for establishment of 40,000A Temperature Rise Test Facility at High Power Laboratory, CPRI-Bengaluru, India. Layout drawing and Detailed Scope of work are mentioned in Attachment - 1.				
3	Qualifying requirements for Bidder	The supplier shall have manufacturing and service facility for MV/LV switchgear panels and Busducts covering the range given in the scope of work. The supplier shall submit the relavent documents for the above along with the Bid.				

Section IV T -Technical Specification

CENTRAL POWER RESEARCH INSTITUTE, BENGALURU/BHOPAL Web: www.cpri.in, www.tenderwizard.com/CPRI

Sl.No.	Parameters	CPRI Technical Specification / Requirements	Qty	To be completed by the Bidder		
				Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
4	Climatic Conditions	MV and LV Switchgear Panels, SPBD, Power Cables and its interconnection shall be designed for satisfactory operation under tropical climatic conditions prevailing at the site are as follows; Altitude above Mean Sea Level : 920 m Maximum ambient temperature : 45°C Minimum ambient temperature : 10°C Average annual temperature : 24°C Average Humidity : 81% Special corrosion conditions : Nil Solar Radiation (DNI) : 4.5-5.0 kWh/Sq. m/Day Atmospheric UV radiation : High Pollution level : Moderate Snow fall : Nil Seismic Zone : Zone-II Wind Speed : Average 5.6 km/h Annual rainfall : 1000mm-1500mm	1			
5	Switchgear Panel Layout Drawing at site for Scope	Refer Attachment - 1				
6	**Technical Specification of 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite Metal clad Switchgear Panel - Refer Annexure-I**					
6(a)	Foreword	Refer Clause 1.0 of Annexure-I				
6(b)	General	Refer Clause 2.0 of Annexure-I				
6(c)	Scope	Refer Clause 3.0 of Annexure-I				
6(d)	System Particulars	Refer Clause 4.0 of Annexure-I				
6(e)	Standards	Refer Clause 5.0 of Annexure-I				
6(f)	Main Technical Parameters	Refer Clause 6.0 of Annexure-I				
6(g)	MV panel design and construction	Refer Clause 7.0 of Annexure-I				
6(h)	Inspection and Tests	Refer Clause 8.0 of Annexure-I				
6(i)	Installation and Commissioning	Refer Clause 9.0 of Annexure-I				
6(j)	Spare Parts and Maintenance	Refer Clause 10.0 of Annexure-I				
6(k)	Technical Information to be Submitted with the Bid	Refer Clause 11.0 of Annexure-I				

6(l)	Figures (Only for illustrative purpose and not for computational purpose)	Refer Clause 12.0 of Annexure-I				
7	**Technical Specification of 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Composite Metal clad Switchgear Panel - Refer Annexure-II**					
7(a)	Foreword	Refer Clause 1.0 of Annexure-II				
7(b)	General	Refer Clause 2.0 of Annexure-II				
7(c)	Scope	Refer Clause 3.0 of Annexure-II				
7(d)	System Particulars	Refer Clause 4.0 of Annexure-II				
7(e)	Standards	Refer Clause 5.0 of Annexure-II				
7(f)	Main Technical Parameters	Refer Clause 6.0 of Annexure-II				
7(g)	MV panel design and construction	Refer Clause 7.0 of Annexure-II				
7(h)	Inspection and Tests	Refer Clause 8.0 of Annexure-II				
7(i)	Installation and Commissioning	Refer Clause 9.0 of Annexure-II				
7(j)	Spare Parts and Maintenance	Refer Clause 10.0 of Annexure-II				
7(k)	Technical Information to be Submitted with the Bid	Refer Clause 11.0 of Annexure-II				
7(l)	Figures (Only for illustrative purpose and not for computational purpose)	Refer Clause 12.0 of Annexure-II				
8	**Technical Specification of 0.440 kV, 400A, 20kA/1Sec, 50/60Hz, Indoor Composite Metal clad Switchgear Panel - Refer Annexure-III**					
8(a)	Foreword	Refer Clause 1.0 of Annexure-III				
8(b)	General	Refer Clause 2.0 of Annexure-III				
8(c)	Scope	Refer Clause 3.0 of Annexure-III				
8(d)	System Particulars	Refer Clause 4.0 of Annexure-III				
8(e)	Standards	Refer Clause 5.0 of Annexure-III				
8(f)	Main Technical Parameters	Refer Clause 6.0 of Annexure-III				
8(g)	MV panel design and construction	Refer Clause 7.0 of Annexure-III				
8(h)	Inspection and Tests	Refer Clause 8.0 of Annexure-III				
8(i)	Installation and Commissioning	Refer Clause 9.0 of Annexure-III				

Section IV T -Technical Specification

CENTRAL POWER RESEARCH INSTITUTE, BENGALURU/BHOPAL Web: www.cpri.in, www.tenderwizard.com/CPRI

8(j)	Spare Parts and Maintenance	Refer Clause 10.0 of Annexure-III				
8(k)	Technical Information to be Submitted with the Bid	Refer Clause 11.0 of Annexure-III				
8(l)	Figures (Only for illustrative purpose and not for computational purpose)	Refer Clause 12.0 of Annexure-III				
9	Power cables	The supplier shall select the Power cable rating as per continuous rating, short time withstand rating and duration of fault mentioned in Annexure -I, II and III. Power cable Connection and its termination as per SLD are in the scope of Supplier. The details of power cables shall be submitted in the Bid.				
10	Segregated Phase Bus Duct (SPBD) and Open Bus bar Connection	The supply, mounting is in the scope of supplier. For details refer Annexure - IV.				
11	Bill of Material (BoM)	The supplier shall submit BoM and Mandatory spares as per the scope of work,. Mandatory spares required for tourble free operation of equipment as per scope for 12 months from the date of commisioning. Mandatory spares cost shall be considered for price bid evaluation.				
12	Installation and Commissioning	All panel are installed and inter connected with power cables including its termination, SPBD and Open bus bar connection as per Annexure -I, Annexure -II, Annexure -III, Annexure -IV and Attachment - 1 .				
13	Warranty	12 months from the date of Installation and Commissioning				

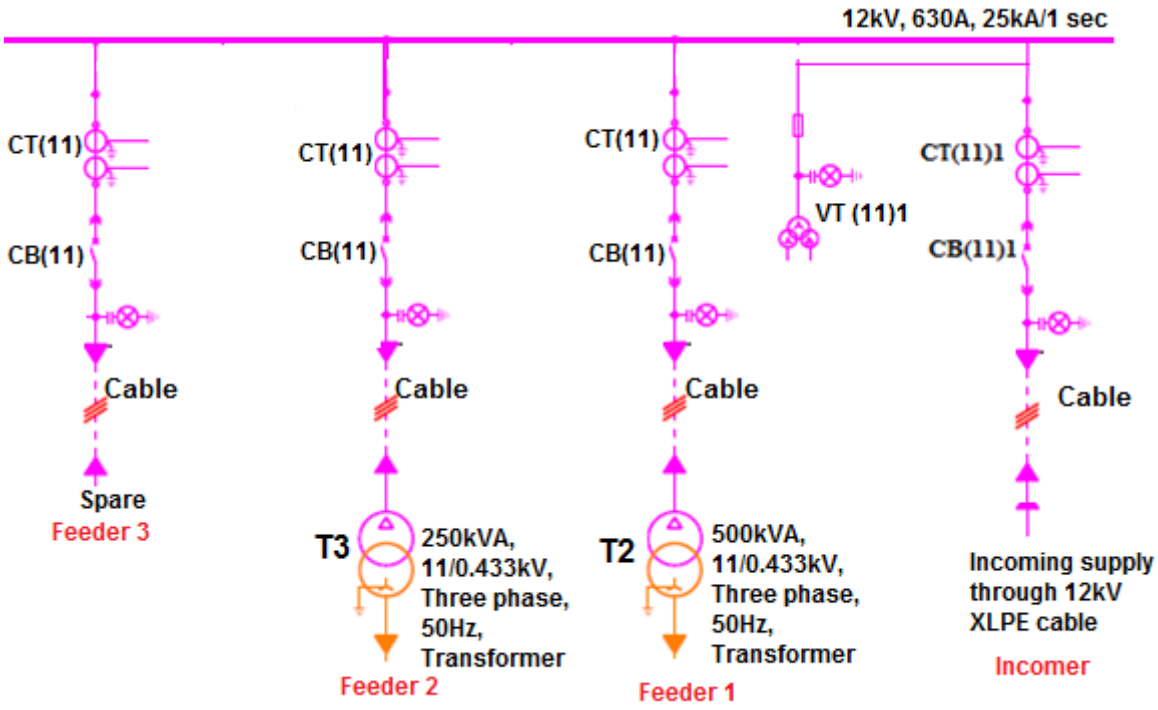
PN: 1) Mere statement of "Complied" do not suffice the requirement. The details of technical parameters in proof of CPRI requirements shall be furnished along with technical write-up, catalogues, brouchers, literatures, phamplates, or any other documents shall be submitted in hard copy along with technical bid.
2) Calibration reports/certificates, factory test reports/certificates from an accreditated agencies/facilites shall be submitted wherever applicable.
3) CPRI reserves the right to conduct "predispatch inspection" prior to dispatch at the works of the supplier and the expenditure towards PDI shall be borne by CPRI. However information regarding the rediness of the equipment/machinary for the PDI shall be communicated in writing at lease 70 days in advance.

ANNEXURE-I

Technical Specification of
12 kV, 630A, 25kA/1Sec, 50Hz,
Indoor Composite Metal clad Switchgear Panel

TABLE OF CONTENTS

Clause No.	TECHNICAL SPECIFICATION
1.0	**FOREWORD** Central Power Research Institute (herein after referred to as CPRI) intends to establish 40,000A temperature rise test facility at High Power Laboratory (HPL) in Bengaluru in order to perform the temperature rise test upto 40kA on MV Bus ducts, MV/HV Circuit Breakers, MV/HV Switchgear and Control gear, HV Switches and HV Disconnectors. This Specification covers the supply of 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel complete with all accessories as specified in this document, for establishment of 40,000A Temperature Rise Test Facility at High Power Laboratory, CPRI-Bengaluru, India.
2.0	**GENERAL**
2.1	12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel complete with all accessories covered by this specification will form part of the new 40,000A Temperature Rise Test Facility in High Power Laboratory, CPRI, Bengaluru, India.
2.2	The feature of such composite VCB panel is used to connect the power supply to auxiliary load through 250kVA, 11/0.433kV, 50Hz, Three phase transformer – TR(11)2 for 40,000A Temperature Rise Test Laboratory and also it connect the power supply to Static Frequency Controller load through 500kVA, 11/0.433kV, 50Hz, Three phase transformer TR(11)1.
3.0	**SCOPE** The scope covers the design, engineering, manufacture, assembly, testing at manufacturer's works, painting, packing and transportation, insurance, supply, loading, unloading, handling, storage, erection installation, site testing and commissioning of 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel (as per fig.(1)) complete including voltage transformers, current transformers, disconnectors, earth switches, metering instruments, protection relays with all fittings, and spares, for establishment of 40,000A Temperature Rise Test Facility (TRTF) at High Power Laboratory, CPRI-Bengaluru, India. The equipment offered by the Bidder shall be complete in all respects. Any material and component not specifically stated in this specification but which are necessary for trouble free operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded. All such equipment / accessories shall be supplied without any extra cost. Also all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory. These Technical Specifications detail the requirements for modular indoor medium voltage (MV) panel comprising factory-built metal-enclosed switchgear assembles, to be installed in the 40kA TRTF building of CPRI HPL in Bangalore (India).

Clause No.	TECHNICAL SPECIFICATION
	The supply shall include also the assistance for installation and commissioning activities, by a team of specialized workers of the Supplier. These activities will be performed in a dedicated period, according to the CPRI, in order to avoid interferences with other works
4.0	**SYSTEM PARTICULARS**
4.1	The 12kV, 630A, 25kA/1Sec, 50Hz, composite VCB panel is used to connect the power supply to auxiliary load through 250kVA, 11/0.433kV, 50Hz, Three phase transformer – TR(11)2 for 40,000A Temperature Rise Test Laboratory and also it connect the power supply to Static Frequency Controller load through 500kVA, 11/0.433kV, 50Hz, Three phase transformer TR(11)1. The 12kV, 630A, 25kA/1Sec, 50Hz, metal clad switchgear panel lay out consists of Panel Incomer : One Incomer – 630 Amps Outgoing Feeder : 3 nos. 630 Amps each 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite Metal clad Switchgear Panel single line diagram is shown fig.(1).  *Fig.(1) : Single line diagram of 12 kV, 630A, 25kA/1Sec, 50Hz Indoor Composite Metal clad Switchgear Panel.*

Clause No.	TECHNICAL SPECIFICATION
	Electrical System particulars are as follows; Rated system voltage : 11kV (±10% variation) Highest system voltage : 12kV Frequency : 50Hz (±3% variation) Number of phases : Three Neutral earthing system : Isolated system Fault current : 25kArms
5.0	**STANDARDS**
5.1	12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel along with accessories shall generally conform to the latest editions of the relevant IEC Publications and requirements of this specification.
5.2	The 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel and accessories shall comply with the requirements of the latest edition of the following IEC/IS Standards: **IEC Standards** [1] IEC 62271-200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV [2] IEC 62271-1: High-voltage switchgear and controlgear – Part 1: Common specifications [3] IEC 62271-103: High-voltage switchgear and controlgear – Part 103: Switches for rated voltages above 1 kV up to and including 52 kV [4] IEC 62271-100: High-voltage alternating-current circuit-breakers [5] IEC 62271-102: High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches [6] IEC 61869-1: Instrument transformers – Part 1: General requirements [7] IEC 61869-2: Additional requirements for current transformers [8] IEC 60529: Degrees of protection provided by enclosures (IP Code) [9] IEC-60255: Electrical Relays [10] IEC 62052 : Electricity metering equipment (AC) **Indian Standards** [1] IS : 722 AC electricity meters. [2] IS : 996 Single phase small AC and universal electrical motors. [3] IS : 1248 Direct Acting indicating analogue electrical measuring instruments and Accessories. [4] IS : 2544 Porcelain post insulators for systems with nominal voltages greater than 1000V.

<table>
<tr><th>Clause No.</th><th>TECHNICAL SPECIFICATION</th></tr>
<tr><td></td><td>[5] IS : 2705 Current transformers.
[6] IS : 3156 Voltage Transformers
[7] IS : 3231 Electrical relays for power system protection.
[8] IS : 3427 Metal enclosed switchgear and control gear
[9] IS : 5082 Specification for wrought aluminium and aluminium alloy bars, rods, tubes and selections for electrical purposes.
[10] IS : 6005 Code of practice for phosphating of iron and steel.
[11] IS : 8686 Specification for static protective relays.
[12] IS : 9046 AC contactors for voltages above 1000 volts and up to and including 11000 V.
[13] IS : 9921 A.C. disconnectors (isolators) and earthing switches for voltages above 1000 V
[14] IS : 9224 Low voltage fuses
[15] IS : 9385 HV fuses
[16] IS : 9431 Specification for indoor post insulators of organic material for system with nominal voltages greater than 1000 volts up to and including 300 KV
[17] IS : 11353 Guide for uniform system of marking and identification of conductors and apparatus terminals.
[18] IS : 13118 Specification for high voltage AC circuit breakers.
[19] IS : 13947 Degree of protection provided by enclosures for low voltage switchgear and control gear.</td></tr>
<tr><td>5.3</td><td>If a relevant IEC/IS Publication does not exist, the supplier shall adopt other internationally accepted standards and codes.
In the matter of conformity, the following order shall be binding:
• The requirements of this specification
• The latest versions of IEC/IS Publication
• To the latest versions of other national/international standards/codes as applicable to the relevant equipment or component or the material used in the manufacture of the same.
• In the event a requirement is not covered by any of the above mentioned documents the same will be decided by mutual agreement between the purchaser and the supplier.
• Moreover reference has to be made to all applicable Indian laws.</td></tr>
<tr><td>6.0</td><td>MAIN TECHNICAL PARAMETERS</td></tr>
<tr><td></td><td>Mandatory particulars of Panel:
<table>
<tr><td>Type</td><td>Metal clad, air insulated with VCB type indoor panel</td></tr>
<tr><td>Installation</td><td>Indoor</td></tr>
<tr><td>Rated voltage</td><td>11 kV</td></tr>
<tr><td>Number of phases</td><td>3</td></tr>
</table></td></tr>
</table>

Clause No.	TECHNICAL SPECIFICATION

Frequency	50Hz
Rated current	630 Amps (Busbar, Circuit Breaker)
Highest system voltage	12 kV
Short-duration power-frequency withstand voltage	28.0 kVrms
Lightning impulse withstand voltage	75 kVpeak
Fault short circuit current	25kArms
Rated duration of short circuit current	1.0 sec
Fault short circuit current peak	62.5kApeak
Type of accessibility to switchgear/controlgear	A (restricted to authorized personnel only)
Enclosure degree of protection	HV compartment : IP 4X LV compartment : IP5X
Aux. voltage	AC : 230 V, DC : 110 V *****
Thickness of metal sheet (minimum)	Load bearing : 2.0 mm Doors & covers and other: 2.0 mm
Bus bar current	630 Amps
Bus bar & Earth bus material	Aluminium
Current density	0.8 Amps / sq. mm (max)
Power cable entry	From Rear Bottom
Control cable entry	From Backside
Position of Mechanical & Electrical Emergency Trip Arrangement	Front side of the Panel
Overall Dimension of panel	Depth : 1000 mm (minimum)
Paint type	Powder coated
Paint shade	RAL 7032 (both external & internal)
Paint thickness	50 microns (min)

Mandatory particulars of Circuit Breaker:

Medium for interrupting capability and insulation	Vacuum
Installation	Indoor
Mounting type	Horizontal draw out type
Number of poles	3
Rated voltage	11 KV
Highest system voltage	12 KV
Insulation level	12 kVrms/28 kVrms/75 kVpeak
Rated frequency	50Hz
Rated normal current	630A
Short circuit breaking current	25kArms
Short circuit making current	62.5kApeak
DC component	As per IEC 62271-100
Short time withstand current for 3 sec	25kArms
First pole to clear factor	1.5
Rated operating sequence	O – 0.3sec – CO – 3min – CO

Clause No.	TECHNICAL SPECIFICATION

Total braking time	≤ 60mSec
Total closing time	≤ 100mSec
Operating mechanism	Motor wound spring charged stored energy type as per IEC-62271
Mechanical endurance	M1 class
Rated Auxiliary Supply For Spring	230V AC, 50Hz, Single phase
Rated supply Voltage for Tripping/Closing coil	230V AC/110V DC *****
Degree of protection	IP 5X
Power frequency withstand voltage on Auxiliary circuit	2 KV (rms)/1 Minute
auxiliary contacts for open position and for closed position	4

Mandatory particulars of Current Transformer:

Type	Cast resin, Indoor type . Marking on primary and secondary terminal as per requirement of IEC 60044-1, IS 2705 and shall be indelibly marked. The secondary terminals shall have screw type terminals.
Reference Standard	IEC : 60044-1, IS : 2705
Rated voltage	11 KV
Highest system voltage	12 KV
Rated operating frequency	50Hz
Insulation level	12 kVrms/28 kVrms/75 kVpeak
STC	25 KA for 3 Sec
Class of insulation	E or better
Continuous over load capacity	120 % of rated primary current
Incomer & Feeder	Transformer
Ratio	Incomer :Ip/5-5 A Feeder : Ip/5-5 A Primary current (Ip) ratings shall be decided as per the actual and rated current.
No of secondary	Two
Core identification	Core 1 : Metering, Core 2 : Protection
Accuracy class	Core 1 : 0.5 Core 2 : Protection class
Burden	VA rating to be defined by supplier for all cores
Power frequency withstand voltage for secondary winding	2kV rms for one minute

Clause No.	TECHNICAL SPECIFICATION

Mandatory particulars of Potential Transformer:

Type	Cast resin, Indoor type.
Rated voltage	11 KV
Highest system voltage	12 KV
Rated operating frequency	50Hz
Insulation level	12 kVrms/28 kVrms/75 kVpeak
Class of insulation	E or better
Rated voltage factor	1.2 continuous and 1.5 for 30 seconds
Ratio	11000/110-110 V
No of secondary	Two
Core identification	Core 1 : Metering, Core 2 : Protection
Accuracy class	Core 1 : 0.5 Core 2 : Protection class
Burden	VA rating to be defined by supplier for all cores
Power frequency withstand voltage for secondary winding	2kV rms for one minute

Mandatory particulars of Common earthing truck:

Installation	Indoor
Number of poles	3
Rated voltage	11 KV
Highest system voltage	12 KV
Insulation level	12 kVrms/28 kVrms/75 kVpeak
Rated normal current	630A
Rated frequency	50Hz
Short time withstand current for 1 sec	25kArms

*****If the offered switchgear equipment requires DC power supply, the actual sizing and supply of DC Power source is in the scope of Supplier. The overall sizing of DC Power source shall also meet the requirements of other switchgear panels (11 kV and 0.440kV).

7.0 MV PANELS DESIGN AND CONSTRUCTION

7.1 Design criteria

All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion. The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards at maximum operating temperature of 45˚C.

The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.

Clause No.	TECHNICAL SPECIFICATION
	The electrical safety clearances of all live parts of the equipment shall be as per relevant standards. All the different components contained within the enclosure are subjected to the individual IS/IEC Standards applying to them. The switchgear panel shall be designed to operate locally and remotely.
7.2	**Standards and quality** The specified MV panels and all the relevant equipment shall be designed, manufactured and tested according to applicable IS/IEC Standards. The equipment shall also comply with all Indian standards and rules applicable.
7.3	**Panel Construction** The switchgear shall be indoor, metal - clad, floor mounted, horizontal draw out type design and construction shall be such as to allow extension at either end. Panel shall be made of CRCA sheet steel or Alu-Zinc. The switchgear enclosure shall conform to the degree of protection IP-4X. However, degree of protection of LV chamber shall be IP-5X. The minimum thickness of CRCA sheet steel shall be 2 mm for load bearing members and 2 mm for the rest. Louvers for enclosure shall be avoided by suitably derating the equipment. In accordance with applicable standards, the panels shall be designed so that normal service, inspection, maintenance operations, determination of the energized or de-energized state of the main circuit, earthing of connected cables, locating of cable faults, voltage tests on connected cables or other apparatus and the elimination of dangerous electrostatic charges can be carried out safely. The switches and the switchboards shall be designed in such a way that the positions of the various devices shall be visible by the operator from the front of the panel, from where it shall be possible to operate the switchgear.
7.4	**Busbars and Insulators** (a) All busbar and jumper connections shall be of high conductivity aluminium alloy. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents. Busbar cross-section shall be uniform throughout the length of switchgear. Busbars and other high voltage connection shall be sufficiently corona free at maximum working voltage. All connection hardware shall have high corrosion resistance. Bimetallic connectors or any other technically proven method shall be used for aluminum to copper connections. (b) Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic,

Clause No.	TECHNICAL SPECIFICATION
	non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators. (c) The supplier shall furnish calculation establishing adequacy of busbar sizes for the specified continuous and short time current ratings. (d) All busbars shall be color coded. (e) The temperature of the busbar and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Indian Standards, duly considering the specified ambient temperature (45 deg. C).
7.5	**Anti corrosion and protection finishing** Protection against corrosion shall be ensured by the use of suitable materials or by the application of suitable protective coatings to the exposed surfaces, taking into account the service conditions described in the Technical Specification.
7.6	**Circuit Breakers** a) The circuit breakers shall be of Vacuum type. They shall comprise of three separate, identical single pole interrupting units, operated through a common shaft by a sturdy operating mechanism. b) Outgoing breakers shall be suitable for switching transformers at any load. c) Circuit breaker shall be restrike free, stored energy operated and trip free type. d) The circuit breakers shall be equipped with a stored energy type operating mechanism including: • pushbuttons for opening and closing; • motor mechanism for electrical charging of the operating mechanism; • mechanical "open / closed" position indicator; • "charged / discharged" indicator for the operating mechanism springs; • local means for manually discharging the springs; • auxiliary contacts.
7.7	**Current transformers** The current transformers shall have the same short-time withstand current and rated voltage of the switchgear. They shall be made of cast epoxy resin and must be labelled individually. The current transformers shall be fully assembled and tested before leaving the factory. The manufacturer shall be provide type-test reports. The rating of secondary winding shall be 5 Amps. However, the current transformers will have to satisfy the requirement of rated VA burden, class of accuracy, accuracy limit factor and short time thermal rating as have been specified in clause No. 8 at all transformation ratio. The ratings of current transformers of all classes regarding ratio error, knee point voltage, resistance of secondary winding etc. shall have to be coordinated with the requirements

Clause No.	TECHNICAL SPECIFICATION
	of protective relays and protection scheme, without any extra cost.
7.8	**Voltage transformers** VTs shall be provided with HRC type fuses on the secondary side. The VT fuses on primary side shall also be provided with all safety precautions. One of the secondary terminals of the VTs shall be solidly earthed. The manufacturer shall be provided type-test reports.
7.9	**Earthing Switches** Common earthing truck for cable side and busbar side shall be provided. The rating of Common earthing truck shall have same continuous rating and fault rating as that of switchgear.
7.10	**Indicating and integrating meters/instruments :** Meters from incomer to all outgoing feeders shall be an integral part of the multifunction numerical relays. Metering signal shall be communicated through IEC 61850 protocol.
7.11	**Relays** All protections (over current, earth faults, over voltage etc.) shall be through multifunction numerical relay on IEC 61850 protocol with built in testing facilities. Other auxiliary relays shall be non-communicable static/ electro-mechanical type and mounted within the cubicle. The relay shall be housed in dust tight enclosure, suitable for IP 5X degree of protection. The protection requirements are 11kV Incomer circuit and 11kV outgoing feeders circuit 1) Over current trip 2) Earth fault trip 3) Over voltage trip
7.12	**Earthing Bus** Earth bus shall be provided at the bottom and shall extend throughout the length of the switchboard. It shall be bolted/welded to the framework of panel and each breaker/earthing contact bar. The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth as indicated under switchgear parameters without exceeding the allowable temperature rise. Suitable arrangement shall be provided at each end of the earth bus for bolting to Employer's earthing conductors. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.

Clause No.	TECHNICAL SPECIFICATION
7.13	**Cable Terminations and Cable Glands** Cable termination compartment shall have provision for termination of power cable(s) (stranded Aluminium conductor, XLPE Insulated, FRLS, shielded, armoured single core / three core) of sizes as indicated during detailed engineering with removable undrilled gland plates. For all cables gland plates shall be of nonmagnetic material. Cable entry shall be from bottom. Supply of the cables and cable terminations shall be in the scope of supplier.
7.14	**Interlocking devices** All interlocks between different components needed for protective and operating reasons shall be provided. Interlocking devices shall satisfy the mandatory provisions of IEC 62271-200.
7.15	**Secondary Wiring :** All Internal wiring in the switchgear panel shall be carried out with 1100 V grade, single core stranded copper with PVC insulation, however, CT circuits shall be wired up with standard copper wire.
7.16	**Space Heater** (a) Each switchgear panel shall be equipped with thermostatically controlled space heater(s), suitably located in breaker and cable compartments to prevent condensation within the enclosure. The space heater shall be connected to 240V single phase AC auxiliary supply available in the switchgear, through switches and fuses provided separately for each panel. (b) A 240V single phase 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF switch for connection of hand lamp.
7.17	**Nameplates** The MV panels shall be provided with durable and clearly legible nameplates containing all the information requested by IEC 62271-200. In addition, each cubicle shall carry a suitably dimensioned identification label clearly indicating the functions of the cubicle.
7.18	**Mimic Diagram** The switchgear panel shall be provided with mimic diagram. The mimic shall represent a single line arrangement of incomer and feeders.
7.19	**Indicating Lamps** Indicating lamps shall be provided on the panel to indicate the visual indication of ON and OFF position of each circuit breaker, spring charged indication of circuit breaker and auto trip indication of each circuit breaker, VT supply indication.

Clause No.	TECHNICAL SPECIFICATION
7.20	**Ferrules** Ferrules engraved/printed with the numbers, letters or symbols as indicated in the connection and wiring diagram shall be provided on the terminals end of all wires for identification of circuits for inspection and maintenance.
7.21	**Fault Alarm Annunciation Scheme** The switchgear panel shall be equipped with annunciation scheme for indicating all the annunciations required for trip alarms as per incomer and outgoing feeders. They are 11kV Incomer circuit and 11kV outgoing feeders circuit 1) Over current trip 2) Earth fault trip 3) Over voltage trip Required auxiliary relays shall be provided in the annunciator scheme to indicate each trip alarm individually. Each alarm shall have visual as well as audible annunciation. The visual annunciator alarm shall be in the form of flashing display type glow pattern. This shall remain illuminated till the particular initiating contact is reset. The automatic trip of the circuit breaker due to the operation of protection relays shall be indicated by sounding of a hooter.
8	**INSPECTIONS AND TESTS**
8.1	**Inspection during manufacturing** The Supplier shall propose a comprehensive inspection program during manufacture of the equipment. The CPRI personnel shall be permitted to visit the Manufacturer works in order to verify the progress of works and the respect of agreed time schedule.
8.2	**Tests**
8.2.1	**<u>Type tests</u>** The type test reports of individual Circuit Breakers, Earth switches, Current Transformers, Potential Transformers, Relays, meters etc. shall be complete in all respect along with oscillographic records, photographs etc. in respect of type tests as per below shall be submitted to CPRI. Otherwise type test will be performed at Supplier exclusive cost. A list of type tests to be performed is given below as per IEC 62271-100; a. Dielectric tests (power-frequency voltage tests, lightning impulse voltage tests, dielectric tests on auxiliary and control circuits) b. Temperature-rise tests by calculation method c. Short-time withstand current and peak withstand current tests d. Basic short circuit test duties e. Mechanical endurance test

Clause No.	TECHNICAL SPECIFICATION
8.2.2	**Routine tests** Before delivery, factory acceptance tests shall be executed on MV panel assembly in the presence of CPRI at the Manufacturer works, consisting in individual tests (routine tests) according to applicable Standards. Factory accepting tests, in accordance with IEC standards shall include the following: 1. Dielectric test on the main circuit (power-frequency voltage test); 2. Dielectric tests on LV auxiliary and control circuits; 3. Design and visual checks for conformity with plans and drawings; 4. Mechanical operation tests; 5. Tests of auxiliary electrical and checking of the interlocking; 6. Functional test of low-voltage circuits. The supplier shall inform CPRI of the Factory Acceptance Tests program 30 days in advance and shall allow CPRI representatives to witness them.
9.0	**INSTALLATION AND COMMISSIONING** The supplier shall carryout the installation and commissioning activities at site includes, but not limited to; 1. Assembly of switchgear panels, busbars and instrument transformers etc., as per SLD mentioned in clause 4 of this technical specification. 2. Installation of switchgear panels at site as per layout drawing. 3. Internal connection of bus wiring and instrument transformer secondary wiring 4. Interconnecting cables and it's termination from switchgear to external equipment as per SLD mentioned in clause 4 of this technical specification. 5. Earthing of switchgear panels with CPRI building earthing points. 6. Adjustment of protection and control relays to the operating set point for Over voltage, Over current and earth fault. 7. Energisation of Switchgear panel. During Energisation there shall not be any undue operation of Switchgear panel. 8. Training to CPRI officials, after successful energisation of Switchgear panel. The supply shall include the activities performed by a team of specialized workers of the bidder. These activities will be performed in a period defined by the CPRI, in order to avoid interferences with other works.
10.0 **10.1**	**SPARE PARTS AND MAINTENANCE** The supplier is required to list the suggested mandatory spares for 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel, which may be required for ensuring the guaranteed availability. The cost of mandatory spares is included in the total bid cost.

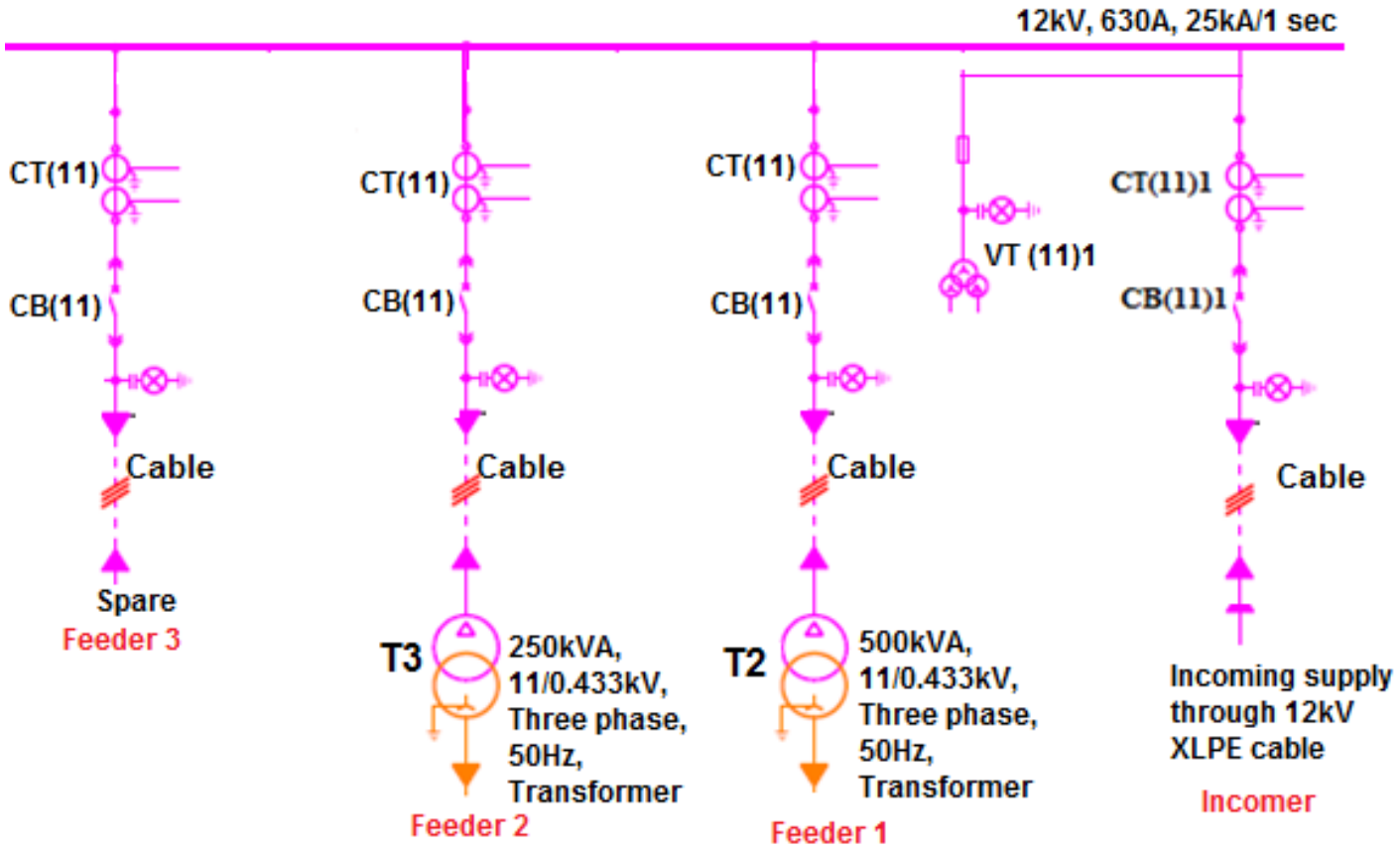
Clause No.	TECHNICAL SPECIFICATION
10.2	The supplier shall indicate the proposed maintenance schedule during the guarantee period and the life period of the 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel.
11.0	**TECHNICAL INFORMATION TO BE SUPPLIED BY THE BIDDER** The following technical information shall be included in the bid: 1) MV panel General arrangement drawing 2) MV panel and Individual equipment details 3) BoM of MV panel 4) Tests certificates relevant the type tests 5) Masses [kg]: total mass in service condition 6) Mass of the heaviest piece for transportation [kg] 7) Dimensions in operation conditions (length, width, height) [mm] 8) List of the suggested spare parts. The following documents shall be provided along with the supply: 1) General drawings, electrical schemes, wiring drawings, installation drawings 2) Operational manual and Maintenance manual: These manuals shall include specific instruction relevant to the handling, installation, troubles shooting and servicing 3) Reports on inspection during manufacturing 4) Reports of routine, type and acceptance tests. All documents shall be issued in English language and provided both on paper and software copy.

FIGURE

FIGURE 1

12 KV, 630A, 25KA/1SEC, 50HZ, INDOOR COMPOSITE VCB PANEL

FOR 40,000A TEMPERATURE RISE TEST FACILITY



ANNEXURE-II

Technical Specification of
12kV, 5500A, 10kA/1Sec, 50Hz,
Indoor Metal clad Switchgear Panel

ANNEXURE-II

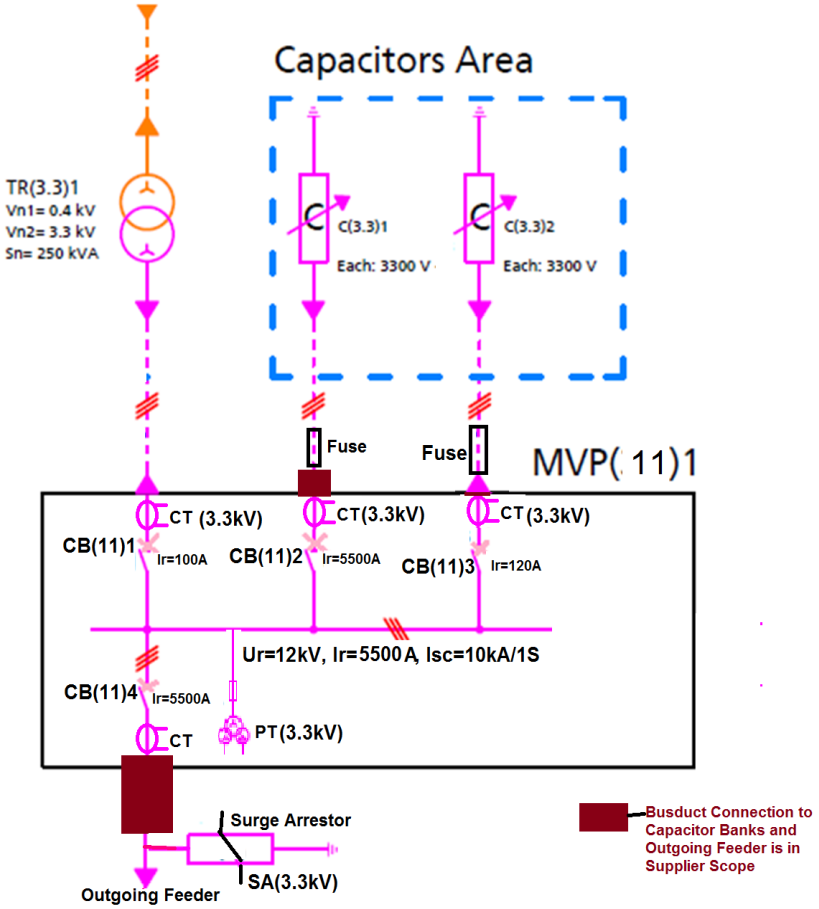
TABLE OF CONTENTS

Clause No.	TECHNICAL SPECIFICATION
1.0	**FOREWORD** Central Power Research Institute (herein after referred to as CPRI) intends to establish 40,000A temperature rise test facility at High Power Laboratory (HPL) in Bengaluru in order to perform the temperature rise test upto 40kA on MV Bus ducts, MV/HV Circuit Breakers, MV/HV Switchgear and Control gear, HV Switches and HV Disconnectors. This Specification covers the supply of 12 kV, 5500A, 10kA/1Sec,50Hz, Indoor Metal clad Switchgear Panel as specified in this document, for establishment of 40,000A Temperature Rise Test Facility at High Power Laboratory, CPRI-Bengaluru, India.
2.0	**GENERAL**
2.1	12 kV, 5500A, 10kA/1Sec,50Hz, Indoor Metal clad Switchgear Panel covered by this specification will form part of the new 40,000A Temperature Rise Test Facility in High Power Laboratory, CPRI, Bengaluru, India.
2.2	The feature of such panel is used to connect the input through 250kVA, 0.4/3.3kV, 50Hz, Three phase transformer and output of Capacitor banks C(3.3)1 & C(3.3)2, output of panel is going to connect 40kA transformer as shown in fig.1.
3.0	**SCOPE** The scope covers the design, engineering, manufacture, assembly, testing at manufacturer's works, painting, packing and transportation, insurance, supply, loading, unloading, handling, storage, erection installation, site testing and commissioning of 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Composite VCB Panel (as per fig.(1)) complete including 5500A Busduct, Voltage transformers, Current transformers, Fuses, Surge Arrester, Earth switches, Metering instruments, Protection relays with all fittings, and Spares, for establishment of 40,000A Temperature Rise Test Facility (TRTF) at High Power Laboratory, CPRI-Bengaluru, India. The equipment offered by the Bidder shall be complete in all respects. Any material and component not specifically stated in this specification but which are necessary for trouble free operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded. All such equipment / accessories shall be supplied without any extra cost. Also all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory. These Technical Specifications detail the requirements for modular indoor medium voltage (MV) panel comprising factory-built metal-enclosed switchgear assembles, to be installed in the 40kA TRTF building of CPRI HPL in Bangalore (India).

<table>
<tr><th>Clause No.</th><th>TECHNICAL SPECIFICATION</th></tr>
<tr><td></td><td>The supply shall include also the assistance for installation and commissioning activities, by a team of specialized workers of the Supplier. These activities will be performed in a dedicated period, according to the CPRI, in order to avoid interferences with other works.</td></tr>
<tr><td>4.0
4.1</td><td>SYSTEM PARTICULARS
The feature of 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Metal clad Switchgear Panel is an intermediate panel connecting the power supply to 40kA transformer through capacitor bank loads as shown in fig 1.

Electrical System particulars are as follows;
Rated system voltage : 11.0kV(±10% variation)
Highest system voltage : 12.0kV
Frequency : 50Hz (±3% variation),
Number of phases : Three
Neutral earthing system : Isolated system
Fault current : 10kArms

The 12 kV, 5500A, 10kA/1Sec, Indoor Metal clad Switchgear Panel lay out consists of
<table><tr><td>Panel Incomer : Incomer -1: 100 Amps
Incomer -2: 5500 Amps (Busduct)
Incomer -3: 120 Amps</td></tr><tr><td>Outgoing Feeder : 1 no. 5500 Amps (Busduct)</td></tr></table>
12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Metal clad Switchgear Panel single line diagram is shown fig.(1).</td></tr>
</table>

Clause No.	TECHNICAL SPECIFICATION
	 *Fig.(1) : Single line diagram of 12 kV, 5500A, 10kA/1Sec, Indoor Metal clad Switchgear Panel.*
5.0	**STANDARDS**
5.1	12 kV, 5500A, 10kA/1Sec, Indoor Metal clad Switchgear Panel shall generally conform to the latest editions of the relevant IEC Publications and requirements of this specification.
5.2	The 12 kV, 5500A, 10kA/1Sec, Indoor Metal clad Switchgear Panel shall comply with the requirements of the latest edition of the following IEC Standards: **IEC Standards** [1] IEC 62271-200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV [2] IEC 62271-1: High-voltage switchgear and controlgear – Part 1: Common specifications [3] IEC 62271-103: High-voltage switchgear and controlgear – Part 103: Switches for rated voltages above 1 kV up to and including 52 kV

Clause No.	TECHNICAL SPECIFICATION
	[4] IEC 62271-100: High-voltage alternating-current circuit-breakers [5] IEC 62271-102: High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches [6] IEC 61869-1: Instrument transformers – Part 1: General requirements [7] IEC 61869-2: Additional requirements for current transformers [8] IEC 60529: Degrees of protection provided by enclosures (IP Code) [9] IEC-60255 Electrical Relays **Indian Standards** [1] IS : 722 AC electricity meters. [2] IS : 996 Single phase small AC and universal electrical motors. [3] IS : 1248 Direct Acting indicating analogue electrical measuring instruments and Accessories. [4] IS : 2544 Porcelain post insulators for systems with nominal voltages greater than 1000V. [5] IS : 2705 Current transformers. [6] IS : 3156 Voltage Transformers [7] IS : 3231 Electrical relays for power system protection. [8] IS : 3427 Metal enclosed switchgear and control gear [9] IS : 5082 Specification for wrought aluminium and aluminium alloy bars, rods, tubes and selections for electrical purposes. [10] IS : 6005 Code of practice for phosphating of iron and steel. [11] IS : 8686 Specification for static protective relays. [12] IS : 9046 AC contactors for voltages above 1000 volts and up to and including 11000 V. [13] IS : 9921 A.C. disconnectors (isolators) and earthing switches for voltages above 1000 V [14] IS : 9224 Low voltage fuses [15] IS : 9385 HV fuses [16] IS : 9431 Specification for indoor post insulators of organic material for system with nominal voltages greater than 1000 volts up to and including 300 KV [17] IS : 11353 Guide for uniform system of marking and identification of conductors and apparatus terminals. [18] IS : 13118 Specification for high voltage AC circuit breakers. [19] IS : 13947 Degree of protection provided by enclosures for low voltage switchgear and control gear.
5.3	If a relevant IEC Publication does not exist, the supplier shall adopt other internationally accepted standards and codes.

Clause No.	TECHNICAL SPECIFICATION
	In the matter of conformity, the following order shall be binding: • The requirements of this specification • The latest versions of IEC Publication • To the latest versions of other national/international standards/codes as applicable to the relevant equipment or component or the material used in the manufacture of the same. • In the event a requirement is not covered by any of the above mentioned documents the same will be decided by mutual agreement between the purchaser and the supplier. • Moreover reference has to be made to all applicable Indian laws.
6.0	**MAIN TECHNICAL PARAMETERS**

Mandatory particulars of Panel:

Type	Metal clad, air insulated indoor panel
Installation	Indoor
Rated voltage	11 kV
Number of phases	3
Frequency	50Hz
Rated current	Refer fig (1) Common busbar – 5500A Incomer -1: 100A Incomer -2: 5500A (Busduct) Incomer -3: 120A Outcomer : 5500A (Busduct)
Highest system voltage	12 kV
Short-duration power-frequency withstand voltage	28.0 kVrms
Lightning impulse withstand voltage	75 kVpeak
Fault short circuit current	10kArms
Rated duration of short circuit current	1.0 sec
Fault short circuit current peak	25.0kApeak
Type of accessibility to switchgear/controlgear	A (restricted to authorized personnel only)
Enclosure degree of protection	HV compartment : IP 4X LV compartment : IP 5X
Aux. voltage	AC : 230 V, DC : 110 V *****
Thickness of metal sheet (minimum)	Load bearing : 2 mm Doors & covers and other : 2 mm
Bus bar & Earth bus material	Aluminium
Current density	0.8 Amps / sq. mm (max)
Power cable entry	From Rear Bottom
Control cable entry	From Backside
Position of Mechanical & Electrical	Front side of the Panel

Clause No.	TECHNICAL SPECIFICATION

Emergency Trip Arrangement	
Dimension of panel	Depth ≥1000 mm
Paint type	Powder coated
Paint shade	RAL 7032 (both external & internal)
Paint thickness	50 microns (min)

Mandatory particulars of Circuit Breaker:

Medium for interrupting capability and insulation	Vacuum
Installation	Indoor
Mounting type	Horizontal draw out type
Number of poles	3
Rated voltage	11 KV
Highest system voltage	12 KV
Insulation level	12 kVrms/28 kVrms/75 kVpeak
Rated frequency	50Hz
Rated normal current	As per incomer and outgoing feeder rating Incomer -1: 100A (minimum) Incomer -2: 5500A (minimum) Incomer -3: 120A (minimum) Outcomer : 5500A (minimum)
Short circuit breaking current	10kArms (minimum)
Short circuit making current	25kApeak (2.5 times the breaking current)
DC component	As per IEC 62271-100
Short time withstand current for 1 sec	25kArms
First pole to clear factor	1.5
Rated operating sequence	O – 0.3sec – CO – 3min – CO
Total braking time	≤ 60mSec
Total closing time	≤ 100mSec
Operating mechanism	Motor wound spring charged stored energy type as per IEC-62271
Mechanical endurance	M1 class
Rated Auxiliary Supply For Spring	230V AC, 50Hz, Single phase
Rated supply Voltage for Tripping/Closing coil	230V AC/110V DC *****
Power frequency withstand voltage on Auxiliary circuit	2 KV (rms)/1 Minute
auxiliary contacts for open position and for closed position	4

Mandatory particulars of Common earthing truck:

Installation	Indoor
Number of poles	3
Rated voltage	11 KV

Clause No.	TECHNICAL SPECIFICATION

Highest system voltage	12 KV
Insulation level	12 kVrms/28 kVrms/75 kVpeak
Rated frequency	50Hz
Rated normal current	5500A
Short time withstand current for 1 sec	10kArms (minimum)

Mandatory particulars of Current Transformer:

Type	Cast resin, Indoor type. Marking on primary and secondary terminal as per requirement of IEC 60044-1, IS 2705 and shall be indelibly marked. The secondary terminals shall have screw type terminals.
Reference Standard	IEC : 60044-1, IS : 2705
Rated voltage	3.3 KV
Highest system voltage	3.6 KV
Rated operating frequency	50 and 60Hz
Insulation level	3.6 kVrms/10 kVrms/20 kVpeak
STC	10 KA for 3 Sec
Class of insulation	E or better
Continuous over load capacity	120 % of rated primary current
Incomer & Feeder	Transformer and Capacitor bank
Ratio	Incomer :As per primary current rating /5-5 A Feeder : As per outgoing feeder rating/5-5 A
No of secondary	Two
Core identification	Core 1 : Metering, Core 2 : Protection
Accuracy class	Core 1 : 0.5 Core 2 : Protection class
Burden	VA rating to be defined by supplier for all cores
Power frequency withstand voltage for secondary winding	2kV rms for one minute

Mandatory particulars of Potential Transformer:

Type	Cast resin, Indoor type.
Rated voltage	3.3 KV
Highest system voltage	3.6 KV
Rated operating frequency	50 and 60Hz
Insulation level	3.6 kVrms/10 kVrms/20 kVpeak
Class of insulation	E or better
Rated voltage factor	1.2 continuous and 1.5 for 30 seconds
Ratio	3300/110-110 V

<table>
<tr><th>Clause No.</th><th>TECHNICAL SPECIFICATION</th></tr>
<tr><td></td><td>
<table>
<tr><td>No of secondary</td><td>Two</td></tr>
<tr><td>Core identification</td><td>Core 1 : Metering,
Core 2 : Protection</td></tr>
<tr><td>Accuracy class</td><td>Core 1 : 0.5
Core 2 : Protection class</td></tr>
<tr><td>Burden</td><td>VA rating to be defined by supplier for all cores</td></tr>
<tr><td>Power frequency withstand voltage for secondary winding</td><td>2kV rms for one minute</td></tr>
</table>
*If the offered switchgear equipment requires DC power supply, the actual sizing and supply of DC Power source is in the scope of Supplier. The overall sizing of DC Power source shall also meet the requirements of other switchgear panels (12kV and 0.440kV).
</td></tr>
<tr><td>7.0</td><td>MV PANELS DESIGN AND CONSTRUCTION</td></tr>
<tr><td>7.1</td><td>Design criteria
All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion. The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards at maximum operating temperature of 45˚C.

The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.

The electrical safety clearances of all live parts of the equipment shall be as per relevant standards.
All the different components contained within the enclosure are subjected to the individual IEC Standards applying to them.

All circuit breakers, disconnectors and earth switches shall be designed to operate locally and remotely.</td></tr>
<tr><td>7.2</td><td>Standards and quality
The specified MV panels and all the relevant equipment shall be designed, manufactured and tested according to applicable IEC Standards. The equipment shall also comply with all Indian standards and rules applicable.</td></tr>
<tr><td>7.3</td><td>Panel Construction
The switchgear shall be indoor, metal - clad, floor mounted, horizontal draw out type design and construction shall be such as to allow extension at either end. Panel shall be made of CRCA sheet steel or Alu-Zinc. The switchgear enclosure shall conform to the degree of protection IP-4X. However, degree of protection of LV chamber shall be IP-5X. The minimum thickness of CRCA sheet steel shall be 2.0 mm for load bearing members and 2 mm for the rest. Louvers for enclosure shall be avoided by suitably</td></tr>
</table>

Clause No.	TECHNICAL SPECIFICATION
	derating the equipment. In accordance with applicable standards, the panels shall be designed so that normal service, inspection, maintenance operations, determination of the energized or de-energized state of the main circuit, earthing of connected cables, locating of cable faults, voltage tests on connected cables or other apparatus and the elimination of dangerous electrostatic charges can be carried out safely. The switches and the switchboards shall be designed in such a way that the positions of the various devices shall be visible by the operator from the front of the panel, from where it shall be possible to operate the switchgear.
7.4	**Busbars and Insulators** (a) All busbar and jumper connections shall be of high conductivity aluminium alloy. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents. Busbar cross-section shall be uniform throughout the length of switchgear. Busbars and other high voltage connection shall be sufficiently corona free at maximum working voltage. All connection hardware shall have high corrosion resistance. Bimetallic connectors or any other technically proven method shall be used for aluminum to copper connections. (b) Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators. (c) The supplier shall furnish calculation establishing adequacy of busbar sizes for the specified continuous and short time current ratings. (d) All busbars shall be color coded. (e) The temperature of the busbar and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Indian Standards, duly considering the specified ambient temperature (45 deg. C).
7.5	**Anti corrosion and protection finishing** Protection against corrosion shall be ensured by the use of suitable materials or by the application of suitable protective coatings to the exposed surfaces, taking into account the service conditions described in Clause 4.0.

Clause No.	TECHNICAL SPECIFICATION
7.6	**Circuit Breakers** a) The circuit breakers shall be of Vacuum type. They shall comprise of three separate, identical single pole interrupting units, operated through a common shaft by a sturdy operating mechanism. b) Outgoing breakers shall be suitable for switching transformers at any load. c) Circuit breaker shall be restrike free, stored energy operated and trip free type. d) The circuit breakers shall be equipped with a stored energy type operating mechanism including: • pushbuttons for opening and closing; • motor mechanism for electrical charging of the operating mechanism; • mechanical "open / closed" position indicator; • "charged / discharged" indicator for the operating mechanism springs; • local means for manually discharging the springs; • auxiliary contacts.
7.7	**Current transformers** The current transformers shall have the same short-time withstand current and rated voltage of the switchgear. They shall be made of cast epoxy resin and must be labelled individually. The current transformers shall be fully assembled and tested before leaving the factory. The manufacturer shall be provide type-test reports. The rating of secondary winding shall be 5 Amps. However, the current transformers will have to satisfy the requirement of rated VA burden, class of accuracy, accuracy limit factor and short time thermal rating as have been specified in clause No. 8 at all transformation ratio. The ratings of current transformers of all classes regarding ratio error, knee point voltage, resistance of secondary winding etc. shall have to be coordinated with the requirements of protective relays and protection scheme, without any extra cost.
7.8	**Voltage transformers** VTs shall be provided with HRC type fuses on the secondary side. The VT fuses on primary side shall also be provided with all safety precautions. One of the secondary terminals of the VTs shall be solidly earthed. The manufacturer shall be provide type-test reports.
7.9	**Earthing Switches** Common earthing truck for cable side and busbar side shall be provided. The rating of Common earthing truck shall have same continuous rating and fault rating as that of switchgear.
7.10	. **Indicating and integrating meters/instruments :** Meters from incomer to all outgoing feeders shall be an integral part of the

Clause No.	TECHNICAL SPECIFICATION
	multifunction numerical relays. Metering signal shall be communicated through IEC 61850 protocol.
7.11	**Relays** : All protections (over current, earth faults, over voltage etc.) shall be through multifunction numerical relay on IEC 61850 protocol with built in testing facilities. Other auxiliary relays shall be non-communicable static/ electro-mechanical type and mounted within the cubicle. The relay shall be housed in dust tight enclosure, suitable for IP 5X degree of protection. The protection requirements are 11kV Incomer circuit and 11kV outgoing feeders circuit 1) Over current trip 2) Earth fault trip 3) Over voltage trip
7.12	**Earthing Bus** A copper earth bus shall be provided at the bottom and shall extend throughout the length of the switchboard. It shall be bolted/welded to the framework of panel and each breaker/earthing contact bar. The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth as indicated under switchgear parameters without exceeding the allowable temperature rise. Suitable arrangement shall be provided at each end of the earth bus for bolting to Employer's earthing conductors. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.
7.13	**Cable Terminations and Cable gland** Cable termination compartment shall have provision for termination of power cable(s) (stranded Aluminium conductor, XLPE Insulated, FRLS, shielded, armoured single core / three core) of sizes as indicated during detailed engineering with removable undrilled gland plates. For all cables gland plates shall be of nonmagnetic material. Cable entry shall be from bottom. Supply of the cable and cable termination shall be in the scope of supplier.
7.14	**Interlocking devices** All interlocks between different components needed for protective and operating reasons shall be provided. Interlocking devices shall satisfy the mandatory provisions of IEC 62271-200.

Clause No.	TECHNICAL SPECIFICATION
7.15	**Secondary Wiring :** All Internal wiring in the switchgear panel shall be carried out with 1100 V grade, single core stranded copper with PVC insulation, however, CT circuits shall be wired up with standard copper wire.
7.16	**Space Heater** (a) Each switchgear panel shall be equipped with thermostatically controlled space heater(s), suitably located in breaker and cable compartments to prevent condensation within the enclosure. The space heater shall be connected to 240V single phase AC auxiliary supply available in the switchgear, through switches and fuses provided separately for each panel. (b) A 240V single phase 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF switch for connection of hand lamp.
7.17	**Nameplates** The MV panels shall be provided with durable and clearly legible nameplates containing all the information requested by IEC 62271-200. In addition, each cubicle shall carry a suitably dimensioned identification label clearly indicating the functions of the cubicle.
7.18	**Fuse** Fuse shall be placed in the switchgear panel in the incoming side of the Capacitor Banks C(3.3)1 and C(3.3)2 shown in fig (1). The rating of Fuse shall be selected as switchgear rating to protect the switchgear equipment.
7.19	**Surge Arrestor** Surge Arrestor shall be placed in the switchgear panel in the outgoing feeder side as show in fig (1) to protect the outgoing equipment. The rating of Surge Arrestor shall be selected as 3.6kV, 10kA.
7.20	**Mimic Diagram** The switchgear panel shall be provided with mimic diagram. The mimic shall represent a single line arrangement of incomer and feeders.
7.21	**Indicating Lamps** Indicating lamps shall be provided on the panel to indicate the visual indication of ON and OFF position of each circuit breaker, spring charged indication of circuit breaker and auto trip indication of each circuit breaker, VT supply indication.
7.22	**Ferrules** Ferrules engraved/printed with the numbers, letters or symbols as indicated in the connection and wiring diagram shall be provided on the terminals end of all wires for

Clause No.	TECHNICAL SPECIFICATION
	identification of circuits for inspection and maintenance.
7.23	**Fault Alarm Annunciation Scheme** The switchgear panel shall be equipped with annunciation scheme for indicating all the annunciations required for trip alarms as per incomer and outgoing feeders. They are 11kV Incomer circuit and 11kV outgoing feeders circuit 1) Over current trip 2) Earth fault trip 3) Over voltage trip Required auxiliary relays shall be provided in the annunciator scheme to indicate each trip alarm individually. Each alarm shall have visual as well as audible annunciation. The visual annunciator alarm shall be in the form of flashing display type glow pattern. This shall remain illuminated till the particular initiating contact is reset. The automatic trip of the circuit breaker due to the operation of protection relays shall be indicated by sounding of a hooter.
8	**INSPECTIONS AND TESTS**
8.1	**Inspection during manufacturing** The Supplier shall propose a comprehensive inspection program during manufacture of the equipment. The CPRI personnel shall be permitted to visit the supplier workshop in order to verify the progress of works and the respect of agreed time schedule. CPRI representatives shall be allowed to inspect the production process in the factory.
8.2	**Type tests** The type test reports of individual Circuit breaker, Earth switches, CTs and VTs shall be complete in all respect along with oscillographic records, photographs etc. in respect of type tests as per below shall be submitted to CPRI. Otherwise type test will be performed at Supplier exclusive cost. A list of type tests to be performed as per IEC 62271-100 given below: a. Dielectric tests (power-frequency voltage tests, lightning impulse voltage tests, dielectric tests on auxiliary and control circuits) b. Temperature-rise tests verification by calculation c. Short-time withstand current and peak withstand current tests by calculation d. Mechanical endurance test
8.3	**Routine tests** Before delivery, factory acceptance tests shall be executed on MV panel assembly in the presence of CPRI at the Manufacturer workshop, consisting in individual tests (routine tests) according to applicable Standards. Factory accepting tests, in accordance with IEC standards shall include the following: 1. Dielectric test on the main circuit (power-frequency voltage test);

Clause No.	TECHNICAL SPECIFICATION
	2. Dielectric tests on LV auxiliary and control circuits; 3. Design and visual checks for conformity with plans and drawings; 4. Mechanical operation tests; 5. Tests of auxiliary electrical and checking of the interlocking; 6. Functional test of low-voltage circuits. The supplier shall inform CPRI of the Acceptance Tests program 30 days in advance and shall allow CPRI representatives to witness them.
9.0	**INSTALLATION AND COMMISSIONING** The supplier shall carryout the installation and commissioning activities at site includes, but not limited to; 1. Assembly of switchgear panels, busbars and instrument transformers etc., as per SLD mentioned in clause 4 of this technical specification. 2. Installation of switchgear panels at site as per layout drawing. 3. Internal connection of bus wiring and instrument transformer secondary wiring 4. Interconnecting cables and it's termination from switchgear to external equipment as per SLD mentioned in clause 4 of this technical specification. 5. Earthing of switchgear panels with CPRI building earthing points. 6. Adjustment of protection and control relays to the operating set point for Over voltage, Over current and earth fault. 7. Energisation of Switchgear panel. During Energisation there shall not be any undue operation of Switchgear panel. 8. Training to CPRI officials, after successful energisation of Switchgear panel. The supply shall include the activities performed by a team of specialized workers of the bidder. These activities will be performed in a period defined by the CPRI, in order to avoid interferences with other works.
10.0	**SPARE PARTS AND MAINTENANCE**
10.1	The supplier is required to list the suggested mandatory spares for 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Panel, which may be required for ensuring the guaranteed availability. The cost of mandatory spares is included in the total bid cost.
10.2	The Bidder shall indicate the proposed maintenance schedule during the guarantee period and the life period of the 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Panel.
11.0	**TECHNICAL INFORMATION TO BE SUPPLIED BY THE BIDDER** The following technical information shall be included in the bid: 1) MV panel General arrangement drawing 2) MV panel and Individual equipment details

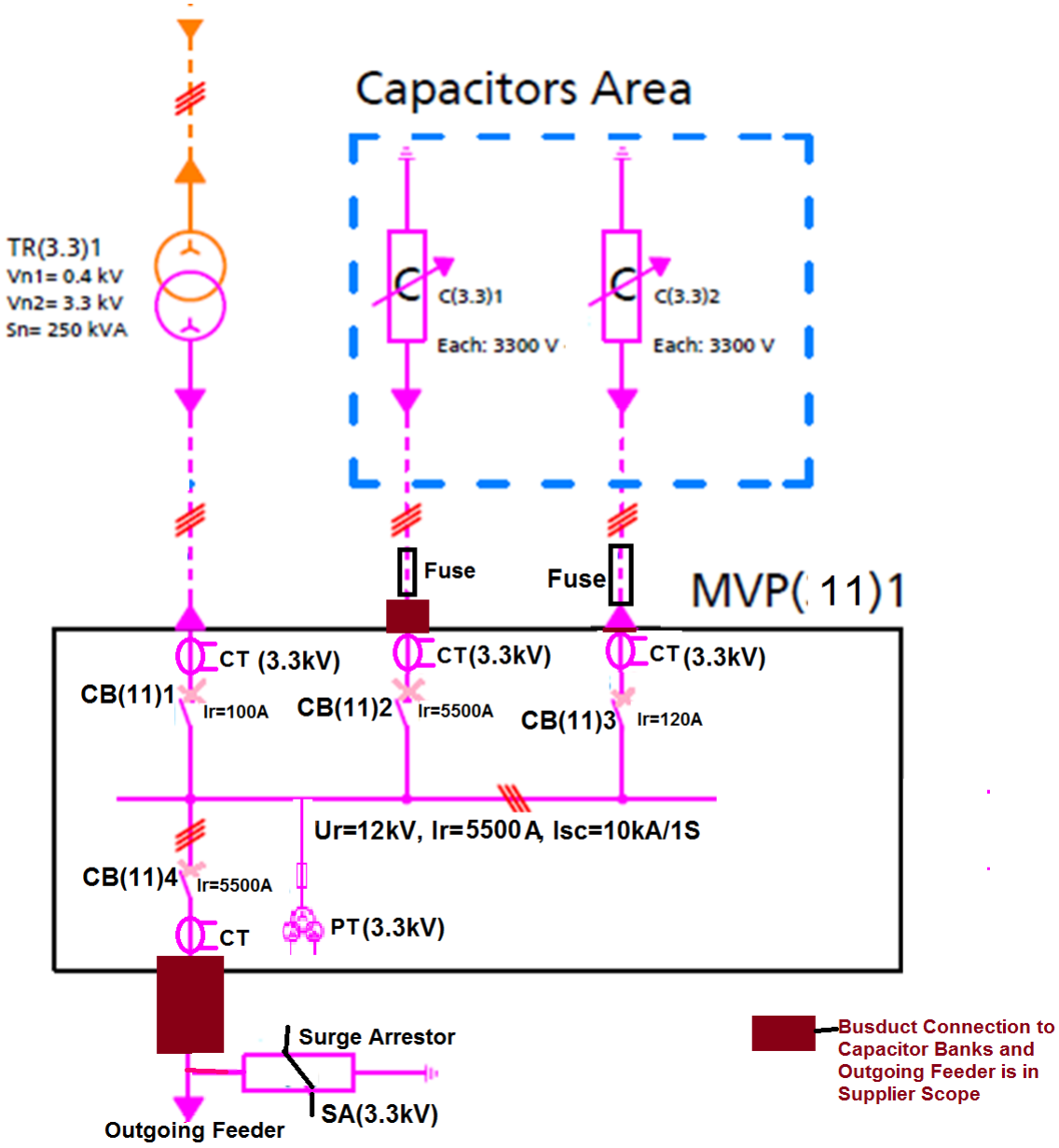
Clause No.	TECHNICAL SPECIFICATION
	3) BoM of MV panel 4) Tests certificates relevant the type 5) Masses [kg]: total mass in service condition 6) Mass of the heaviest piece for transportation [kg] 7) Dimensions in operation conditions (length, width, height) [mm] 8) List of the suggested spare parts. The following documents shall be provided along with the supply: 1) General drawings, electrical schemes, wiring drawings, installation drawings 2) Operational manual and Maintenance manual: These manuals shall include specific instruction relevant to the handling, installation, troubles shooting and servicing 3) Reports on inspection during manufacturing 4) Reports of routine, type and acceptance tests. All documents shall be issued in English language and provided both on paper and software copy.

FIGURE

FIGURE 1

12 KV, 5500A, 10KA/1SEC, INDOOR PANEL

FOR 40,000A TEMPERATURE RISE TEST FACILITY



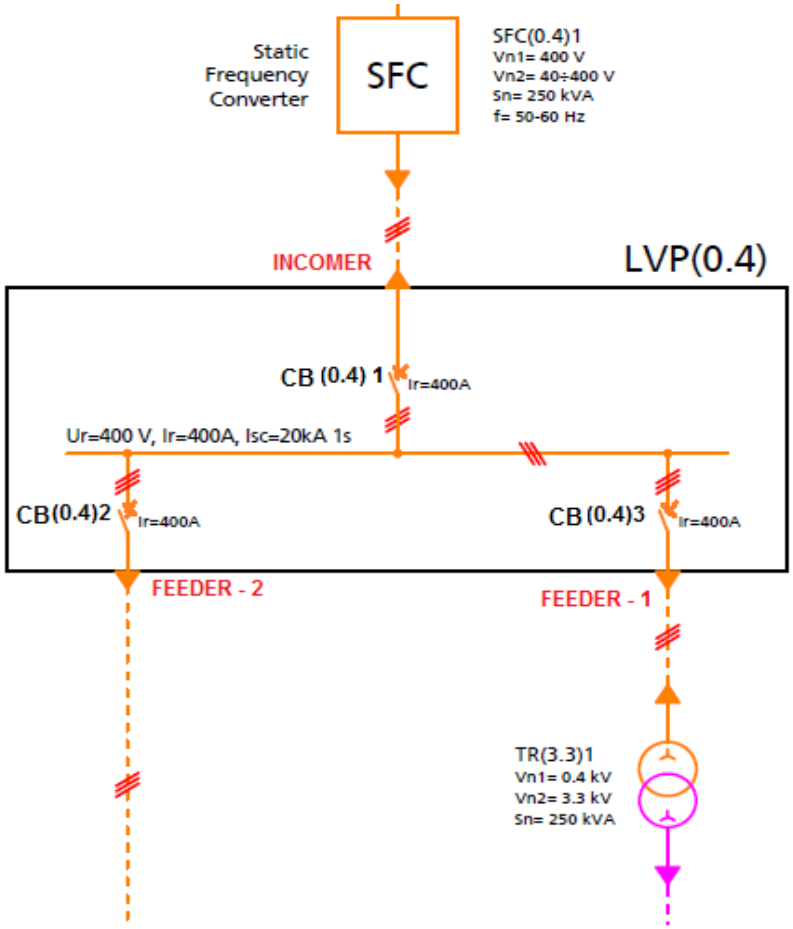
ANNEXURE-III

Technical Specification of
440V, 400A, 20kA/1Sec, 50/60Hz,
Indoor metal clad switchgear Panel

ANNEXURE-III

TABLE OF CONTENTS

Clause No.	TECHNICAL SPECIFICATION
1.0	**FOREWORD** Central Power Research Institute (herein after referred to as CPRI) intends to establish 40,000A temperature rise test facility at High Power Laboratory (HPL) in Bengaluru in order to perform the temperature rise test upto 40kA on MV Bus ducts, MV/HV Circuit Breakers, MV/HV Switchgear and Control gear, HV Switches and HV Disconnectors. This Specification covers the supply of 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad switchgear Panel as specified in this document, for establishment of 40,000A Temperature Rise Test Facility at High Power Laboratory, CPRI-Bengaluru, India.
2.0	**GENERAL**
2.1	440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel covered by this specification will form part of the new 40,000A Temperature Rise Test Facility in High Power Laboratory, CPRI, Bengaluru, India.
2.2	The feature of such panel is used to connect the input through 250kVA, 50/60Hz, Three phase Static frequency converter and output of panel is going to connect 250kVA, 0.4/3.3kV, 50/60Hz, Three phase transformer and one spare as shown in fig.1.
3.0	**SCOPE** The scope covers the design, engineering, manufacture, assembly, testing at manufacturer's works, painting, packing and transportation, insurance, supply, loading, unloading, handling, storage, erection installation, site testing and commissioning of 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel (as per fig.(1)) complete including disconnectors, earth switches and spares, for establishment of 40,000A Temperature Rise Test Facility (TRTF) at High Power Laboratory, CPRI-Bengaluru, India. The equipment offered by the Bidder shall be complete in all respects. Any material and component not specifically stated in this specification but which are necessary for trouble free operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded. All such equipment / accessories shall be supplied without any extra cost. Also all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory. These Technical Specifications detail the requirements for 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel to be installed in the 40kA TRTF building of CPRI HPL in Bangalore (India). The supply shall include also the assistance for installation and commissioning activities, by a team of specialized workers of the Supplier. These activities will be performed in a dedicated period, according to the CPRI, in order to avoid interferences with other works.

Clause No.	TECHNICAL SPECIFICATION
4.0	**SYSTEM PARTICULARS**
4.1	The feature of such panel is used to connect the input through 250kVA, 50/60Hz, Three phase Static frequency converter and output of panel is going to connect 250kVA, 0.4/3.3kV, 50/60Hz, Three phase transformer and one spare as shown in fig.1. Electrical System particulars as follows; Rated system voltage : 440V(±10% variation) Highest system voltage : 440V Frequency : 50/60Hz (±3% variation) Number of phases : Three + Neutral Neutral earthing system : Effectively earthed system Fault current : 20kArms 440V, 400A, 20kA/1Sec, Indoor metal clad Panel Single line diagram is shown fig.(1).  *Fig.(1) : Single line diagram of 440V, 400A, 20kA/1Sec,* 50/60Hz, *Indoor metal clad Panel.*

Clause No.	TECHNICAL SPECIFICATION
	The 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel lay out consists of Panel Incomer : 400 Amps Outgoing Feeder 1 : 400 Amps Outgoing Feeder 2 : 400 Amps (spare)
5.0	**STANDARDS**
5.1	440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel shall generally conform to the latest editions of the relevant IEC/IS Publications and requirements of this specification.
5.2	The 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel shall comply with the requirements of the latest edition of the following IS/IEC Standards: a) IS : 375 Marking and arrangements of bus bars. b) IS : 722 AC Electricity Meters. c) IS : 1248 Electrical Indicating instruments. d) IS : 2147 Degree of protection provided by enclosures for low voltage switchgear and control gear. e) IS : 2208 & IS : 9224 (part II) HRC Cartridge Fuses. f) IS : 2516 A.C. Circuit Breakers. g) IS : 2629 Hot dip galvanising. j) IS : 3072 Code of practice for installation and maintenance of switchgear. l) IS : 3202 Code of practice for climate proofing of electrical equipment. m) IS : 4064 Air-breaker switches, air break disconnectors, air break disconnector and fuse combination units for voltage not exceeding 1000V AC or 1200V DC. n) IS : 4237 General requirements for switchgear and control gear for voltages not exceeding 1000V o) IS : 5082 Wrought Aluminum and aluminum alloys for electrical purposes. p) IS : 6005 Code of practice of phosphating iron and steel. q) IS : 8623 Specification for factory-built assemblies of switchgear & control gear for voltages up to and including 1000V AC/1200 V OC. r) IS : 13947 Low voltage switchgear and Control Gear. s) IEC 61439-1 Low-voltage switchgear and controlgear assemblies. Part 1: General

<table>
<tr><th>Clause No.</th><th>TECHNICAL SPECIFICATION</th></tr>
<tr><td>5.3</td><td>Rules
t) IEC 61439-2 Low-voltage switchgear and controlgear assemblies. Part 2: Power switchgear and control switchgear assemblies

If a relevant IS/IEC Publication does not exist, the supplier shall adopt other internationally accepted standards and codes.
In the matter of conformity, the following order shall be binding:
The requirements of this specification
The latest versions of IS/IEC Publication
To the latest versions of other national/international standards/codes as applicable to the relevant equipment or component or the material used in the manufacture of the same.
In the event a requirement is not covered by any of the above mentioned documents the same will be decided by mutual agreement between the purchaser and the supplier.
Moreover reference has to be made to all applicable Indian laws.</td></tr>
<tr><td>6.0</td><td>MAIN TECHNICAL PARAMETERS</td></tr>
<tr><td></td><td>Mandatory particulars of Panel:
<table>
<tr><td>Type</td><td>Metal clad, air insulated indoor panel</td></tr>
<tr><td>Rated voltage</td><td>440V</td></tr>
<tr><td>Number of phases</td><td>3+1 (three phase with neutral)</td></tr>
<tr><td>Frequency</td><td>50/60Hz</td></tr>
<tr><td>Rated current</td><td>Refer fig (1)
Common busbar – 400A
Incomer -1: 400 A
Outcomer -1 : 400A
Outcomer -2 : 400A</td></tr>
<tr><td>Highest system voltage</td><td>0.440 kV</td></tr>
<tr><td>Short-duration power-frequency withstand voltage</td><td>1.0 kVrms</td></tr>
<tr><td>Lightning impulse withstand voltage</td><td>10 kVpeak</td></tr>
<tr><td>Fault short circuit current</td><td>20kArms</td></tr>
<tr><td>Rated duration of short circuit current</td><td>1.0 sec</td></tr>
<tr><td>Fault short circuit current peak</td><td>As per IS/IEC 61439</td></tr>
<tr><td>Type of accessibility to switchgear/controlgear</td><td>A (restricted to authorized personnel only)</td></tr>
<tr><td>Aux. voltage</td><td>AC : 230 V, DC : 110 V *</td></tr>
<tr><td>Thickness of metal sheet (minimum)</td><td>Load bearing : 2 mm
Doors & covers : 2 mm</td></tr>
<tr><td>Bus bar & Earth bus material</td><td>Aluminium</td></tr>
<tr><td>Current density</td><td>0.8 Amps / sq. mm (max)</td></tr>
</table></td></tr>
</table>

Clause No.	TECHNICAL SPECIFICATION

Power cable entry	From Rear Bottom
Control cable entry	From Backside
Position of Mechanical & Electrical Emergency Trip Arrangement	Front side of the Panel
Dimension of panel	Depth ≥1000 mm
Paint type	Powder coated
Paint shade	RAL 7032 (both external & internal)
Paint thickness	50 microns (min)

Mandatory particulars of Circuit Breaker:

Installation	Indoor
Type	Air blast
Number of poles	3 + Neutral
Rated voltage	440V
Highest system voltage	0.440 KV
Insulation level	0.44kVrms/1.0 kVrms/10 kVpeak
Rated frequency	50/60Hz
Rated normal current	Refer fig (1) Common busbar – 400A Incomer -1: 400 A Outcomer -1 : 400A Outcomer -2 : 400A
Short circuit breaking current	20kArms
Short circuit making current	As per IEC 61439
Short time withstand current for 1 sec	20kArms
Operating mechanism	Motor operated
Mechanical endurance	1000 operations
Rated Auxiliary Supply For Spring	230V AC, 50Hz, Single phase
Rated supply Voltage for Tripping/Closing coil	230V AC / 110V DC *****
Power frequency withstand voltage on Auxiliary circuit	2 KV (rms)/1 Minute
auxiliary contacts for open position and for closed position	2

*****If the offered switchgear equipment requires DC power supply, the actual sizing and supply of DC Power source is in the scope of Supplier. The overall sizing of DC Power source shall also meet the requirements of other switchgear panels (11kV).

Clause No.	TECHNICAL SPECIFICATION
7.0	**LV PANELS DESIGN AND CONSTRUCTION**
7.1	**Design criteria** All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion. The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards at maximum operating temperature of 45˚C. The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration. The electrical safety clearances of all live parts of the equipment shall be as per relevant standards. All the different components contained within the enclosure are subjected to the individual IS/IEC Standards applying to them. All circuit breakers shall be designed to operate locally and remotely.
7.2	**Standards and quality** The specified LV panels and all the relevant equipment shall be designed, manufactured and tested according to applicable IS/IEC Standards. The equipment shall also comply with all Indian standards and rules applicable.
7.3	**Panel Construction** The switchgear shall be indoor, metal - clad, floor mounted, horizontal draw out type design and construction shall be such as to allow extension at either end. Panel shall be made of CRCA sheet steel or Alu-Zinc. The switchgear enclosure shall conform to the degree of protection IP-4X. However, degree of protection of LV chamber shall be IP-5X. The minimum thickness of CRCA sheet steel shall be 2.0 mm for load bearing members and 2 mm for the rest. Louvers for enclosure shall be avoided by suitably derating the equipment. In accordance with applicable standards, the panels shall be designed so that normal service, inspection, maintenance operations, determination of the energized or de-energized state of the main circuit, earthing of connected cables, locating of cable faults, voltage tests on connected cables or other apparatus and the elimination of dangerous electrostatic charges can be carried out safely. The switches and the switchboards shall be designed in such a way that the positions of the various devices shall be visible by the operator from the front of the panel, from where it shall be possible to operate the switchgear.

Clause No.	TECHNICAL SPECIFICATION
7.4	**Busbars and Insulators** (a) All busbar and jumper connections shall be of high conductivity aluminium alloy. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents. Busbar cross-section shall be uniform throughout the length of switchgear. Busbars and other high voltage connection shall be sufficiently corona free at maximum working voltage. All connection hardware shall have high corrosion resistance. Bimetallic connectors or any other technically proven method shall be used for aluminum to copper connections. (b) Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators. (c) The supplier shall furnish calculation establishing adequacy of busbar sizes for the specified continuous and short time current ratings. (d) All busbars shall be color coded. (e) The temperature of the busbar and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Indian Standards, duly considering the specified ambient temperature (45 deg. C).
7.5	**Anti corrosion and protection finishing** Protection against corrosion shall be ensured by the use of suitable materials or by the application of suitable protective coatings to the exposed surfaces, taking into account the service conditions described in Clause 4.0.
7.6	**Circuit Breakers** a) The circuit breakers shall be of Air blast type. They shall be operated through a common shaft by a sturdy operating mechanism. b) Outgoing breakers shall be suitable for switching transformers at any load. c) Circuit breaker shall be restrike free, stored energy operated and trip free type. d) The circuit breakers shall be equipped with a stored energy type operating mechanism including: • pushbuttons for opening and closing; • motor mechanism for electrical charging of the operating mechanism; • mechanical “open / closed” position indicator; • “charged / discharged” indicator for the operating mechanism springs; • local means for manually discharging the springs; • auxiliary contacts.

Clause No.	TECHNICAL SPECIFICATION
7.7	**Earthing Bus** Earth bus shall be provided at the bottom and shall extend throughout the length of the switchboard. It shall be bolted/welded to the framework of panel and each breaker/earthing contact bar. The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth as indicated under switchgear parameters without exceeding the allowable temperature rise. Suitable arrangement shall be provided at each end of the earth bus for bolting to Employer's earthing conductors. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.
7.8	**Cable Terminations** Cable termination compartment shall have provision for termination of power cable(s) (stranded Aluminium conductor, PVC/XLPE Insulated, FRLS, shielded, armoured single core / three core) of sizes as indicated during detailed engineering with removable undrilled gland plates. For all single core cables gland plates shall be of nonmagnetic material. Cable entry shall be from bottom. Supply of the cable termination kit and cable terminations shall be in scope of contractor.
7.9	**Interlocking devices** All interlocks between different components needed for protective and operating reasons shall be provided. Interlocking devices shall satisfy the mandatory provisions of IEC standard.
7.10	**Secondary Wiring :** All Internal wiring in the switchgear panel shall be carried out with 1100 V grade, single core stranded copper with PVC insulation.
7.11	**Space Heater** (a) Each switchgear panel shall be equipped with thermostatically controlled space heater(s), suitably located in breaker and cable compartments to prevent condensation within the enclosure. The space heater shall be connected to 240V single phase AC auxiliary supply available in the switchgear, through switches and fuses provided separately for each panel. (b) A 240V single phase 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF switch for connection of hand lamp.

Clause No.	TECHNICAL SPECIFICATION
7.12	**Nameplates** The LV panels shall be provided with durable and clearly legible nameplates containing all the information requested by IEC 61439. In addition, each cubicle shall carry a suitably dimensioned identification label clearly indicating the functions of the cubicle.
8.0	**INSPECTIONS AND TESTS**
8.1	**Inspection during manufacturing** The Supplier shall propose a comprehensive inspection program during manufacture of the equipment. The CPRI personnel shall be permitted to visit the supplier workshop in order to verify the progress of works and the respect of agreed time schedule. CPRI representatives shall be allowed to inspect the production process in the factory.
8.2	**Type tests** The type test reports of Circuit breaker shall be complete in all respect along with oscillographic records, photographs etc. in respect of type tests as per below shall be submitted to CPRI. Otherwise type test will be performed at Supplier exclusive cost. A list of type tests to be performed as per IS/IEC standards as given below: a. Dielectric tests (power-frequency voltage tests, dielectric tests on auxiliary and control circuits) b. Temperature-rise tests by calculation method c. Short-time withstand current and peak withstand current tests by calculation d. Mechanical endurance test
8.3	**Routine tests** Before delivery, factory acceptance tests shall be executed on LV panel assembly in the presence of CPRI at the Manufacturer workshop, consisting in individual tests (routine tests) according to applicable Standards. Factory accepting tests, in accordance with IS/IEC standards shall include the following: 1. Dielectric test on the main circuit (power-frequency voltage test); 2. Dielectric tests on LV auxiliary and control circuits; 3. Design and visual checks for conformity with plans and drawings; 4. Mechanical operation tests; 5. Tests of auxiliary electrical and checking of the interlocking; 6. Functional test of low-voltage circuits. The supplier shall inform CPRI of the Acceptance Tests program 30 days in advance and shall allow CPRI representatives to witness them.

Clause No.	TECHNICAL SPECIFICATION
9.0	**INSTALLATION AND COMMISSIONING** The supplier shall carryout the installation and commissioning activities at site includes, but not limited to; 1. Assembly of switchgear panels, busbars etc., as per SLD mentioned in clause 5 of this technical specification. 2. Installation of switchgear panels at site as per layout drawing. 3. Internal connection of bus wiring and instrument transformer secondary wiring 4. Interconnecting cables and it's termination from switchgear to external equipment as per SLD mentioned in clause 5 of this technical specification. 5. Earthing of switchgear panels with CPRI building earthing points. 6. Energisation of Switchgear panel. During Energisation there shall not be any undue operation of Switchgear panel. 7. Training to CPRI officials, after successful energisation of Switchgear panel. The supply shall include the activities performed by a team of specialized workers of the bidder. These activities will be performed in a period defined by the CPRI, in order to avoid interferences with other works.
10.0	**SPARE PARTS AND MAINTENANCE**
10.1	The supplier is required to list the suggested mandatory spares for 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel, which may be required for ensuring the guaranteed availability. The cost of mandatory spares is included in the total bid cost.
10.2	The Bidder shall indicate the proposed maintenance schedule during the guarantee period and the life period of the 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad Panel.
11.0	**TECHNICAL INFORMATION TO BE SUPPLIED BY THE BIDDER** The following technical information shall be included in the bid: 1) LV panel General arrangement drawing 2) LV panel and Individual equipment details 3) BoM of LV panel 4) Tests certificates relevant the type tests 5) Masses [kg]: total mass in service condition 6) Mass of the heaviest piece for transportation [kg] 7) Dimensions in operation conditions (length, width, height) [mm] 8) List of the suggested spare parts. The following documents shall be provided along with the supply: 1) General drawings, electrical schemes, installation drawings

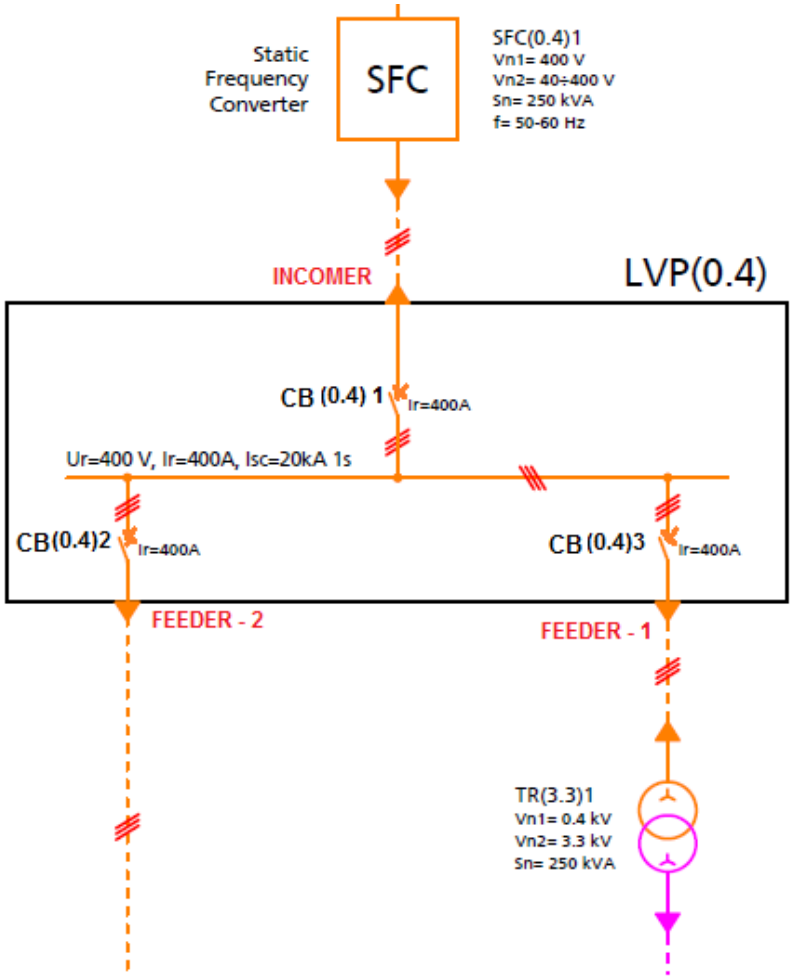
Clause No.	TECHNICAL SPECIFICATION
	2) Operational manual and Maintenance manual: These manuals shall include specific instruction relevant to the handling, installation, troubles shooting and servicing 3) Reports on inspection during manufacturing 4) Reports of routine, type and acceptance tests. All documents shall be issued in English language and provided both on paper and software copy.

FIGURE

FIGURE 1

440.0 V, 400A, 20KA/1SEC, 50/60HZ, INDOOR PANEL

FOR 40,000A TEMPERATURE RISE TEST FACILITY



ANNEXURE-IV

Segregated Phase Bus Duct (SPBD) and Open Bus bar Connection

1. SPBD connection between Outgoing feeder of 12kV, 5500A, Switchgear Panel and 3.3kV Power transformer

Scope of Aluminium Busduct connection between 12kV switchgear outgoing feeder and 3.3kV power transformer is shown in fig.(1). The scope of supplier includes 3.3kV, 5500A, 10kA, 50/60Hz Aluminium SP Busduct connection from outgoing terminals of 12kV switchgear panel to open busbar. 3.3kV, 5500A, 50/60Hz open Busbar connection with proper support of 3.6kV, 50/60Hz insulators on the wall as shown in Fig (1).

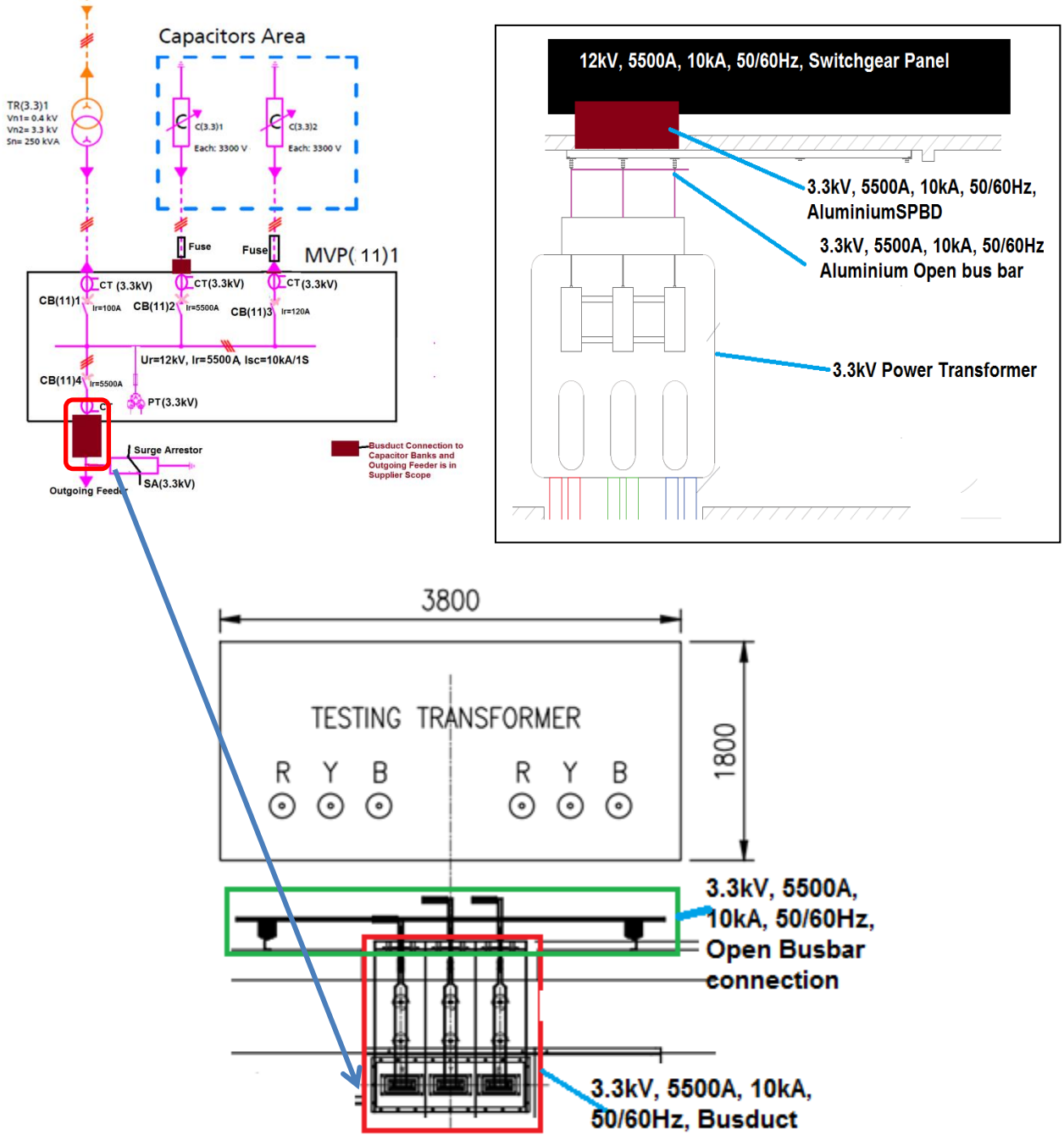
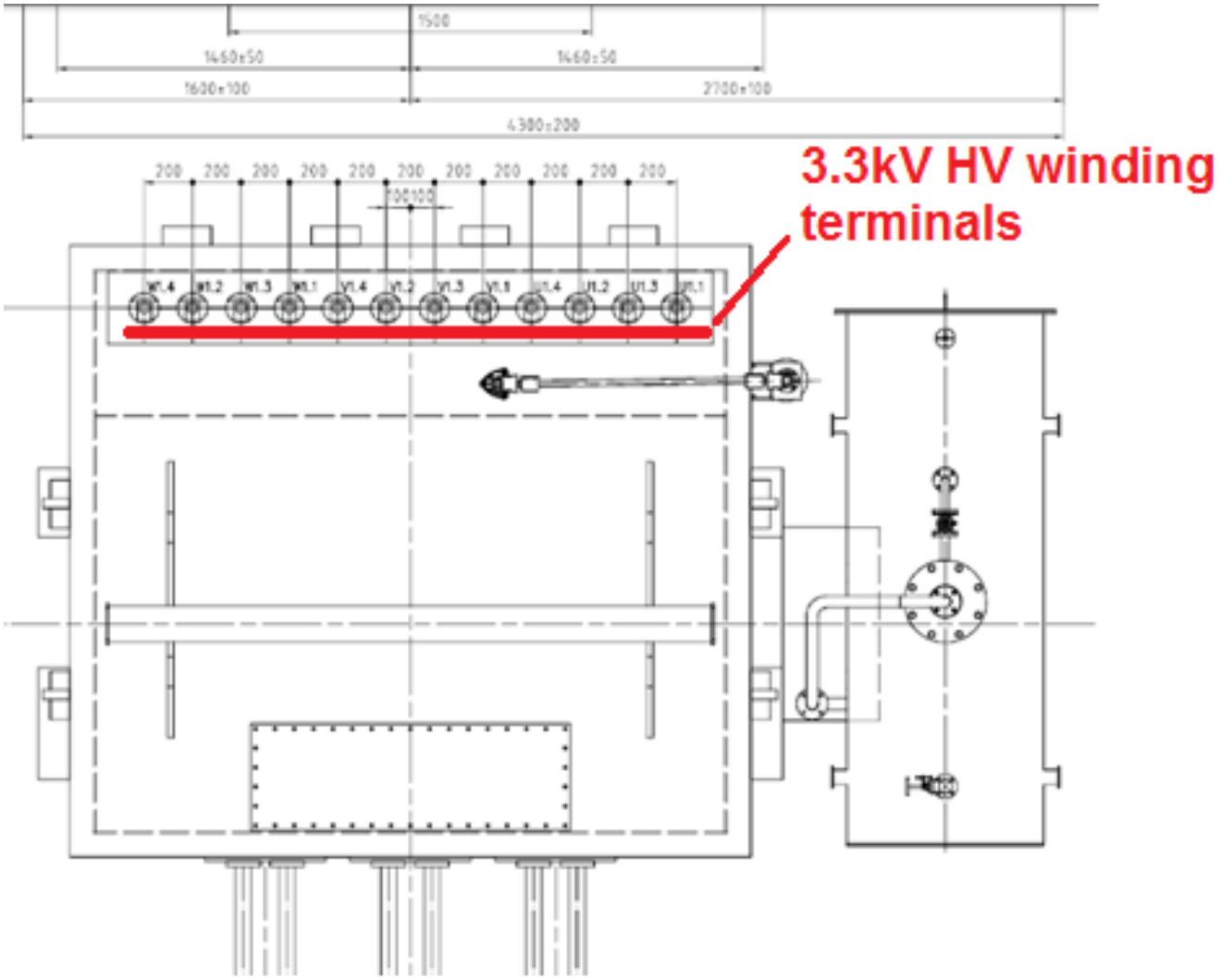


Fig. (1): Aluminium SPBD connection between 12kV,5500A panel Outgoing feeder and 3.3kV power transformer

3.3kV Power Transformer Top view GA drawing



2. SPBD connection between 12kV,5500A, Switchgear panel and Capacitor Bank C(3.3)1

Aluminium Busduct connection between 12kV, 5500A, switchgear panel and Capacitor bank C(3.3)1 is shown in Fig.(2). The scope of supplier includes 3.3kV, 5500A, 10kA, 50/60Hz Aluminium Busduct connection from 12kV,5500A, switchgear panel to Capacitor bank C(3.3)1 as per Fig(2).

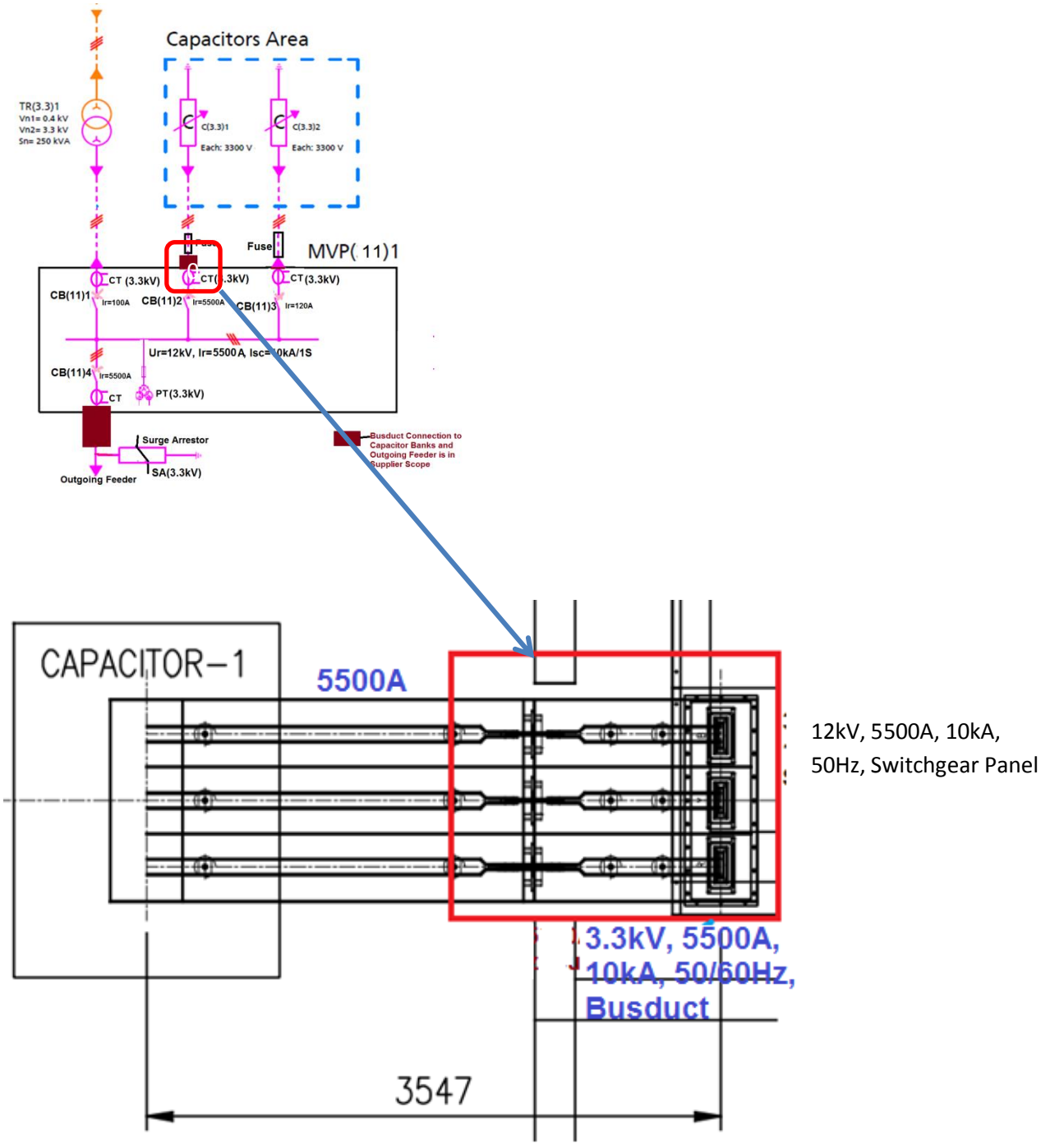
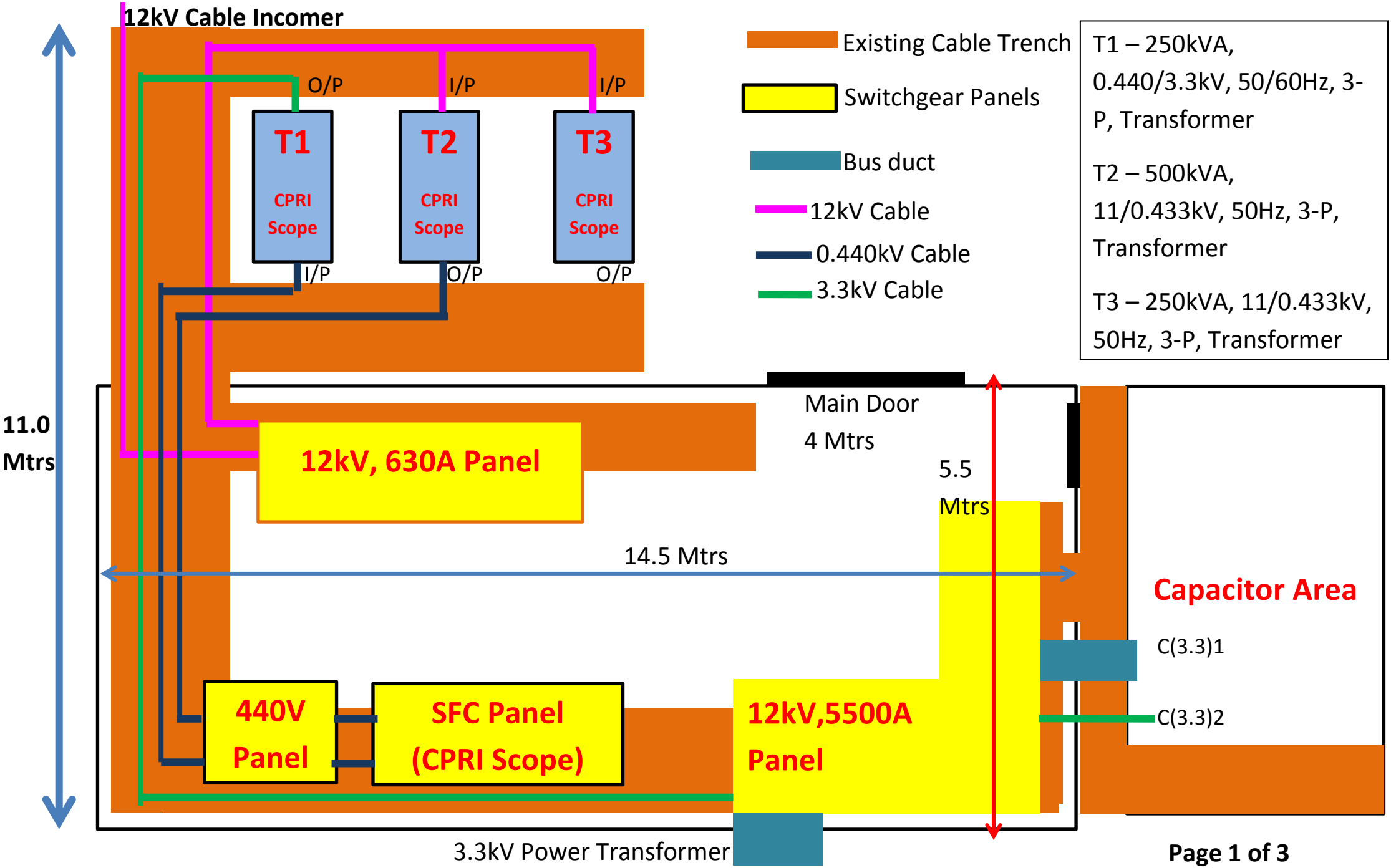


Fig. (2): Aluminium SPBD connection between 12kV,5500A, switchgear panel and Capacitor bank C(3.3)1

SITE LAYOUT DRAWING



The detailed scope of work includes the following;

1) 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel, Common Earthing Truck-Bus side and Common Earthing Truck-Cable side as per Annexure - I

2) 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Metal clad Switchgear Panel, Common Earthing Truck-Bus side and Common Earthing Truck-Cable side as per Annexure - II

3) 440V, 400A, 20kA/1Sec, 50/60Hz, Indoor metal clad switchgear Panel as per Annexure - III

4) Segregated Phase Bus Duct (SPBD) connection **from** 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Composite VCB Panel **to** 3.3kV C(3.3)1 capacitor bank as per Annexure – IV.

5) Segregated Phase Bus Duct (SPBD) connection **from** outgoing feeder of 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Composite VCB Panel **to** 3.3kV, 5500A, 10kA/1sec, 50/60Hz, Three phase Aluminium open busbar as per Annexure - IV.

   The rating of Segregated Phase Bus Duct (SPBD) is 3.3kV, 5500A, 10kA/1sec, 50/60Hz, Three phase and the current carrying bus is made with Aluminium material. The length of SPBD is as per layout drawing.

6) 3.3kV, 5500A, 10kA/1sec, 50/60Hz, Three phase Aluminium open busbar connection along with insulator supports on wall **from** end of sl no. 6 in 12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Composite VCB Panel to 3.3kV power transformer terminals as per Annexure - IV. The length of Open bus bar is as per layout drawing.

7) Erection and Mounting works of Segregated Phase Busduct (SPBD) and open busbar connection along with insulator supports on wall. Minor civil works to make drill on wall for placing SPBD and Open bus bar.

8) Earthing connection of All Switchgear panels sl. no. 1, 2 and 3 with existing earth points at site.

9) Cable connections and Cable termination in Switchgear panels

Sl. No.	Switchgear Panel	Cable connection and termination	Length of Cable
9.1	12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel	• XLPE Cable connection **from** Outgoing feeder -1 of 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel **to** Transformer T2 (500kVA, 11/0.433kV, 50Hz, 3-P, Transformer) • XLPE Cable connection **from** Outgoing feeder -2 of 12 kV, 630A, 25kA/1Sec, 50Hz, Indoor Composite VCB Panel **to** Transformer T3 (250kVA, 11/0.433kV, 50Hz, 3-P, Transformer)	As per Layout drawing
9.2	0.440 kV, 400A, 20kA/1Sec, 50/60Hz, Indoor Composite VCB Panel	• PVC/XLPE Cable connection **from** Transformer T2 (500kVA, 11/0.433kV, 50Hz, 3-P, Transformer) secondary **to** 0.440 kV, SFC panel. • PVC/XLPE Cable connection **from** 0.440kV SFC panel **to** 0.440 kV, 400A, 20kA/1Sec, 50/60Hz, Indoor switchgear Panel. • PVC/XLPE Cable connection **from** 0.440 kV, 400A, 20kA/1Sec, 50/60Hz, Indoor switchgear Panel **to** Transformer T1 (250kVA, 0.440/3.3kV, 50/60Hz, 3-P, Transformer)	As per Layout drawing
9.3	12 kV, 5500A, 10kA/1Sec, 50Hz, Indoor Composite VCB Panel	• 3.3kV, 100A, 10kA/1sec, 50/60Hz, PVC/ XLPE Cable connection **from** Transformer T1 (250kVA, 0.440/3.3kV, 50/60Hz, 3-P, Transformer) **to** incoming of 12kV,5500A, 10kA/1sec, 50Hz, switchgear panel • 3.3kV, 120A, 10kA/1sec, 50/60Hz, PVC/ XLPE Cable connection **from** 12kV,5500A, 10kA/1sec, 50Hz, switchgear panel **to** Capacitor Bank C(3.3)2.	As per Layout drawing

10. All Switchgear panels shall be arranged at site in such a way that sufficient space maintained for operation and maintenance.

11. Engineering Drawings and Bill of Material of scope shall be submitted for manufacturing approval after award of Purchase Order from CPRI.

12. Scope excludes supply of Transformers (T1, T2 & T3), SFC panel, 3.3kV class power transformer, Capacitor banks and Earth pits.