



READY RECKONER FOR ELECTRICAL INFRASTRUCTURE



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INTRODUCTION

Gujarat International Finance Tec-City ("GIFT") is being developed as a global financial and IT / ITeS hub in the state of Gujarat, a first of its kind in India. GIFT has been planned as a city with next class infrastructure and real estate including commercial high rises business districts, quality residential housing, retail and recreational spaces. The GIFT city is located on the bank of the river Sabarmati and is about 12 KMs from Ahmadabad Airport, and 8 km from Gandhinagar.

GIFT is expected to be above or at par to the all other international financial districts in terms of scale, scope and quality of infrastructure and real estate. GIFT will encompass an area of 886 acres with a total Built-up area ("BUA") of around 64 million square feet.

To develop and implement the Project, Government of Gujarat has established Gujarat International Finance Tec-city Company Ltd ("GIFTCL").

Part of the GIFT Project is planned to be developed as Multi Services SEZ to be developed as International Finance Service Centre. Development of SEZ would be undertaken by GIFT SEZ Limited, a 100% subsidiary company of GIFTCL.

GIFTCL and GIFT SEZ Ltd would undertake development of various infrastructure components like internal roads, water supply, solid waste management, sewerage, storm water drainage, landscaping, ICT Systems, District Cooling, power distribution etc. GIFTCL will provide required infrastructure up to Building level in each of sub enclave as per the requirement of development. GIFT Power Company Ltd. has incorporated as 100% subsidiaries of GIFTCL for power distribution.

PURPOSE

Purpose of this ready reckoner is to unify the electrical system throughout the GIFT City for cluster development and end users.

This ready reckoner is developed to cover following main aspects of GIFTCL.

- a) Power supply requirement
- b) Installation and design Practice for consumer
- c) Technical requirement for service equipment
- d) Maintenance of power quality

Ready reckoner is a single source document that is adopted across the GIFT City for development and O&M of Electrical infrastructure. Note: Design details of this ready reckoner are applicable upto the 122 meters height building. For buildings with height more than 122 meters new version of ready reckoner shall be issued.

PREFACE

This publication is produced by:

THE GIFT POWER COMPANY LIMITED

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This ready reckoner provides guidelines for developer/ co-developer to build infrastructure in-order to provide reliable power up to the end-users/ occupier of the units. This ready reckoner refers to standards as below.

Gujarat Electricity Regulatory Commission (GERC)

Electricity supply code and Related Matters Regulations

The Indian Electricity Rules, 1956 (as amended up-to date)

National Building Code of India with latest amendment

Code of Practice for Fire Safety of Buildings (General): Electrical installations

This ready reckoner should be treated equivalent to:

THE GIFT CITY ELECTRICAL REGULATION

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1 DEFINITIONS:

“CODE”

The National Building Code of India adopted by this regulation or a subsequent and similar Code adopted by this Regulation.

“IE REGULATION”

The Indian electricity rules, 1956 (with all up to date amendments)

ADOPTION OF “THE NATIONAL BUILDING CODE” Except as varied by this Regulation, **National Building Code**, is hereby adopted as part of this Regulation, and a violation or contravention of the Code is a violation or contravention of this Regulation.

In the event of any conflict, explicit or implied, between the provisions set out in the Code and the Regulation, the provisions set out in this Regulation shall prevail. In such case it is responsibility of the person amending modification to maintain reliability of the system.

“AUTHORITY”

Designated employees are authorized to conduct inspections and take steps to administer and enforce these requirements in line with the regulation.

The details of any construction which are not specifically dealt within this regulation shall be performed to the satisfaction of a designated employee, which authority shall be reasonably exercised by the designated employee. Designated employees are hereby authorized to determine whether equipment, techniques, conditions, circumstances and all other matters meet the standards

and requirements of this regulation or are otherwise acceptable.

“DEVELOPER”

A persons or entity, to whom the development rights have been granted by GIFTCL / GIFT SEZ, GIFT City.

“ELECTRICAL CONTRACTOR”

Individual whom holds Electrical Contractor’s License in line with the requirements of the IE regulations and performing electrical work.

“Unit holder/ Transferee”

A person or the entity, who owns, manages or is in possession of land or a building to which this ready reckoner applies.

“ACT”

The Electricity Act, 2003 (Act 36 of 2003);

“Diversity factor”

The ratio of the sum of the individual maximum demands of the subdivisions of the system to the maximum demand of the complete system.

“Demand factor”

The ratio of the maximum demand of a system to the total connected load of the system. Since demand load cannot be greater than the connected load, the demand factor cannot be greater than unity. Those demand factors permitted by the NEC (for example, services and feeders) must be considered in sizing the electric system (with few exceptions, this is 100%); otherwise, the circuit may be sized to support the anticipated load.

“LOAD FACTOR”

The ratio of total number of units (kWh) consumed during a given period to the total number of units (kWh) which may have been consumed had the Contract Demand / Sanctioned Load been maintained throughout the same period subject to the availability of power from GIFT POWER COMPANY and shall usually be expressed as a percentage;

“APPLICANT”

A person who makes an application for supply of electricity, increase or reduction in the contract demand / sanctioned load, change of name, disconnection or restoration of power supply or termination of agreement, as the case may be, in accordance with the provisions of the Act and the Rules & Regulations made there under;

“AUTHORISED REPRESENTATIVE”

An officer or person discharging functions under the general or specific authority of GIFT PCL.

“COMMISSION”

The Gujarat Electricity Regulatory Commission.

“CONSUMER”

Any person who is supplied with electricity for his own use by the GIFT POWER COMPANY LIMITED (GIFT PCL) and includes any person whose premises are for the time being connected for the purpose of receiving electricity with the works of GIFT POWER COMPANY LIMITED.

“Connected load”

The sum of the continuous ratings of the power-consuming apparatus connected to the system or any part thereof in watts, kilowatts, or horsepower

“DEDICATED DISTRIBUTION FACILITIES”

Such facilities, not including a service line, forming a part of the distribution system of the GIFT POWER COMPANY, which are clearly and solely dedicated to the supply of electricity to a single consumer or a group of consumers on the same premises or contiguous premises;

“DISTRIBUTING MAIN”

The portion of any main, with which a service line is, or is, intended to be, immediately connected;

“DISTRIBUTION SYSTEM”

The system of wires and associated facilities between the delivery points on the transmission lines or the generating station connection and point of connection to the installation of the consumers;

“ELECTRICITY”

Electrical energy generated, transmitted, supplied or traded for any purpose, or used for any purpose except the transmission of a message;

“ELECTRICAL INSPECTOR”

A person appointed as such by the Government under Sub – Section (1) of Section 162 of the Act and also includes Chief Electrical Inspector;

“ELECTRICITY SUPPLY CODE”

The “Gujarat Electricity Regulatory Commission (Electricity Supply Code & Other Conditions of Supply) Regulations, 2005, as specified by the Commission or as may be specified;

“GOVERNMENT/ State Government”

Government of Gujarat having jurisdiction under the Act;

“HARMONICS”

A component of a periodic wave having a frequency that is

an integral multiple of the fundamental power line frequency of 50 Hz causing distortion to pure sinusoidal waveform of voltage or current, and as governed by IEEE STD 519 – 1992, namely “IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems” and corresponding standard as may be specified in accordance with Clause (c) of Sub – Section (2) of Section 185 of the Act;

“HIGH TENSION OR HT”

High Tension or HT/ High Voltage refers to the voltage greater than 440 V and lesser than 66 kV.

“HT CONSUMER”

A consumer who obtains supply at HT;

“INSTALLATION”

The whole of the energy consuming electrical fittings including electric equipment, machines, apparatus, gadgets, devices, etc. installed / erected within a premise associated with a point of supply of a consumer, duly wired & connected to the GIFT POWER COMPANY’s power supply system;

“LICENSED ELECTRICAL CONTRACTOR”

An electrical contractor licensed by the State Government for the purpose of carrying out electrical works;

“LOW TENSION OR LT”

Low Tension or LT/ Low Voltage refers to Voltage not exceeding 440 volts;

“LT CONSUMER”

A consumer who obtains supply at LT;

“MAXIMUM DEMAND”

In kW or kVA, as the case may be, shall mean an average kW/kVA supplied during consecutive 30/15 minutes (depending upon the type of meter being used) period of maximum use where such meter with the features of reading the maximum demand in kW/kVA directly, has been provided; ;

“METER”

Meter refers to an equipment used for measuring, indicating and recording electrical quantities like energy in kWh or kVAh, maximum demand in kW or kVA, reactive energy in kVARh etc. including accessories like Current Transformer (CT), Voltage Transformer (VT) / Potential Transformer (PT) / Capacitor Voltage Transformer (CVT) etc. where used in conjunction with such meter;

“OVERHEAD LINE”

An electric line, which is placed above the ground and in the open air but does not include live rails of a traction system;

“OCCUPIER”

The person in occupation of the premises where electric energy is used or is proposed to be used;

“PERSON”

Shall include any Company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person;

“POINT OF SUPPLY”

The point at the outgoing terminals of the GIFT POWER COMPANY's cut outs fixed in the premises of the

consumer; Provided that, in case of HT Consumers, the point of supply means the point at the outgoing terminals of the GIFT POWER COMPANY's metering cubicle placed before such HT Consumer's apparatus;

Provided further that, in the absence of any metering cubicle or, where the metering is on the LT side of the HT installation, the point of supply shall be the incoming terminals of such HT Consumer's main switchgear;

"PREMISES"

Includes any land, building or structure;

"REGULATIONS"

Regulations prescribed or as may be prescribed by the Commission under the Act;

"RULES"

The Rules prescribed or as may be prescribed under the Act;

"SANCTIONED LOAD"

Load in Kilo watt (kW) / Horse Power (HP) mutually agreed between the GIFT POWER COMPANY and the consumer;

"SERVICE LINE"

Any electric supply line through which electricity is, or is intended to be, supplied-

(a) To a single consumer either from a distributing main or immediately from the GIFT POWER COMPANY's premises;
or

(b) From distributing main to a group of consumers on the same or contiguous premises supplied from the same point of the distributing main;

"STREET"

Includes any way, road, lane, square, court, alley, passage

or open space, whether a thoroughfare or not, over which the public have a right of way and also the roadway and footway over any Public Bridge or Causeway;

“TEMPORARY SUPPLY”

Supply of electricity for a temporary period, not exceeding two (1) years, as may be agreed between the GIFT POWER COMPANY and the applicant or as may be modified from time to time by GERC through notified regulations.

“VOLTAGE”

Difference of electric potential measured in volts between any two conductors or between any part of either conductor and the earth as measured by a suitable voltmeter and is said to be

“Low”, where the voltage does not exceed 250 volts

“Medium”, where the voltage does not exceed 650 volts;

“High”, where the voltage does not exceed 33,000 volts;

Under normal conditions however, subject to the percentage variation allowed by the Indian Electricity Rules, 1956 until the introduction of any Regulations for the same under the provisions of the Act;

“SUBSTATION”

Any grouping of switchgear and transformers located near a source or user.

2 GIFT POWER INFRASTRUCTURE:

2.1 POWER DISTRIBUTION IN GIFT

2.1.1 Entire Power Network of the GIFT PCL is divided into two parts

2.1.1.1 Main Receiving Station at centralized Location

2.1.1.2 Individual Zonal Switching stations

2.1.2 At present the GIFT PCL main receiving station receive power at 66kV from GETCO receiving station.

2.1.3 66kV / 33kV substation is developed by GIFT PCL to serve the electrical load requirement of consumers in GIFT city.

2.1.4 From the main Receiving Station there will be a 66kV or 33kV cable transmission system to various switching stations located in various zones identified.

2.1.5 From main receiving station and 33kV switching station 33kV ring will be developed which will be feeding plot wise power requirement. Power will be distributed to the entire city at 33 KV up to the building package level, wherefrom the same will be taken up and distributed further to the points of consumption.

2.2 UTILITY TUNNEL

2.2.1 Power distribution in GIFT city is underground. Network of all HT cables, LT cables and IT / Fibre optic cables shall be carried through utility tunnel.

2.2.2 Utility tunnel is an underground passage developed by GIFTCL to house utility lines such as electricity, water, etc.

2.2.3 All 33 kV switching panels units will be installed in utility tunnel, assigned HT room.

2.2.4 Building Electrical system will be connected by 33 KV cables through Utility tunnel.

2.3 VOLTAGE LEVEL

2.3.1 Except where otherwise previously approved, the GIFT PCL, shall give power supply on the following systems, namely

2.3.2 Low Voltage(LV) –

Alternating current, 230 Volt single phase, 50 cycles;

Alternating current, 400 Volt three phase, 50 cycles

2.3.3 High Voltage (HV) –

Alternating current, 33000 Volt three phase, 50 cycles

Alternating current, 11000 Volt, three phase, 50 cycles (for construction purpose only)

2.4 SYSTEM OF SUPPLY

2.4.1 Except where otherwise previously approved, the classification of the supply system shall be as follows:

2.4.2 Abstract of GERC's Electricity supply code and Related Matters Regulations

a) 230 V - Single Phase

- For all installations up to & inclusive of 6 kW of Connected Load, subject to motive power load other than irrigation pump not exceeding 2 HP in the aggregate.

b) 400V - Three Phase

- For all installations exceeding 6 kW of Connected Load & up to 100 kVA/kW of Contracted Demand/ up to 150

kVA/kW of Contracted Load if opted by the applicant/consumer.

c) 11KV Three Phase

➤ For all installation with Contract Demand exceeding 100/150 kVA/kW and up to 4000 KVA/kW – for construction purpose only.

d) 33 kV Three Phase

For all installations with Contract Demand exceeding 100/150 kVA/kW and up to 4000 kVA/kW and above – for Permanent power.

3 QUALITY OF ELECTRIC SUPPLY

The parameters which decide the quality of electric supply are:-

3.1 Voltage & Frequency

3.1.1 Neutral voltage shall not exceed 2% of the supply voltage and earth resistance should be maintained below 1 Ohm.

3.1.2 Voltage variation tolerance band for different voltages are as under:

3.1.2.1 In the case of Low voltage, +6% and -6%

3.1.2.2 In the case of High voltage, +6% and -9%, and

3.1.2.3 In the case of Extra high voltage, +10% and -12.5%

3.1.3 Frequency variation shall not be permitted beyond +/- 3% of 50 Cycles.

3.1.4 Equipment shall be suitable for operation on a supply voltage with the variation in supply voltage, frequency and combined voltage and frequency of $\pm 10\%$, $\pm 5\%$ and $\pm 10\%$ respectively.

3.1.5 The GIFT PCL may refuse to permit or apply conditions and/or tests for the connection of equipment in the following categories if it is considered that, by such connection the supply to other customers would be adversely affected -

- a) Equipment which could cause excessive fluctuation of voltage on the Distributor's system as a result of its large or fluctuating demand, e.g. Non linear load control such as variable speed motors, gas discharge lighting, arc furnaces, welding machines, X-ray units, frequently-started large motors, etc.
- b) Equipment which could cause excessive distortion of the wave shape of the supply system voltage, e.g. rectifiers, frequency converters, load control devices using thyristors or saturable reactors, etc.

3.2 Power factor

3.2.1 Consumers obtaining three phase supply shall maintain an average power factor above 90% in respect of their installation.

3.2.2 GIFT PCL shall not commence power supply to any applicant requiring motive power load of 2 KW or more unless his installation is provided with adequate power factor corrective equipment like the shunt capacitor.

3.3 Harmonics

3.3.1 The consumer must keep harmonic currents below the limits specified in the IEEE Standard 519-1992 'Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems'.

3.3.2 Users having loads with high harmonic content and fluctuations shall have inbuilt appropriate harmonic mitigation technique. UPS load with Harmonic content more than permissible limit shall have isolation transformer.

4 GENERAL REQUIREMENT FOR SUPPLY

4.1 Power Distribution philosophy

Some salient points for consideration in designing Electrical network of building by Developer & GIFT PCL:

4.1.1 GIFT PCL shall provide HT network up to switching Panel in utility tunnel.

4.1.2 Access from utility tunnel to building electric room should be clearly defined in mutual agreed path keeping in view prudent practices of power distribution.

4.1.3 Electrical Infrastructure shall be based on type of consumers in the building. There will be mainly three type of consumer mix:

4.1.3.1 High tension consumer : Only Consumer with contract demand more than 100/150 KVA/kW and independent HT and LT network for the consumer in the building.

4.1.3.2 Low tension consumer mix: All Consumers with Contracted Demand less than 100/150 kVA/kW in the building.

4.1.3.3 HT and LT consumer mix: Independent network for HT consumer not feasible due to HT and LT consumer in same building. In such case HT and LT both consumers will be fed power through same network of building, as independent distribution

infrastructure is not possible for each HT consumers in such building. HT consumer shall pay transformation losses as per GERC guideline. Any change in consumer category will be based on approval from GERC.

4.1.4 GIFT PCL shall assign two numbers of feeding points for each building plant HT feeder.

4.1.5 In case of standalone (separate single consumer in premises with demand more than 100KVA and separate transformer and LT network for such consumer only) Summation CT arrangement shall be provided for metering of HT consumption and there shall be only one metering point.

4.1.6 In case of common network for building consumers with demand less than 100KW shall be considered as LT consumer of respective tariff and consumers with demand more than 100KVA shall be considered as HT consumer of respective tariff as per purpose of use of power defined in tariff.

4.1.7 An independent and well ventilated electrical service room shall be provided on the ground level/ highest floor area of first basement with direct access from outside or from the corridor for the purpose of termination of electrical supply from the licensees' (GIFT PCL) service and alternative supply cables. The doors provided for the service room shall have fire resistance of not less than 2 Hrs.

4.1.8 Developer is responsible to develop complete electrical infrastructure of building from his point of supply to the unit owner's / occupier point of supply.

Scope includes supply, install and commissioning of HT panel, transformer, LT panel, Bus duct, Floor wise LT panel/metering panel, power factor correction arrangement, harmonic filters, earthing arrangement, etc. as per approved drawings of GIFT PCL.

- 4.1.9 Adequate circuit breakers shall be provided at the appropriate location. Maximum allowable distance of breaker from the field equipment/transformer is 20 meters.
- 4.1.10 Metering equipment shall be provided by GIFT PCL for HT and LT all type of customers. This includes Energy meter, Meter Box (if Metering panel is not provided by the developer) and related accessories.
- 4.1.11 If floor wise metering is required then, developer shall provide redundancy in LT distribution up to floor level, than it should be arranged in such way that single metering point arrangement condition should be complied, means changeover should be arranged in incoming source of each floor level distribution system. However, If vertical power distribution from transformer to floors is through cables then all meters will be installed on ground floor, developer have to provide separate space for meter installation and provide direct access to metering room.
- 4.1.12 No diesel generators will be allowed for backup power to developer.
- 4.1.13 If failure is at unit holder/ transferee/ occupier point of supply, load is transfer to alternate feeding point.

Infrastructure should be designed for uniform distribution of the load in such condition. Transformer should not be overloaded at the same time alternate point should be available for feeding power to unit holder/ transferee/ occupier.

4.1.14 Backup power arrangement is provided on demand by GIFT PCL and in case of grid failure. GIFT PCL can provide backup power LT Panel of common area at voltage level of 415 Volts from centralized backup source as per developer demand for critical loads. Backup power will be available in 1 minute. Developer is required to pay capital cost (capex) and operation and maintenance (opex) cost separately based on backup power demand as per backup power Policy. If developer want to provide backup power to various tenants of floor, then there shall be separate busduct for same having independent control for all outgoing of busduct and it should be feed from critical panel.

4.1.15 Developer/unit holder/ transferee/ occupier shall make necessary arrangement for segregation of emergency load as per contract demand of backup power and control his consumption within the assigned capacity required in case of GRID failure in network. System to changeover should be SCADA controlled in case of GRID failure. Control of changeover system shall be with GIFT PCL. At the time of GRID failure, Developer shall provide acknowledgement signal of segregated load within 3 second.

- 4.1.16 GIFT PCL will provide GRID failure & GRID restoration signal by soft signal for common area of building, Developer shall have provision for accepting that soft signal and have to provide acknowledgement for the same.
- 4.1.17 Developer has to ensure that maximum allowable instant loading on backup system shall be 30% of total backup demand and remaining 70 % of backup demand shall apply after 30 Sec. of initial loading.
- 4.1.18 Developer has to ensure that at the time of GRID failure, only Critical load shall be charge (On) Non-critical load shall be automatically switched off. At any incident, if consumer/building increase their power consumption from their committed limit (for Normal & Backup) power will be Tripped (automatically by switching panel Relay) for that consumer/building. Developer has to ensure that APFC (any capacitor bank) shall be switched-off at the time of GRID failure and its switching shall be done automatically through PLC or BMS. In case of grid failure condition, if backup power system get leading power factor due to the developer's/consumer's load, then this may lead to failure of backup power supply and that failure will be the developer's responsibility. Hence consumer need to ensure no leading power factor from their connected loads during back up power supply. This is applicable for all the Developers/Consumers who have opted for HT backup as per previous scheme.

- 4.1.19 Developer should design network to keep emergency fire system and UPS network independent from normal network. Independent network shall be there to feed UPS load.
- 4.1.20 Developer shall provide necessary facilities for voice and data communication and transfer of on-line operational data to Load control centre of GIFT PCL such as voltage, frequency, status of breaker position and other parameters as prescribed by the GIFT PCL.
- 4.1.21 Modern buildings use large number of electro-mechanical, electronic devices, which for their proper operation and protection require quality electric supply.
- 4.1.22 Developer is responsible to maintain quality of electrical supply within his premises. It is responsibility of developer to provide specific additional equipments like Voltage correctors, isolation transformers, filters, protection, surge protection, UPS, etc. as necessary to improve performance.
- 4.1.23 Emergency power supplying distribution system for critical requirement for functioning of fire and life safety system and equipment, shall be planned for efficient and reliable power and control supply to the following systems and equipment where provided: (NBC-2016, clause 4.2.1, point 27, Pg no 22)

4.1.23.1 Firefighting pumps;

- 4.1.23.2 Pressurization and smoke venting; including its ancillary systems such as dampers and actuators;
 - 4.1.23.3 Fireman's lifts (including all lifts).
 - 4.1.23.4 Exit signage lighting; (if not have independent backup)
 - 4.1.23.5 Emergency lighting;
 - 4.1.23.6 Fire alarm system;
 - 4.1.23.7 Public address (PA) system (relating to emergency voice evacuation and annunciation);
 - 4.1.23.8 Magnetic door hold open devices; and
 - 4.1.23.9 Illumination for the firefighting pumps and panels and for security room.
- 4.1.24 Power supply to these systems and equipment shall be from normal and backup power sources with changeover facility. Developer has to take backup power connection from GIFT PCL as per backup power policy. Developer must take backup power connection equivalent to their fire and life safety equipment load as mentioned in clause 4.1.23.
- 4.1.25 During any Emergency/ Fire/mishap condition, normal load bus should be isolated from any power source by remote operation, and only emergency fire and life safety panel shall be charged.
- 4.1.26 Developer has to ensure that while taking backup power, developer have to single PT signal combined to all LT incomer from main LT panel.
- 4.1.27 The power supply to the panel/distribution board of these fire and life safety systems shall be through fire proof enclosures or circuit integrity cables or

through alternate route in the adjoining fire compartment to ensure that supply of power is reliable to these systems and equipment. It is to be ensured that the cabling from the adjoining fire compartment is to be protected within the compartment of vulnerability. The location of the panel/distribution board feeding the fire and life safety system shall be in fire safe zone ensuring supply of power to these systems. Cables for fire alarm and PA system shall be laid in metal conduits or armoured to provide physical segregation from the power cables.

4.2 Clear demarcation of boundary of control for GIFT PCL and Developer

Developer shall keep following guidelines in view at the time of designing electrical infrastructure. These guidelines are defining area of control and responsibility to carryout O&M of all the assets and restoring of power supply up to defined area on case to case basis as follows;

- 4.2.1 GIFT PCL is responsible for development and integration of the external infrastructure related electrical system. Developer is responsible development and integration of the electrical system for building internal requirement and external infrastructures linked with building.
- 4.2.2 GIFT PCL will install 33 kV switching panel and lay 33 kV cable in utility tunnel to supply electrical power to building. The developer / user shall be responsible to pay the applicable service

connection charges with applicable security deposit and monthly regular electricity charges.

- 4.2.3 GIFT PCL shall lay cable from switching panel to HT panel of building substation according to path assigned/approved by GIFT PCL, Developer has to pay service connection charges for 33 kV connection.
- 4.2.4 In case of HT consumer GIFT PCL shall be responsible for O&M of assets and restoration of supply, up to point of supply (up to HT metering point). Predominantly located inside GIFTCL utility tunnel/GIFT PCL substation.
- 4.2.5 If point of supply is in ground level near transformer/in common metering room, developer shall arrange necessary wiring to extent point of supply up to the unit holder/ transferee/ occupier premises. In such cases GIFT PCL shall not be responsible for O&M of assets and restoration of supply up to point of supply. GIFT PCL would be responsible for O&M of assets and restoration of power supply till HT metering point only.
- 4.2.6 If developer wants point of supply on each and every floor than on request of developer GIFT PCL may install meters on every floor, but GIFT PCL shall not be responsible for O&M of any assets and restoration of supply inside premises. Developer shall be solely responsible for O&M of assets from HT incoming panel to floor level LT metering points and restoring power in case of fault in network

between HT incoming points to metering point. In case of any fault in tariff meter or tariff metering equipment shall be resolved by GIFT PCL.

- 4.2.7 Developer is responsible for designing electrical infrastructure based on consumer mix of building. It is his responsibility to arrange independent metering for measuring energy consumption of each consumer as per the prudent practices of power distribution. GIFT PCL shall do necessary arrangement for metering of energy consumption of each consumer/building as per tariff.

5 CUSTOMER'S INSTALLATIONS

Developer shall consider following guidelines for projection of load for the building.

5.1 Electrical Load criteria's

- 5.1.1 Developer of any building or plant needs to submit electrical load with basis of calculation of load for all type of loads at the time of submission of DPR. GIFT PCL will validate the load for construction and permanent use submitted by developer. GIFT PCL will validate the load based on minimum loading per square meter for all type of load as per following table 1: (ref. ASHRAE, MEW/R-6/2010, IEEE 241/1990):

Table 1: Electrical Load calculation Factors

Type of load		W/SQM	Demand Factor	Diversity Factor
Lighting	Residential	As per Design	40%	1.5
+Power	Commercial		80%	1

IT load	As per Design	80%	1.5
AHU	As per Design	70%	1
For Cooling	As per Design	70%	1
Lift	As per Design	75%	1
Ventilation	As per Design	35%	1
Life Safety panel	As per Design	50%	1

5.1.2 Latest version of NBC guidelines for considering diversity of different type of load for different purpose can be considered in finalising power demand.

5.1.3 This is considered as minimum load requirement basis for sizing of electrical infrastructure components and rest operational philosophy of infrastructure.

5.1.4 Based on above calculation projection of power demand will be finalised.

5.1.5 The detailed load calculations need to be provided for an exception from above mentioned load.

5.1.6 Developer shall calculate power requirement for cooling load considering chilled water supply connection from GIFTCL's District cooling system.

5.1.7 Finalising electrical load shall be first criterion. Load list shall be validated by GIFTCL.

6 Service equipments

- a. Based on validated electrical load and general guidelines in clause 4, developers should design infrastructure for the building.
- b. GIFTCL has fixed following technical parameters for finalising sizes of HT Panel, transformer, switchgear, LT panel, capacitor panel, etc. for linear and non linear load.

6.1 HT panel

- 6.1.1 33 kV HT panel shall be GIS of (SF6 Gas Insulated) type panel. GIS Panel will reduce the space requirement by 60%, reduce the maintenance cost, more effective in basement area having humid environment, less probability of getting flash and high life cycle of panel. HT panel shall have Circuit breaker with central mounting arrangements and CT PT arrangement at bottom, relay and control cubical in top section of panel. Minimum IP rating for any HT switchgear enclosure shall be IP 4X. HT switchgear should not be installed outdoor.
- 6.1.2 The Technical specifications of 33KV Gas Insulated switchgear (GIS) panel is placed at Annexure-F. Developer must submit GTP, GA & QAP of GIS panel to GIFT for approval before procurement..
- 6.1.3 Breaker sizing should be fulfilling make, break and thermal rating.
- 6.1.4 Switchgear (and its protective device) shall have breaking capacity not less than the anticipated fault level in the system at that point. System fault level at a point in distribution system is predominantly dependant on the transformers size and reactance. Developer should not operate transformer/Generator in parallel with system.
- 6.1.5 HT panel should have provision of redundant incoming power supply.
- 6.1.6 HT Panel's SCADA/BMS I/O list shall be submitted to GIFT PCL, provision of remote trip, ON, OFF and complete status of breaker shall be made available in

BMS/SCADA panel. All relay shall have provision of 'Trip Relay Reset' from remote operation. Signal to be replicated.

6.1.6.1 Acknowledgement Signal for unit holder/ transferee/ occupier

6.1.6.1.1 Grid incoming Healthy

6.1.6.1.2 Grid incoming Fail

6.1.6.1.3 Emergency system in ON

6.1.6.1.4 Over consumption by unit holder/ transferee/ occupier in emergency

6.1.6.1.5 Grid incoming restored

6.1.6.2 List of parameter to be monitored

6.1.6.2.1 Power consumption

6.1.6.2.2 Power factor

6.1.6.3 Command from GIFT SCADA to breaker at

6.1.6.3.1 Point of supply

6.1.6.3.2 Open breaker

6.1.6.3.3 Trip breaker

6.1.6.4 Acknowledgement Signal for SCADA from unit holder/ transferee/ occupier system.

6.1.6.4.1 System emergency distribution corrected

6.1.6.4.2 Trip at the unit holder/ transferee/ occupier main breaker

Developer/unit holder/ transferee/ occupier is responsible to replicate these signals at unit holder/ transferee/ occupier point of supply using BMS/SCADA system. Utilizing this signals for automatic operation and control of his system in integration with GIFT PCL system.

6.1.7 There will be summation CT installed inside HT Panel for metering of complete building.

6.1.8 Once permanent power supply is released at HT Panel incoming; the panel will be sealed by GIFT PCL and developer has to keep that seals intact else the case will be treated as power theft and shall be liable for punishment/penalty as per provision in relevant ACT.

6.1 Transformer

6.1.1 Loading & sizing of transformers shall be such that complete switch-over of load can be possible in single command from BMS/SCADA

6.1.2 Dry type transformer should be provided, if transformer is inside the building.

6.1.3 Power transformer of proper ratings and design must be selected satisfy the minimum acceptable efficiency at 50% and full load rating.

6.1.4 Developer has to submit GTP, GA & QAP of transformer to GIFT for approval before procurement. Transformer shall be designed and manufactured as per IEC 60076-1 and must be rated for Class F1 under fire behaviour.

6.1.5 Performance testing of transformer has to be carried out at OEM premises and one representative from GIFT PCL would be attending the performance inspection of transformer at OEM Plant. Developer has to give the notice of all such inspection min 10 days in advance. Inspection cost of GIFT PCL representative will be levied from Developer.

6.1.6 The arrangement shall be made to have a complete changeover of full load on healthy transformers under transformer failure conditions. Under the full loading

condition, the total load shall constitute 85% of transformer rating.

- 6.1.7 Combination of sizes of transformer shall be selected so as to optimise the loading & maintain the optimum possible redundancy of system.
- 6.1.8 Dry type transformer shall be with on-load tap changing facility.
- 6.1.9 The voltage rating of transformer shall be 33/0.415 kV.
- 6.1.10 The tap changing range for a transformer shall be (+5% to -15% @2.5 %).
- 6.1.11 The detailed technical specifications of the dry type transformer and CSS (compact substation) is placed at Annexure-G.

6.2 Switch-gears

- 6.2.1 Panels, transformers, cables, wires, cable trays etc manufactured by “SYSTEM HOUSE/SYSTEM PARTNER/CHANNEL PARTNER/CONSORTIUM/JOINT VENTURE” will not be acceptable by GIFT PCL.
- 6.2.2 All necessary arrangement should be made for remote operation, control and monitoring of switchgear provided at point of supply. Panel shall have minimum two incomers with one bus coupler with required number of transformer outgoings.
- 6.2.3 Minimum IP rating for any switchgear enclosure is as follows:

HT system: IP 4X	For Indoor switchgear
IP55	For outdoor switchgear
LT system: IP54	For indoor
IP42	For higher rating bus bar chamber

IP55 For outdoor

- 6.2.4 For calculation of short circuit rating of bus-bars, breakers, panel's etc. developer should take base MVA from GIFT PCL.
- 6.2.5 BMS/SCADA monitoring & control shall be possible up to DB level inside developer premises.
- 6.2.6 Complete electrical infrastructures will be sized for 120% of total building connected load to serve the future load growth if any.
- 6.2.7 Bus-bar sizing calculations of switchgears shall be submitted to GIFT PCL for validation.

6.3 LT Panel

- 6.3.1 All LT side incoming breaker shall be 4 pole type. In making sequence breaker neutral should make first and in breaking sequence breaker neutral should break last.
- 6.3.2 The entire LT breakers shall be microprocessor based and shall have provision of ON, OFF & Trip from Remote location. All switchgear above 63 A shall be four pole break type, All LT switchgear above 630 A shall be Air circuit breaker.
- 6.3.3 LT panel should have minimum clear of 1500 mm in front side and 750 mm in remaining three sides. In case of 2 side panel it should have 1500mm clearance on both front and rear side and 750 mm on other two sides.

6.4 Capacitor panel

- 6.4.1 APFC should be designed, to prevent leading PF in case phases are unbalanced.
- 6.4.2 APFC shall have inbuilt relay with minimum pick up current rating with provision of switching between banks so as to achieve long life of capacitor bank. APFC

Panel Should be sized to maintain average monthly power factor in greater then 0.90 lag. Panel should have BMS provisions for data collection.

6.4.3 Capacitor bank shall have inbuilt relay for controlling capacitor bank switching, bank shall be preferably in multiple of 8 steps so as to maintain power factor correction based on different load conditions.

6.4.4 Kindly refer below example for KVAR consideration .

Supplying kW = 650 kW

Original P.F = $\cos\theta_1 = 0.8$

Final P.F = $\cos\theta_2 = 1$

$\theta_1 = \cos^{-1} (0.8) = 36.87;$

$\tan \theta_1 = \tan (36.87) = 0.75$

$\theta_2 = \cos^{-1} (1) = 0^{\circ};$

$\tan \theta_2 = \tan (0^{\circ}) = 0$

Required Capacitor kVAR to improve P.F from 0.8 to 1

Required Capacitor kVAR = $P (\tan \theta_1 - \tan \theta_2)$

= 650kW (0.75– 0)

= **487.5 kVAR**

6.5 HT Cable

6.5.1 33 kV grade XLPE insulated PVC sheathed armoured Aluminium cable shall be 3 core earthed grade. The cable shall conform to IS 7098 and shall be FRLS cable

6.5.2 HT Cable shall be treated to be free from fire throughout length with fire resistant paint added to this at all entry exits through out walls/structures etc fire proof sealing shall be done.

6.5.3 Cable tagging shall be provided in each and every branch, node and throughout length of cable tray so as to facilitate maintenance of cables

6.5.4 Minimum spacing between HT cables of same voltage level shall be equivalent to diameter of that cable.

6.5.5 Minimum spacing between HT & LT cables shall be 300mm.

6.5.6 There should be no straight joints in HT cable inside the building.

6.5.7 Standard sizing of HT cable are 3 Core, 185, 240 or 300 sqmm. HT cable should be of size higher than the maximum expected current consumption. Selected HT cable shall withstand 25KA fault level within the system for 1 sec.

6.6 LT cable

6.6.1 Minimum spacing in LT cable shall be '1d' where 'd' is diameter of cable.

6.6.2 LT cable shall be sized for 120% of connected load.

6.6.3 Additional 25% spare space provision for cables shall be provided during cable tray sizing at initial stage to accommodate last time additions in the design.

6.6.4 Cable supplying power to non-linear loads shall have whole neutral conductor viz. 4 Core LT cable shall be used considering

6.6.5 4 core stranded Aluminium/Coppered conductor XLPE insulated FRLS cables/wires to be used. 6sqmm and below only copper conductor cable/wire to be used. Standard sizes of conductors to be used are 10, 25, 70, 120, 240, 300 sqmm. All cable/wires shall be FRLS type.

6.7 Metering equipment

6.8.1 Metering class for HT side is 0.2S and for LT 0.5S. with minimum Burden of 10 VA

- 6.8.2 There shall be dedicated entry/exit for GIFT PCL from outside premises to reach to metering equipment with lock and key in custody of GIFT PCL
- 6.8.3 Developer may have separate entry/exit for housekeeping reading and supervision of the metering equipment
- 6.8.4 Any kind of damage or transposing with metering equipment shall be treated as power theft and the penalty/ levies will be laid on the consumer as per GERC/CERC and statutory acts.
- 6.8.5 All HT incoming and outgoing feeder should have 0.2S class CTs and SCADA & BMS communicable multifunction meter/Trivector meters. HT CT ratio shall be -/1A
- 6.8.6 Main LT panel incoming and outgoing feeder should have 0.5S class CTs (if CT required) and SCADA & BMS communicable multifunction meter.
- 6.8.7 Common area of premises (Building/Block/Wing) shall be supplied from a common area LT panel through sub-distribution panel for common area load like lifts, water pumps, chilled water pumps, staircase pressurization, lobby lighting and power, staircases lighting etc (shall include all the load of building apart from tenant's load). This Common area LT panel shall have single GRID incoming through ATS switch. Incoming feeder of common area LT Panel shall have separate space for metering CT installation and sealing of that CT compartment.
- 6.8.8 For High rise building more than 15-meter height, floor wise metering is allowed. For High rise

building less than 15-meter height and LT distribution is by LT cable, metering shall be at Ground floor/First basement. Metering location shall always be accessible to the GIFTCL representative

6.9 LT sandwich Bus-duct

6.9.1 Bus Enclosure

- 6.9.1.1 Bus bar cross over shall be avoided and shall be suitably coordinated with transformer manufacturer and panel manufacturer by the contractor.
- 6.9.1.2 Silica gel Breather and space heater shall be provided as required.
- 6.9.1.3 The entire bus duct shall be designed for indoor/outdoor installation, with a dust and vermin-proof construction. Bus duct installations meant for outdoor application shall be of weather proof construction and shall have degree of protection better than or equal to IP-55. Outdoor portion of bus duct shall be provided with rain hood or IP-68.
- 6.9.1.4 Proper earthing should be provided on bus duct.
- 6.9.1.5 The detailed technical specifications of bus duct is placed at Annexure-H.

6.9.2 Bus Conductor

- 6.9.2.1 Sizing should be done as per 120% loading of conductor.
- 6.9.2.2 The temperature rise of conductor shall be as per IS: 8084. Also the temperature of the bus shall not

exceed 250°C while carrying the specified short circuit current for one second when a fault occurs at the operating temperature.

- 6.9.2.3 The bus conductor shall be given a coat of matt black paint to facilitate heat dissipation. The bare conductor with above painting shall be designed to carry the 120% normal rated current without exceeding temperature rise as specified in IS:8084.
- 6.9.2.4 All the joints shall be tested for temperature rise to prove the adequacy of the design. The maximum temperature rise at the joints shall be less than the specified temperature rise for the bus bars.
- 6.9.2.5 Proper insulation should be provided for phase barriers such as non-hygroscopic insulating material i.e. fibre glass.

6.9.3 Wall Frame Assembly and Seal – off Bushing

- 6.9.3.1 Wherever the bus duct passes through the plant building wall, from indoors to outdoors, a wall frame assembly with seal-off bushings shall be provided to prevent any leakage of rain water, infiltration of dust and air temperature variations from indoors to outdoors. The wall frame shall be fabricated out of aluminium angles and sheet and shall be suitable for grouting in the wall. It shall be provided with flanges on both sides to receive the bus duct flanges. A suitable size breather shall be provided for the two sections of the bus-duct between the wall frame assembly.
- 6.9.3.2 The bus duct shall be equipped wherever necessary with seal-off bushings to prevent interchange of air

at different temperatures. The seal-off bushings shall be flanged type. The insulator for wall frame assembly and seal-off bushings shall be of porcelain. Also the bushings shall be designed for thermal expansion/contraction due to temperature differential for outdoor/indoor use.

6.9.3.3 Fire barrier shall be provided between two floors in bus duct shaft.

6.10 UPS

6.10.1 The UPS system shall be true on line static type and the components of UPS shall isolate power line transients, frequency and voltage variations.

6.10.2 The UPS shall provide no-break power supply to the critical loads under normal conditions, during outages in the input power and during failure / mal-operation of the main components of the UPS by switching the alternate supply.

6.10.3 For power distribution through UPS, there will requirement of battery room with sufficient ventilation, UPS system, UPS LT Panel, UPS rising main, main boards/ DBs wiring etc. Necessary space provisions in layout shall be made.

6.10.4 UPS shall comprise a solid state rectifier/ battery charger, battery VRLA/maintenance free, a solid state inverter, static switches and stand-by regulated AC supply as per approved Data sheet.

6.10.5 The three phase AC mains input is fed to the controlled rectifier (full wave bridge) via a matching 2 winding Delta-star connected Isolation transformer.

6.10.6 The downstream inverter converts the DC into a regulated AC. In the event of power sag or failure, the battery which is connected to the DC link circuit, is called up automatically, without any interruption, to supply to critical loads. On mains recovery, the rectifier resumes its function of supplying the inverter and charging the battery.

6.10.7 When a fault develops in the inverter or an overload occurs, the static switch automatically transfers the critical load to the stand-by AC supply, until manually reset.

6.10.8 Unit holder/ transferee/ occupier and Developer should select their UPS with minimum 1 hour battery backup.

Developers shall consider following guidelines in designing electrical infrastructure for quality & uninterrupted supply, backup power arrangement, best energy management and safety of equipment and human being.

7 Earthing design validation & installation guidelines with checks.

7.1 Preferably earthing mat with copper rods shall be provided for reducing the space requirements of no of earth pits

7.2 Soil Resistivity testing as per relevant standards has to be carried out to find the earthing resistance of soil based on the said test the earthing calculations shall be done.

7.3 There shall be separate earth pits for following. Type of earthings and separate layouts shall be prepared and submitted for review

7.4 Earthing Layout for Lightning Arrestor

- 7.5** Earthing Layout for Transformer Neutral & NER
- 7.6** Earthing Layout for UPS
- 7.7** General earthing layout with details for Electrical Panel Body, transformer body, motor body etc, LV Wiring, lighting & Power Circuits, BMS/PLC/SCADA etc ELV systems, Building Structure & cable trays.
- 7.8** Standard should be followed for earthing IS 3043, IEEE80, IEEE142 (Green Book).
- 7.9** Utmost priority shall be given for maintenance of earthing pits and design shall accommodate provision for future repairs of earthing pits.
- 7.10** Location of earthing pits shall be provided such that the maintenance of earthing shall be easily attended.

8 Surge & Lightning protection

The standard to be followed for surge arrester is IS: 15086 and IEC 62305 relevant latest NBC code.

8.1 Insulation co-ordination

8.1.1 Developer to submit detailed insulation co-ordination philosophy for HT & LT distribution network inside building.

8.1.2 Insulation co-ordination must consider local environment conditions and method of neutral earthing.

8.2 Surge arrester

8.2.1 Surge arrester shall be provided in incoming HT panel to bypass lightning surge or lightning impulse arriving in grid.

8.2.2 There shall be dedicated earthing

8.3 Lightning Protection

8.3.1 Direct lightning stroke protection calculations needs to be submitted for building premises and should cover at least 30% nearby exterior area.

8.3.2 There shall be overlapping on area protected by single lightning arrestor. Each lightning arrestor shall have at least 40 % overlapping for overall building premises.

8.3.3 Separate lightning counter for each lightning arrestor shall be provided. There shall not be any breakages or joints in the lightening conductor carrying lightning strokes to ground.

8.3.4 There shall be adequate numbers of Down conductors for each conventional lightning arrestor as per NBC. Each down conductor shall be connected to dedicated earth pits as per NBC.

8.3.5 Earthing pits for lightning protection shall be connected in dedicated earthing grid/mat for lightning.

8.3.6 Building above 60 meter height should be protected against side splashing.

8.3.7 If the Lightning protection system (LPS) is of structural type, then the following material rods shall be considered for down conductors.

- a. Stainless steel
- b. Copper
- c. Copper bounded Steel. (Min copper coating of minimum 250 micron)

9 Installation of Cable

9.1 Cable Installation

- 9.1.1** Cable installations shall be in accordance with IS 1255 amended up to date. Cable shall be laid in ground, trenches, and cable trays and on walls as specified. Installation shall include all supports and clamps as required.
- 9.1.2** Sufficient space should be provided to maintain bending radius of Cable (15D for HT & 12D for LT N/W) 20% above the standard bending radii specified. All HT cable shall have 1-meter clearance from any building structure.
- 9.1.3** Buried cable up to 650/1 100 V shall have a minimum cover of 500 mm measured to the top of the highest cable.
- 9.1.4** Cables Laid in Underground Ducts shall be laid at a minimum depth of 500 mm, ducts shall be surrounded by at least 75 mm of sieved sand except at road crossings where it shall be 1m deep and encased on all sides by 150mm of concrete.
- 9.1.5** Conduit shall be galvanised heavy gauge solid drawn or welded screwed steel type and be in accordance with IS 9537 Part 2 or BS 4568.
- 9.1.6** Cable Installed in Cable Trunkings shall ensure that the size of the trunking is adequate for the number of cables to be installed together with 50% spare capacity and shall in any case be 50mm x 50mm minimum size.
- 9.1.7** All cable tray used shall be processed for hot dipped galvanizing/ powder coating. The sizing of the cable rack system shall provide a minimum of 25% spare capacity.

9.1.8 Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows etc., shall be fabricated from 14 gauge (2.0 mm thick) mild steel sheets. Cable tray covers shall be fabricated from 16 gauge perforated (1.60 mm thick) M.S. sheets.

10 Emergency and backup power requirement & segregation from total load.

10.1 Emergency Load

10.1.1 “Critical Load”

10.1.1.1 Lift Load (min. 50 % of lift)

10.1.1.2 Life safety panels

10.1.1.3 Unit holder/ transferee/ occupiers UPS system

10.1.1.4 Staircase pressurization panel

10.1.1.5 Emergency evacuation system

10.1.1.6 Ventilation panel

10.1.2 “Emergency Load”

10.1.2.1 Service lift

10.1.2.2 Life safety panels

10.1.2.3 Staircase pressurization panel

10.1.2.4 Emergency evacuation system

10.1.2.5 Unit holder/ transferee/ occupier should select their emergency system with 1 Hr battery backup.

10.1.3 Critical Load shall be restricted to 20 % of overall building load. GIFT PCL will provide the backup power to critical and emergency load from backup power source through same distribution infrastructure on chargeable basis

10.1.4 During any Emergency/ Fire/mishap condition, normal load should be isolated from any power

source by remote operation, and only critical load should be charge.

- 10.1.5** If complete electrical system goes off in case any of Fire/mishap condition, backup/emergency power for fire and life safety system will be provided to developer as per the GIFT PCL backup power policy.

10.2 Changeover arrangement

- 10.2.1** Developer shall provide manual and remote changeover arrangement in case of transformer failure/grid failure/emergency/fire condition which should be discussed with GIFT PCL before implementation.

- 10.2.2** In case of Bus duct failure, the LT panel changeover should occur in a step-by-step manner and shall switch floor-wise in ascending or descending order, considering continues loading of supplying transformer.

- 10.2.3** Transformer failure, Emergency condition and Backup power switching plan should be prepared in coordination with GIFT PCL schemes.

- 10.2.4** Common area main LT panel and fire pump panel should have provision of two numbers of the incomer with automatic transfer switch. Further to that, common area main LT panel shall have provision for Second incomer for backup power with electrical and mechanical interlock between two incomers.

- 10.2.5** In case of GRID failure, backup power will be switchover in 1 minutes

- 10.2.6** Developer should manage load according to backup power requirement.
- 10.2.7** Developer should have a provision of load management/ load segregation from HT side by remote operation, to avoid over loading under the grid failure/ emergency conditions.
- 10.2.8** The system should be design on basis of typical SLD provided, unit holder/ transferee/ occupier/ floor occupant/ tenant shall be supplied from main LT panel and all common area load shall be supplied from a single common area panel.
- 10.2.9** Under the GRID failure condition, only critical load should be connected to backup power, non-critical & APFC load shall be switched off.
- 10.2.10** Sudden backup load should not be applied on backup GRID, it should increase gradually. Maximum sudden load should not exceed 10% of load demand.
- 10.2.11** Developer should have provision of gradual load application of critical load.
- 10.2.12** In case if any tenant wants backup power from LT DG set for fast changeover in case of grid failure, GIFT PCL will explore the requirement and criticality. Facility will be provided as per backup power network development policy of GIFT PCL.
- 10.2.13** At present, the capital cost for Backup Power arrangement is Rs. 16,050/- (Rupees Sixteen Thousand and fifty only) per kVA in DTA area and Rs. 13,600/- (Rupees Thirteen Thousand and six hundred only) per kVA in SEZ area. This cost may vary from time to time.

The capital cost for Backup Power arrangement is non-refundable.

10.2.14 The expected life of LT DG set is approx. 15 years. The developer/consumer has to bear the capital cost of replacement of DG set.

10.2.15 At present, the O&M cost of DG set is Rs. 88/- (Rupees eighty eight only) per kVA per month in both DTA and SEZ Area. This cost may vary from time to time. This cost is exclusive of fuel consumption and energy consumption cost.

10.3 Redundancy of N+2 power supply for Life safety panels.

10.3.1 All Life safety panels (Service LIFT, Fire Fighting, staircase pressurization, terrace pressurisation, ventilation, smoke extract system, exhaust fan, basement jet fans, emergency lighting, etc) shall have power supply from two incomer power supply source with automatic changeover.

10.3.2 Facility for connection from substation to adjoining building to feed essential emergency load in that building, such as escape route lighting, fuel or sprinkler pumps, emergency communication systems shall be provided. Similarly, the essential emergency load switchboard of this building or building complex should be so as to be capable of receiving power for such loads from the adjoining building or building complex, when its own substation/DG sets shut off due to crisis conditions such as fire.

11 Harmonics protection design validation & installation guidelines with checks.

11.1 Standard

11.1.1 Developer must keep harmonic currents below the limits specified in the “IEEE Standard 519–1992: Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems” Users having loads with high harmonic content and fluctuations shall install appropriate correction equipment.

11.2 Harmonics Mitigation Technique

11.2.1 Harmonic shall be mitigated at harmonics creation source. As per any system requirements Variable Frequency Drives, SOFT starters, Power Electronic devices are required then harmonics mitigation shall be an in built feature.

11.2.2 Cable bus-duct etc supplying power to non linear loads shall have 4 Core viz. complete neutral conductor of same size as that of phase conductor and the earthing for such circuit shall not be connected separately preferably with UPS earthing.

11.3 Harmonic Measurement

11.3.1 GIFT PCL will measure harmonics at any point in the system hence developer to take the necessary precautions of standards to be followed

11.4 Harmonic Filters

11.4.1 Harmonics filtration shall be done inside equipments at conversion stage; if such technology

is not possible then harmonic filters shall be used in supply as well as load end so as to completely filter the harmonics from system.

12 ENERGY CONSERVATION

Following are the major aspects to be considered for selection of equipment from energy conservation point of view guidelines to be followed from ECBC 2012 or recent standard

12.1 Power Distribution systems

12.1.1 Voltage Drop value shall be maintained as below

- 12.1.1.1 0.5% from transformer to main LT panel,
- 12.1.1.2 1% from Main LT panel to Main distribution board,
- 12.1.1.3 1.5% from Main Distribution Board to sub distribution board/Unit holder/ transferee/ occupier isolator.

12.1.2 Transformer losses should be within the limitation specified by ECBC.

12.2 Lighting Design

Lighting design to be done in such a way that it achieves the required visual comfort at working plane and is energy efficient. Developer should get approval of building Façade lighting for the ambience, from GIFTCL planning team for day and night condition.

12.3 Lighting Management and Energy efficiency

Energy efficient lighting fixture should be used while designing lighting.

13 Metering arrangement as per guideline of CEA and GERC for HT and LT consumers.

13.1 Meter

13.1.1 GIFTPCL shall provide energy meter for all type of connection.

13.1.2 Meter standards shall be as per guideline of CEA and GERC.

13.1.3 Metering equipment shall be sized based on contract demand.

13.2 Sealing

13.2.1 Metering arrangement shall be duly sealed by authorised GIFTPCL representative to make it pilfer proof.

13.2.2 GIFTPCL shall carry out sealing of meters and its accessories in presence of authorised representative of developer/consumer, and take signature of representative on checking sheet/sealing Performa.

13.2.3 Developer/Consumer shall ensure safety and condition of metering equipment and seals.

13.3 Power theft

13.3.1 Any case of pilferage of energy or misuse of energy shall be dealt as per provisions of EA-2003 and GERC notification.

14 Fire safety guidelines compliance.

14.1 Separate circuits for the firefighting pumps, lifts, staircase, corridor lighting and blowers for pressurizing system shall be provided directly from the main switch gear panel and these circuits shall be laid in separate conduit pipes, so that fire in one circuit will not affect the others. Master switches

controlling essential service circuits shall be clearly labelled.

14.2 The electric distribution cable/wiring shall be laid in a separate duct. The duct shall be sealed at every floor with non-combustible materials having the same fire resistance as that of the duct. Low and medium voltage wiring running in shaft and in false ceiling shall run in separate conduits.

14.3 The substation shall have separate fire resisting walls/surroundings and shall necessarily be located at the periphery of the floor having separate access preferably from the escape staircase. The outside walls, ceiling and floor including doors and windows to the substation area shall be of 2H fire rating.

14.4 A substation or switch-station with oil filled equipment must not be located in the building.

14.5 Each life safety panel should have two incomers.

14.6 A substation area shall not be used as storage/dump areas.

15 Design Validation of Electrical Infrastructure

Based on validated electrical load and all above guidelines Developer shall prepare Electrical infrastructure design. Submit design documents as under to GIFT PCL for validation.

15.1 SLD & electrical infrastructure

15.1.1 SLD should be prepared at the beginning after considering of short circuit MVA from GIFT PCL.

15.1.2 System should have provision for critical load separation from remote operation of HT panel.

15.1.3 System should be design in such a way that, there should 2 normal buses and one critical bus for one set of LT consumers.

15.1.4 SIMULATION editable model along with SIMULATION generated reports of following analysis shall be submitted to GIFT PCL for approval.

15.1.5 All lift panel and life safety panel should have provision of 2 incomers. Fire lift shall be supplied from critical load panel.

**Table 2: List of submission from developer in
SIMULATION Model**

Sr No.	Particular	Submission for Review report & model
1	Network Analysis	Short Circuit Analysis Load Flow Analysis Motor Acceleration Analysis Transient stability analysis
2	Arc Flash Analysis	AC Arc Flash Analysis for all HT, LT & ELV APFC etc Panel DC Arc Flash Analysis for UPS, Battery & battery charger panels
3	Protection devices	Relay co-ordination & selection analysis Relay sequence of operation
4	Cable Sizing	HT & LT Cable ampacity & Sizing

5	Distribution system Power Quality	Harmonic load flow analysis Optimal Capacitor placement Single-phase power distribution
6	Transformer	MVA sizing of transformer
7	Earthing	Earthing conductor sizing Electric shock protection

16 Validation of equipment rating, sizing and quality assurance plan:

16.1 GIFTCL will validate all equipments rating and drawings based on standards defined in above all clauses.

16.2 Developer shall submit soft as well as hard copy of each submission along with “Letter of Transmittal” in set of three copies signed and stamped by signing authority of developer; GIFTCL will review and issue comments based on the submitted documents along with “Letter of Approval” which shall have codes indicating the status of approval.

16.3 Developer shall process for compliance of GIFTCL’s comments and resubmit the revised submission for approval with “Letter of Transmittal” as described in above point till receipt of final approval from GIFTCL

16.4 Based on final “Letter of Approval” received from GIFTCL for each infrastructure, developer shall submit the final co-ordinated drawing containing all infrastructure of building in along with walk through model of premises. Developer have to submit details of authorized person for breaker operation in building. Developer shall maintain line clearance book for sae operation.

Minimum space allocation for Electrical Equipment

After validation of Electrical infrastructure network by GIFTPCL, Developer shall allocate space based on following guidelines.

17 Space allocation for electrical Utility

17.1 Developer shall place location of electric substation considering following criterion:

17.1.1 The substation location in Commercial, Social and Mixed Usage buildings shall be located preferably on the ground level or on first basement and shall have direct access from the outside of the building for operation and maintenance of the equipment.

17.1.2 All door openings from substation, electrical rooms, etc., should open outwards. Vertical shutters (like fire rated rolling shutters) may also be acceptable provided they are combined with a single leaf door opening outwards for exit in case of emergency. For large substation room/electrical room having multiple equipment, two or more doors shall be provided which shall be remotely located from each other.

17.1.3 The floor level of the substation shall be at the highest point of the basement. (NBC-2016, clause 4.2.1, point 13, Pg no 20).

17.1.4 The transformer shall be a dry type installation with GIS breakers as HT switch gears and ACB or MCCB as medium voltage (MV) switchgear.

17.1.5 No services or ventilation shafts shall open into substation or switch room unless specific to substation or switch room.

- 17.1.6** In order to prevent storm water entering the transformer and switch rooms through the soak-pits, the floor level of the substation/ switch room shall be at least 300 mm above the highest flood water level that may be anticipated in the locality. Also, facility shall be provided for automatic removal of water. (NBC-2016, clause 4.2.1, point 5, Pg no 19).
- 17.1.7** Substation shall not be located immediately above or below plumbing water tanks or sewage treatment plant (STP) water tanks at the same location. (NBC-2016, clause 4.2.1, point 6, Pg no 19).
- 17.1.8** In case of cable trench in substation/HV switch room/MV switch room, the same shall be adequately drained to ensure no water is stagnated at any time with live cables. (NBC-2016, clause 4.2.1, point 28, Pg no 22).
- 17.1.9** Sufficient numbers of the de-watering pumps shall be provided at the probable flooding areas in a building so as to immediately drain the water into the drainage tank, thus avoiding the related equipment from water flooding.
- 17.1.10** There shall be vehicle movement access by main road up to substation room for any type of vehicle, for O&M purpose and shifting of equipment or material, at any time of the day.
- 17.1.11** Sufficient additional space shall be allowed in Substations and switch rooms to allow operation and maintenance and proper means shall be provided for isolating the equipment to allow access for servicing, testing and maintenance. Sufficient

additional space shall be allowed for temporary location and installation of standard servicing and testing equipment. Space should also be allowed to provide for anticipated future extensions.

17.1.12 Substation shall be placed keeping shortest connectivity path with utility tunnel.

17.1.13 Electrical utilities like transformer, HT Panel, LT Panels & APFC Panels etc shall have clear entry and exits from outside of premises for personal as well as for equipments. There shall be clear space for removal, loading, unloading & Transformers and other equipments.

17.2 Electrical Substation Location & Space provision for the Data Centers in the buildings:

17.2.1 Developers shall assess the demand of users in the building, specially for requirement of Data center in any building.

17.2.2 In case of any consideration of data centers in the commercial buildings and Multi Uses Building, the details of the data centers shall be furnished to the Development authority.

17.2.3 Space provision for separate power distribution network shall be planned which need to be in complete isolation to the building electrical distribution network. Thus, additional space provision for all the electrical equipment installations shall be considered as per the details furnished for the data center.

17.2.4 All the related equipment shall be installed preferably at the ground/1st basement floor in accordance with the latest National Building Code.

17.3 Electrical Substation Location in Residential Buildings:

17.3.1 Residential building will be supplied from nearby centralized substation of GIFT PCL. Typical power distribution scheme for residential building is attached in annexure-C. Power for units of residential building will be provided at LT 0.415 kV level whereas common area power will be supplied either of following way:

- a. Common area load below 400 kVA will be supplied at LT level (subjected to approval of Gujarat electricity regulator commission, applied by GIFT PCL)
- b. Common area load above 400 kVA will be supplied at HT level (33 kV Voltage)
- c. developer have to pay service connection charges for all LT & HT power connections.

17.3.2 All the LT switching panels shall be preferable placed at ground/1st basement level and shall have direct access from the outside of the building for operation and maintenance of the equipment. The Metering panels shall be at the periphery of the building premise with direct access from the road/outside.

17.3.3 In case of residential projects having HT supply and related HT equipment, substation location shall be the same as stated for the Commercial, Social and

Mixed Usage buildings as mentioned above. (as per the clause 17.1)

17.4 Transformer.

No oil type transformer shall be allowed inside the building. Where unavoidable reasons, dry type transformers with minimal combustible materials and specific safety installations may be permitted at ground or first basement levels, subject to following conditions:

- a. The transformer room shall have RCC walls on all sides with 4 hours fire resistance, isolated from building walls.
- b. Minimum 3 Meters clearance shall be maintained on all sides of the transformers. The transformer installation drawings as per layout are at Annexure-A.
- c. HT cables inside the building shall be laid at a distance of one meter from columns and beams of the building.
- d. Only dry type transformers shall be installed inside the building.

The recommended transformer room layout drawing with minimum clearances is placed at Annexure-A.

17.5 Minimum Clearances for electrical equipment

17.5.1 Equipment

Table 3: Minimum clearances required for electrical infrastructure

Sr. No.	Description	Minimum Clearances
1	Vertical from Electrical Equipment to ceiling/beam bottom/HVAC duct	1500 mm

2	Front of operating side of High Voltage Switchgear	2500 mm
3	Front / Open able/ Accessible/ operating sides of low voltage distribution board / Panel should have minimum clearance from door opening space. This clear space should not be below the minimum requirement mentioned.	2000 mm
4	In case of two rows of switchgear, one HT and other LT- front to front clearance	2500 mm
5	If there are any attachments or bare connections on back/rare side of panel, clearances should be not less than	1000mm

17.5.1.1 Addition to above due consideration should be given for opening of panel doors, removal of switch gear accessories etc. In such cases necessary additional space shall be considered.

17.5.2 Entry/Exit/Access Doors

17.5.2.1 All switchgear room doors shall be of opening outside type. All doors of switchgear room shall be fire proof 2hr rated.

17.5.2.2 Sliding and Rolling Shutters shall be only for equipment movement and for personnel movement in switch gear room, doors shall be provided.

17.5.2.3 Sliding and Rolling Shutters should have height clearance of 3500mm or maximum height of equipment + 1000mm which will be greater.

17.5.2.4 All exit spaces shall have 1800mm height clear spaces; there should not be any obstructions or projection of any external component within the clear space.

17.5.3 Cut-outs

17.5.3.1 Cut-out for Electrical equipments, ducts should be designed considering appropriate clearances for installing and accessing components from maintenance. Cut out sizes anywhere should not be less than 300mm.

17.5.3.2 All cut out and opening should be sealed with fire rated material.

17.5.4 Metering arrangement

17.5.4.1 Developer shall keep adequate space provision for installing metering arrangement in accordance with no of consumer and type of consumer in building.

17.5.4.2 Developer shall keep space for metering arrangement for each consumer as per below table:

Table 4 : Space requirement for Metering

Type of consumer	Space required for metering
HT consumer (Independent) CTPT Metering	No space is required, if metering is to be done in Utility Tunnel. Suitable space provision is required, if metering is to be done in Consumer premises.
HT consumer (LT metering) CTPT Metering	Separate summation metering panel of adequate size shall be provided by the developer in the electrical room.

<p>LT consumer (LT metering) CTPT</p> <p>Metering</p>	<p>Space in LT panel for installing CT and potential contact from same bus. The minimum dimension of the metering cubicle in the LT panel shall be 400mm (H)x450mm(W)x450mm(D). For metering to be done outside LT panel, minimum space provision for installing metering equipments shall be 600mm(H)x400mm(W) for 3 phase meter and 450mm(H)x250(W) for 1 phase meter. Minimum space between two-meter boxes shall be 50 mm. Space provision for incoming and outgoing cables and cut-out installed by the consumer shall be provided</p>
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18 Sequence for Design/ Document Submission/ Approval process:

18.1 Load Calculation

18.2 SLD preparation considering higher motor load

18.3 Equipment sizing

- 18.4** Simulation report as per clause 15, table:2
- 18.5** Electrical equipment layout in Architectural Layout & elevation
- 18.6** SLD finalization as per actual motor load
- 18.7** CEIG drawing approval
- 18.8** Equipment GA, GTP and QAP approval
- 18.9** Installation of equipment
 - 18.10** Testing of equipment as per field quality plan
 - 18.11** As built drawings
 - 18.12** Operation manuals
- 19 Electrical plan approval from CEIG. Initial inspection by CEIG inspector and approval for charging the plant. Regular annual inspection of plant by CEIG**
 - 19.1** Developer has to do liaison for approval Drawings of substation and distribution network inside building. Developer have to take drawing approval for distribution network from CEIG, Installation work shall commence only after approval of drawing from CEIG office.
 - 19.2** After work completion approval for charging of network is required from CEIG office.
 - 19.3** Developer shall be responsible for inside the building network and GIFTCL shall be responsible for outside the building distribution network approval from CEIG.
 - 19.4** In case of building height more than 15 meters, permission of electrical installation in high rise building is required from CEIG office.
- 20 Equipment installation, testing and commissioning guidelines.**
 - 20.1 Installation**
 - 20.1.1** Field quality plans, method statement, installation checklist and installation manual if any shall be submitted to GIFTCL for approval

20.1.2 During Installation there shall be supervision from the supplier/manufacturer of equipment

20.1.3 Installation checklist for equipment shall be signed and documented in presence of supplier/manufacturer

20.1.4 Material installation report shall be generated along with remarks/observations if any and shall be treated as a part of O& M manual document.

20.2 Testing

20.2.1 Post installation tests as per approved QAP & Field quality plan shall be carried out by developer in presence of supplier/manufacturer of equipment.

20.2.2 Proper combined report of test carried out and test certificates shall be prepared and submitted along with as built drawing.

20.3 Commissioning

20.3.1 Commissioning test report shall be submitted to GIFTCL for review.

20.3.2 Partial commissioning of any system will be treated as pre-commissioning and again whole commissioning process shall be followed for complete system commissioning.

20.4 Operation & maintenance

20.4.1 List of mandatory spares

20.4.1.1 List of mandatory spares such as HT fuse, MCB, termination kits, etc shall be added in the tender specification and requirements.

20.4.1.2 The relevant standards and best industry practises shall be followed for provision of mandatory spares.

- 20.4.1.3 In case of consumable products such as lubrication oil, filters etc quantity shall be kept in spare for minimum one top up/replacement.

20.4.2 Tools & tackles

- 20.4.2.1 Developer shall provide minimum one set of each necessary tool at every electrical room for hassle free O&M of installation.
- 20.4.2.2 Required tools such as insulation tester, tong tester, multi-meter, thermal imager, etc. Shall be provided.
- 20.4.2.3 Storage Space shall be provided within the electrical room for spares and accessories.

20.4.3 Manuals

- 20.4.3.1 One set of combined documents containing shall be handed over to O &M Staff
- i. As built Drawing of all equipments
 - ii. As built SLD
 - iii. As built Layout drawing
 - iv. Set of installation manual
 - v. Set of operation manual
 - vi. Set of troubleshooting manuals
 - vii. Summary of Past historical data recorded during snag & de-snag

20.4.4 O& M Formats

- 20.4.4.1 Recommend maintenance checks shall be provided with clear demarcation of frequency of preventive maintenance classified as hourly, daily, weekly, monthly, quarterly, annually & SOS (as and when required).

20.4.4.2 Maintenance report shall be prepared in through details so as to avoid any breakdown of infrastructure.

21 ACCESS TO CONSUMER'S PREMISES

21.1 The GIFT PCL (Distribution Licensee) or any person duly authorised by GIFT PCL (Distribution Licensee) may, at any reasonable time, and on informing the occupier of his intention, enter any premises to which electricity is, or has been, supplied by him, or any premises or land, under, over, along, across, in or upon which the electric supply-lines or other works have been lawfully placed by him for the purpose of –

21.1.1 Inspecting, testing, repairing or altering the electric supply lines, meters, fittings, works and apparatus for the supply of electricity belonging to the GIFT PCL (Distribution Licensee); or

21.1.2 Ascertaining the amount of electricity supplied or the electrical quantity contained in the supply; or

21.1.3 Removing where a supply of electricity is no longer required, or where the GIFT PCL (Distribution Licensee) is authorised to take away and cut off such supply, any electric supply-lines, meters, fittings, works or apparatus belonging to the licensee.

21.2 A GIFT PCL (Distribution Licensee) or any person authorised as aforesaid may also, in pursuance of a special order in this behalf made by an Executive Magistrate and after giving not less than twenty-four hours notice in writing to the occupier,

21.2.1 Enter any premises or land referred to in sub-section (1) for any of the purposes mentioned therein;

21.2.2 Enter any premises to which electricity is to be supplied by him, for the purpose of examining and testing the electric wires, fittings, works and apparatus for the use of electricity belonging to the consumer.

21.3 Where a Consumer refuses to allow the GIFT PCL (Distribution Licensee) or any person authorised as aforesaid to enter his Premises or land in pursuance of the provisions of Clause 1 or 2, when such GIFT PCL (Distribution Licensee) or any person has so entered, refuses to allow him to perform any act which he is authorised by those clauses to perform, or fails to give reasonable facilities for such entry or performance, the GIFT PCL (Distribution Licensee) may, after the expiry of twenty-four hours from the service of a notice in writing on the Consumer, cut off the Supply to the Consumer for so long as such refusal or failure continues, but for no longer.

21.4 Developers shall permit GIFT PCL to lay cable network or bus duct and metering arrangement on mutually agreed path and place as per prudent practices of power distribution for distributing power in the same building or any other building in nearby area.

22 PROCEDURE FOR POWER APPLICATION

22.1 SUBMISSION OF APPLICATION

The GIFT PCL provide functionality to apply online for new connection and modification in the existing connection. A consumer can access these functionalities on the GIFT

website <https://utilities.giftgujarat.in>. Consumer can apply online for the following:

- Permanent Connection
- Temporary Connection
- Name Change/Transfer
- Demand Reduction
- Demand Extension
- Premise Amalgamation
- Premise Removal
- Shifting of Service
- Change of Category
- Net Metering
- Backup Power
- Green Power
- Removal of Connection

22.2 Along with an application, consumer is required to upload the requisite documents.

22.2.1 Concept & key single line diagram showing metering point

23 O&M Plan

23.1 Operation, maintenance and condition monitoring of equipments and all electrical infrastructure is completely developer's responsibility.

23.2 Its developer's prime responsibility to appoint the operation & maintenance team during handover stage/completion stage of project to avoid any possible hindrances to the tenants of the building.

23.3 Developer to submit the operational philosophy of building electrical infrastructure covering the normal operational

sequence, scheme to cater transformer/HT cable/LT bus-duct failures, changeover scheme for emergency power supply, preventive maintenance, breakdown maintenance, outages planning, condition monitoring, Standard operating procedures of (SOP)O & M etc.

23.4 As built drawings of HT & LT panels, Transformers, APFC panels, LT DB's etc.

24 Housekeeping of network, plant and assets of GIFT PCL

24.1 GIFT PCL shall be responsible for housekeeping of Substation, switching station, switching panel rooms and any other electrical assets outside building area.

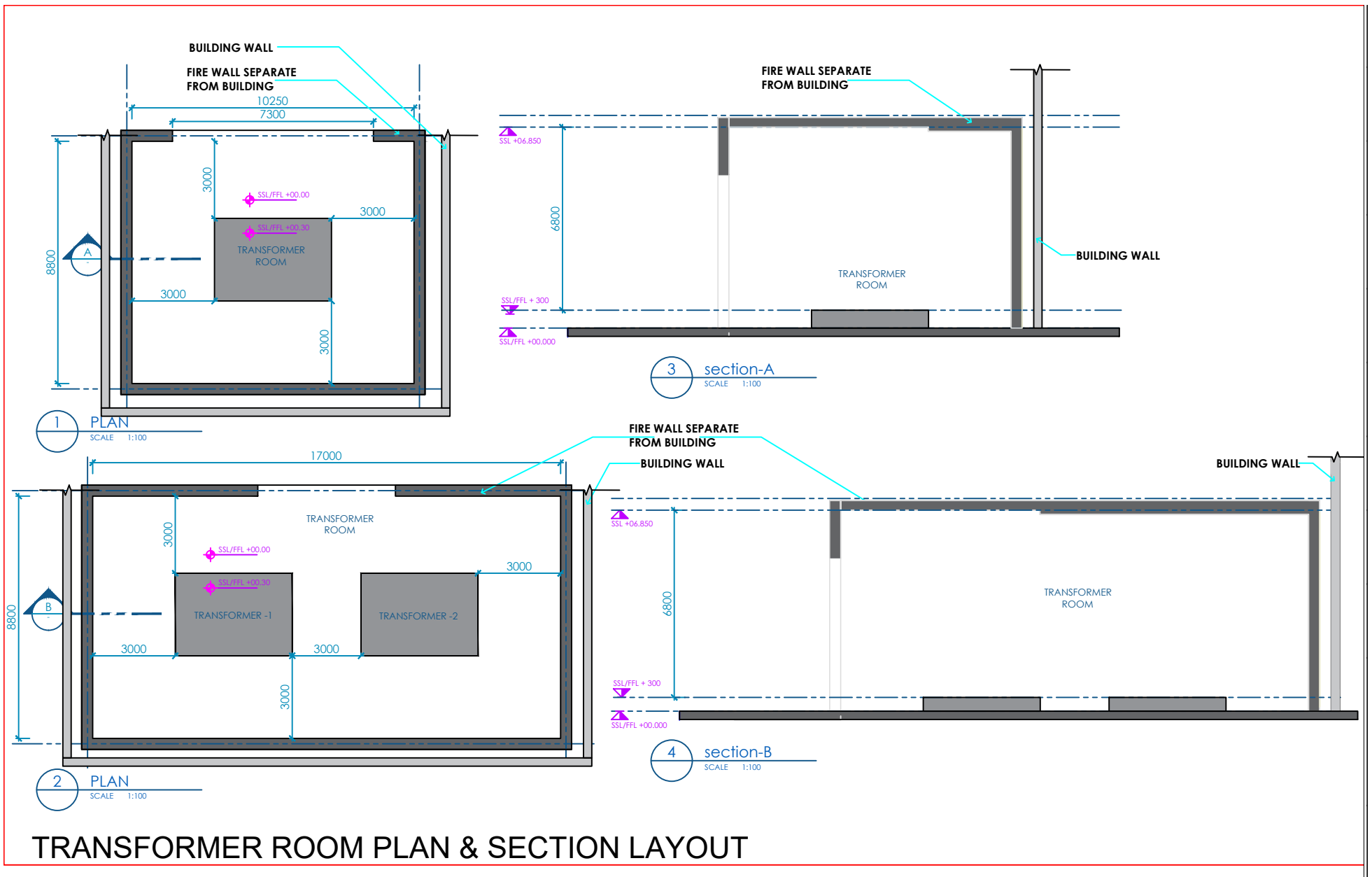
24.2 Developers shall be responsible for housekeeping of electrical rooms in side building including floor level distribution room and cable duct or sand-witch bus duct area under authorised supervision.

25 Charges for Power Connection:

Power connection charges are subject to change from time to time by the Distribution Licensee as per tariff order after approval of Gujarat Electricity Regulatory Commission.

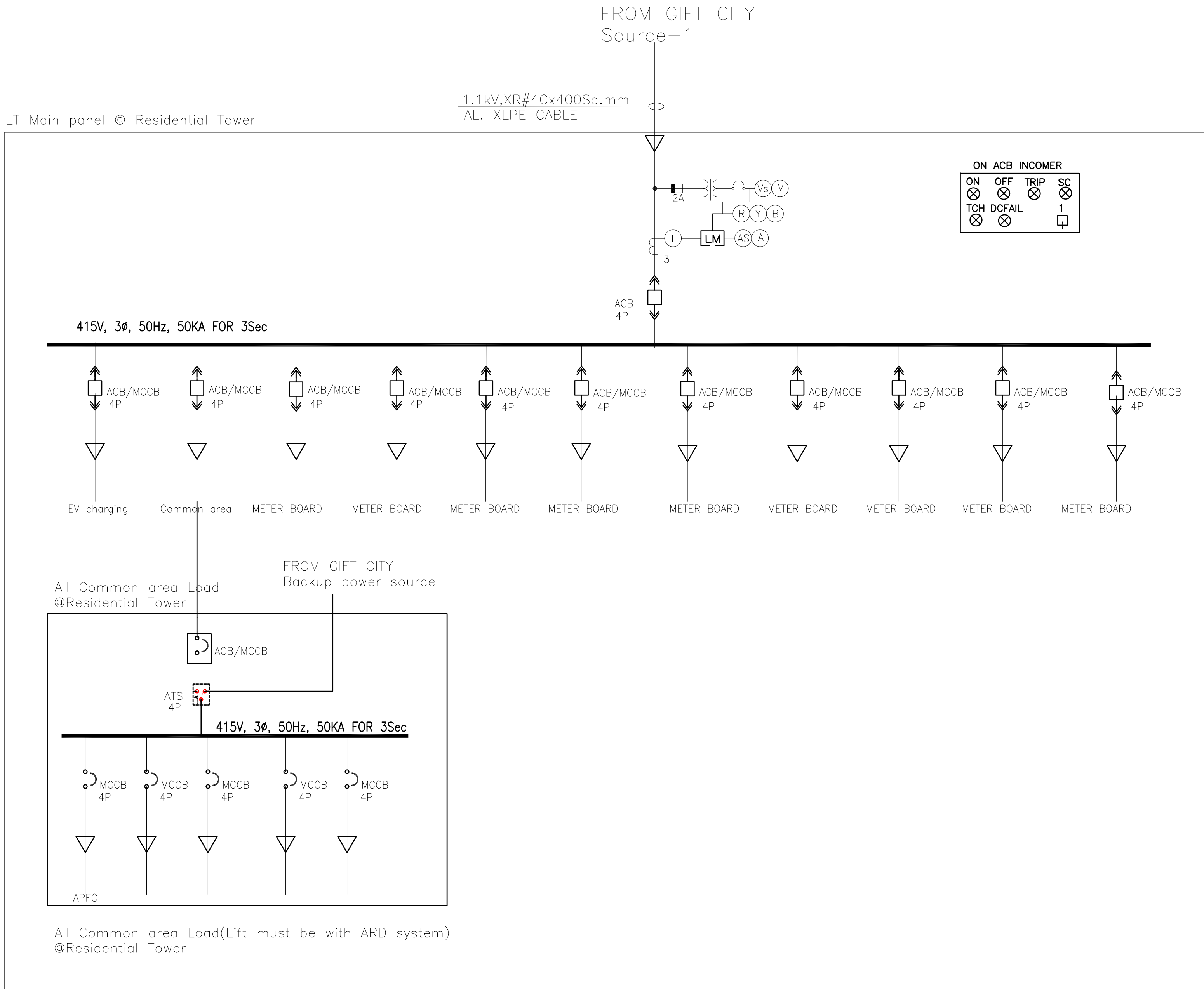
Power connection charges and tariff order can be download from GIFT website <http://utilities.giftgujarat.in>

ANNEXURE-A
TRANSFORMER SPACE PLAN

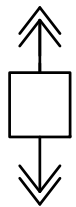


ANNEXURE-B
TYPICAL ELECTRICAL SLD FOR COMMERCIAL
BUILDINGS

ANNEXURE-C
TYPICAL ELECTRICAL SLD FOR RESIDENTIAL
BUILDINGS



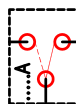
legend



Air Circuit breaker



Molded Case Circuit Breaker



Automatic transfer switch panel

Note:
1. All dimensions are in Meter.
2. Only written dimensions and UTM coordinate reference provided to be followed.
3. Any discrepancy to be brought to the notice of Infrastructure Planning Department before implementation.

Drawn By:
D.M

Date
13/10/2021

Checked By:
P.D

Date
13/10/2021

Approved By:
A.R

Date
13/10/2021



Gujarat International Finance Tec-City Company Ltd.

Zonal Facility Centre, Block - 12, Road 1-D, Zone-1, GIFT SEZ, Gandhinagar - 382355, Gujarat, India

Recommended By: MD & Group CEO

Date 13/10/2021

Issued for

TENDER

Drawing Title:-
Residential SLD
Drawing Subtitle:-
Residential SLD

Drawing Number:-

Scale:-

0 10 20m.

Date:-

13/10/2021

Revision

00

ANNEXURE-D
METERING SCOPE

Annexure D:

Schematic diagram for the metering arrangement, Scope of works for various Buildings in GIFT City.

1. Residential Buildings:

1.1. Case 1:

Power network up to incoming cable of the main LT panel of the premises.

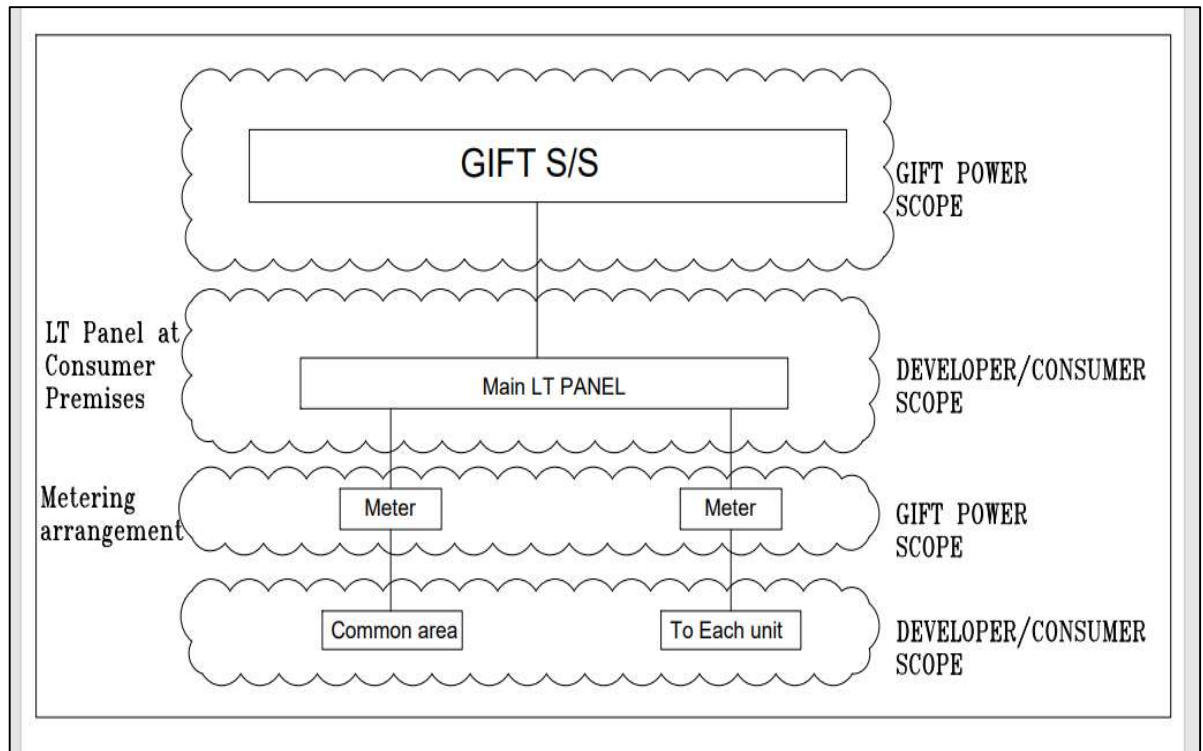


Figure: 1

Case 2:

Power network up to the LT metering point.

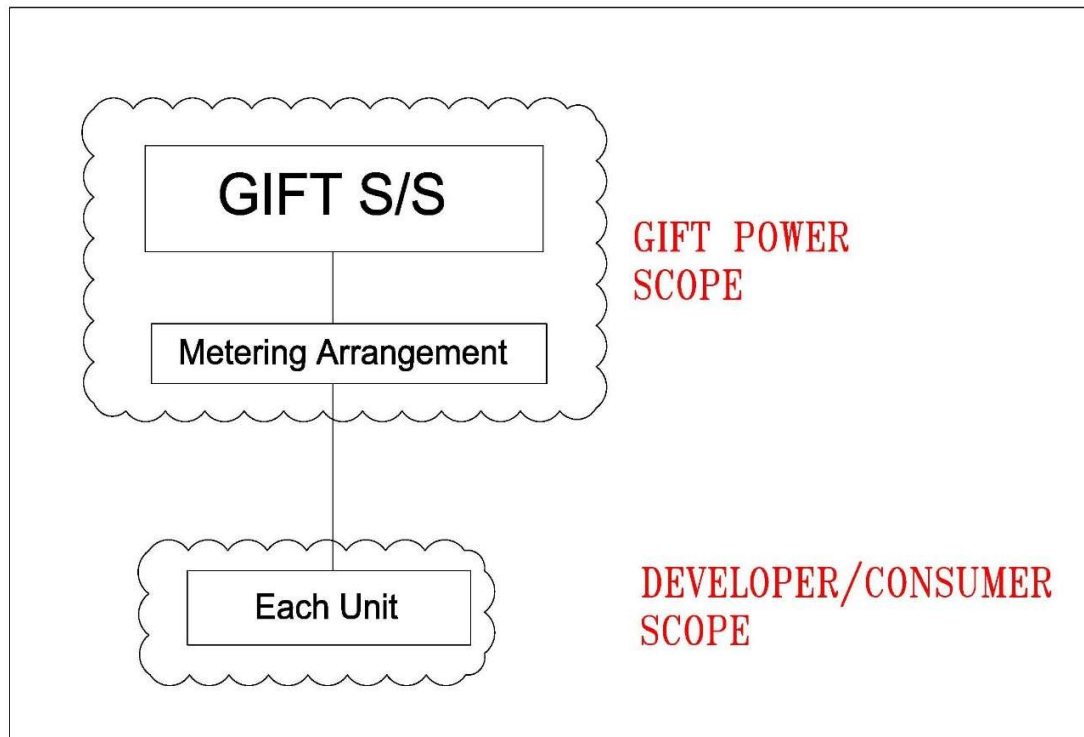


Figure: 2

1.2. Each Unit supply on LT and Common area supply on HT:

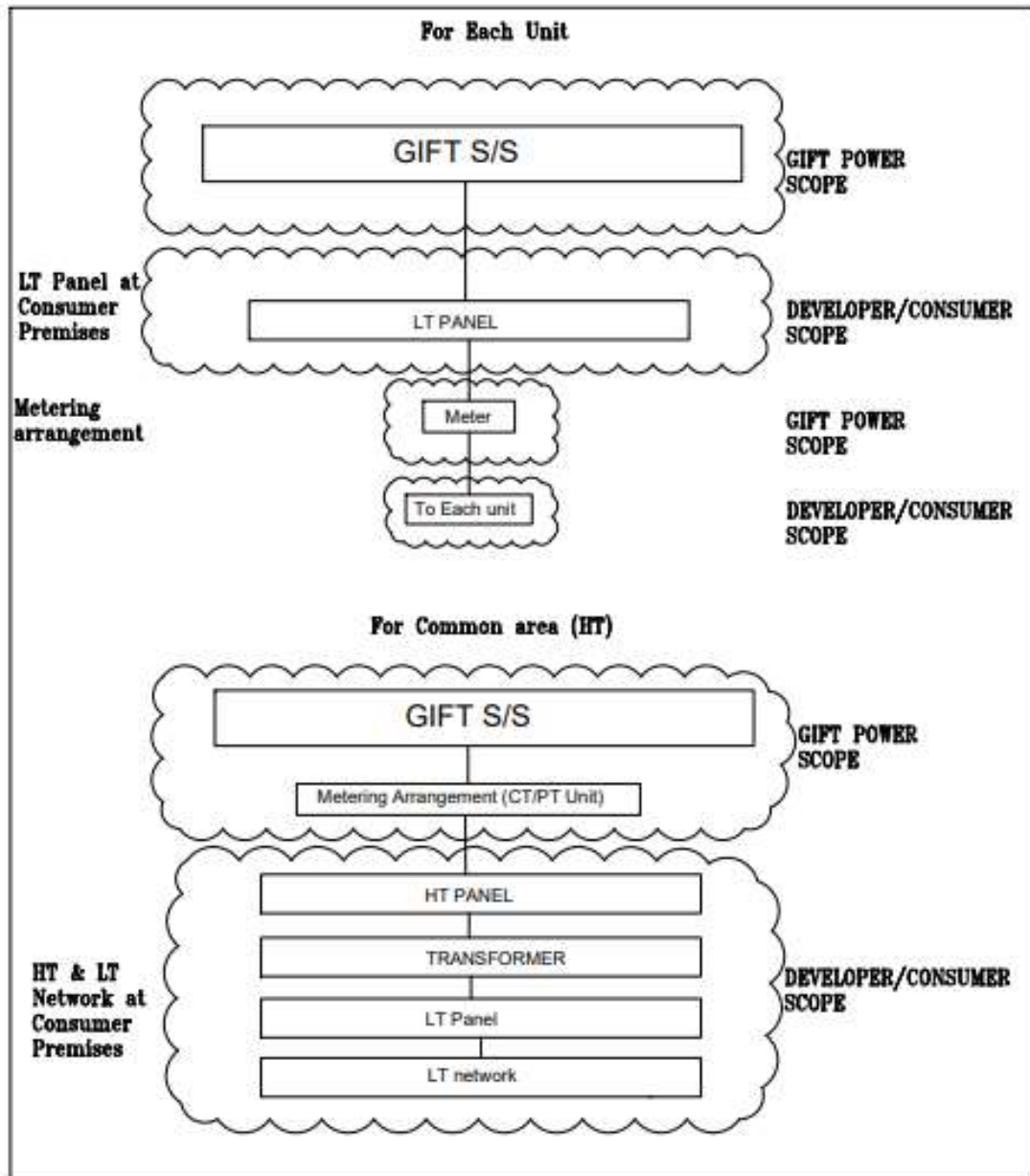


Figure: 3

1.3. Residential scheme as single consumer (HT):

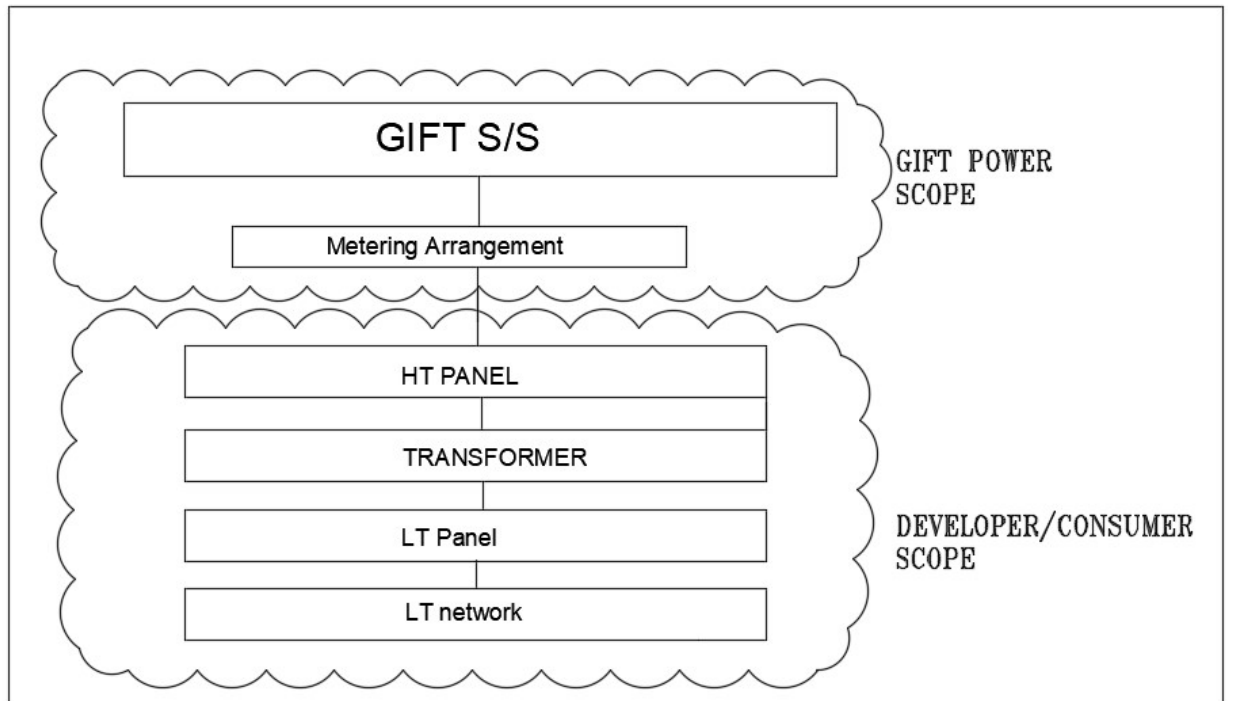


Figure: 4

2. Commercial buildings:

2.1. Commercial Tower as single consumer (HT):

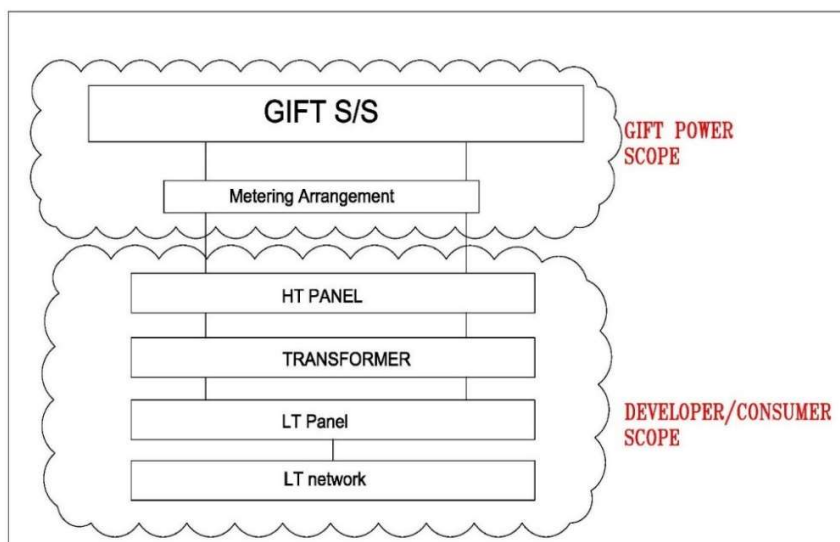


Figure: 5

2.2. Commercial Tower with both HT & LT Consumers:

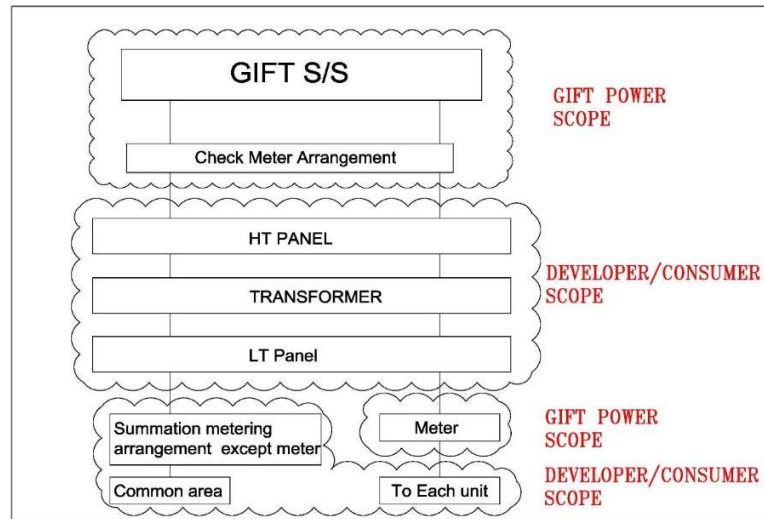


Figure: 6

3. Other buildings and amenities:

3.1. Buildings and amenities like GIFT House, Aspire-3 building, Amenity building etc. with multiple LT consumers.

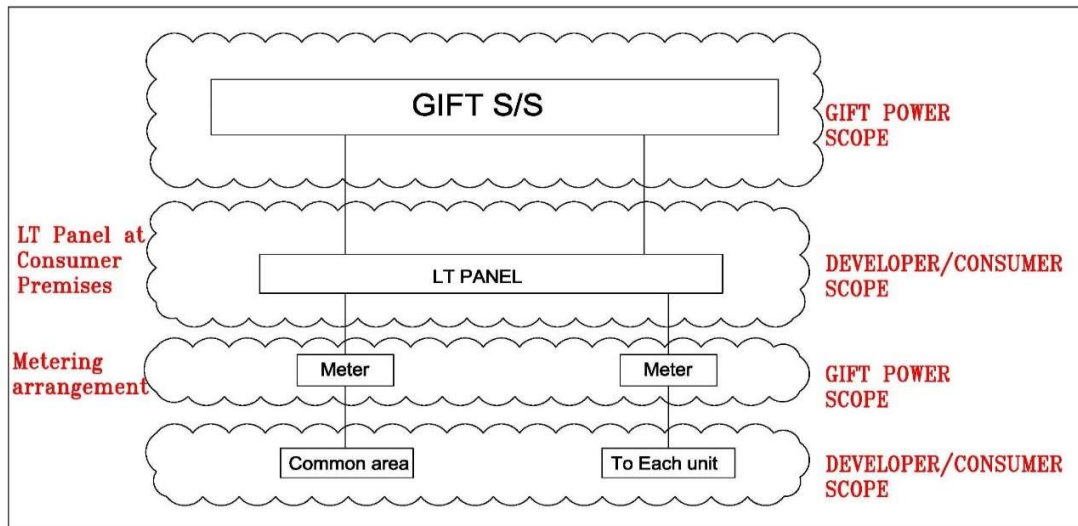


Figure: 7

3.2. Buildings and amenities like School, warehouse, nursery etc. single LT Consumer:

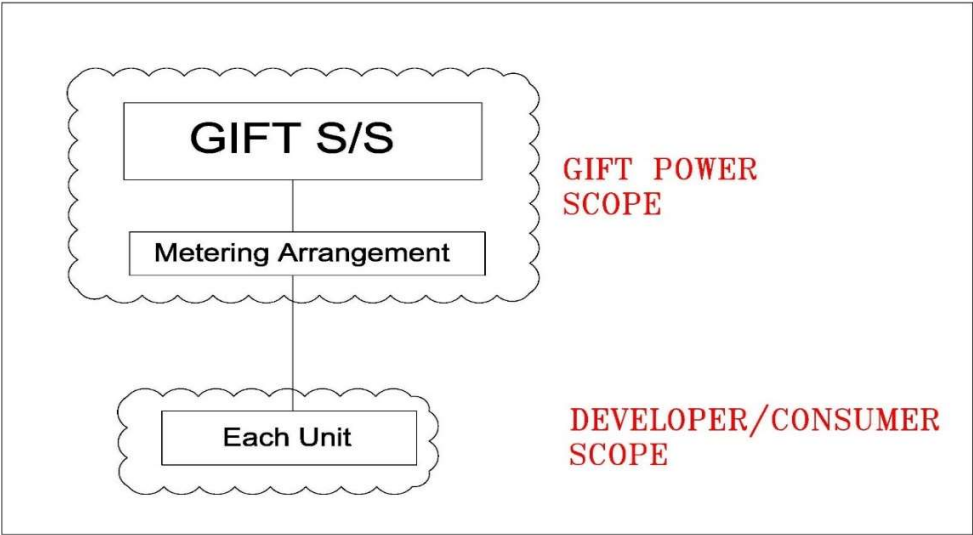


Figure: 8

4. Construction activity:

4.1. Temporary power for construction works:

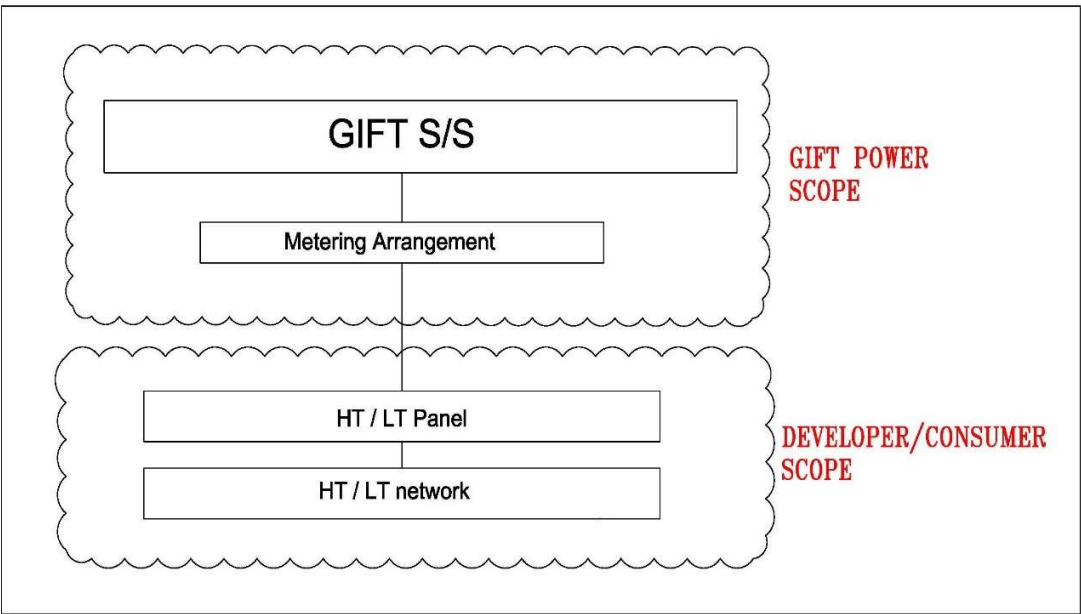


Figure: 9

4.2. Temporary power for interior work within building:

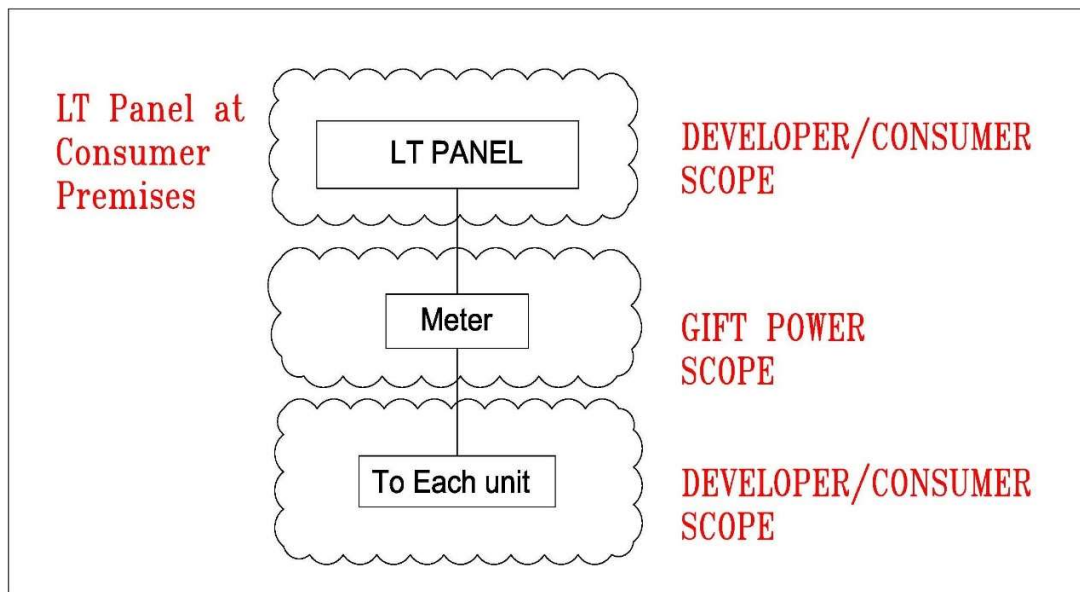


Figure: 10

Note: The developer / user shall be responsible to pay the applicable service connection charges with applicable security deposit and monthly regular electricity charges.

ANNEXURE-E

**TENTATIVE CHECKLIST FOR DOCUMENTS
REQUIRED AT VARIOUS DEVELOPMENT STAGES**

ANNEXURE-E

Submissions/compliances at various stages of Project Development		
Sr.No	STAGES	Documents required
1	Development Permission Stage (DP)	earthing location
		confirmation on HT connections if residential
		Electrical room lay outs
		electrical shaft sizing
		cable routings
		transformer room spacing
		confirmation on plinth for transformer
2	Commencement certificate (CC)	Electrical DBR
		load calculation sheet
		Transformer sizing calculations
		SLD
		APFC calculations
		Short circuit calculations
		Earthing calculations
		Cable Scheduling
		Floor wise Electrical room layouts
		Main transformer room Layouts
		Main HT Panel Room Layouts
		Electrical shaft with bus risers
		Lighting arrestor calculations and Layout
		Cable arrangements in Trays
		Detailed electrical room layouts
		Detailed Lightning arrestor layout with connection details
		Also submissions of the required vendor drawings
		Detailed earthing installation drawings
		Detailed common area lighting and power lighting layout of all floors.
3	Occupancy Certificate	All necessary test reports of electrical installations
		Earthing related test and its reports
		Permanent connection for the Building
		Installation of the metering Panels
		Developer compliances to the comments on site visits

33 kV GIS Panel

1. Scope of work

Supply, installation, Testing and commissioning of 33 kV gas insulated switchgear panel with of 2 incoming, required number of outgoing and one bus coupler and riser with gas insulated breakers, gas insulated busbar panel, gas insulated cable termination chamber, surge arrester, motorized three position switch, required CT and PT along with required smart numerical relays on PRP and IEC61850, EM133 Load Manager, with required accessories and operating accessories such as motor charging handle, disconnector operating rod, voltage presence indicator for all three phases and maintenance tools, with required relay, voltage plug, current plug, meter and SCADA/BMS programming as per specification and single line diagram.

Complete installation shall be done by OEM or OEM & GIFT PCL (both) authorized agency. Only OEM supervision will not be acceptable.

All feeders of GIS panel shall be connected with cable through only inner cone or outer cone type touch proof terminations. All VT shall also be connected through inner cone plugged in.

Cable entry shall be decided based on site condition.

All HV and LV drawing of GIS panel must be reviewed and approved by GIFT PCL and post manufacturing of equipment factory inspection shall be done by GIFT PCL representative based on GIFT PCL's approved drawings and QAP.

Apart from protection core CT, there shall be metering core in the CT having 0.2S sensitivity class and secondary of CT shall be 1 ampere.

Inbuilt power bank with 30 min backup shall be provided in GIS panel with output voltage of 110 V DC. All auxiliary power shall be supplied through 110 V DC only.

2. 33 kV Gas Insulated Switchgear

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, installation at site including testing and commissioning with complete system of 33kV Gas Insulated Indoor switchgear complete with all accessories for trouble free and efficient performance including supply, design, manufacture, and factory production, testing, supervision of installation and commissioning of SF6 gas-insulated vacuum circuit breaker switchgear and associated equipment. 33 kV GIS panel must supplied and installed (which also include field testing and SCADA integration support) by OEM of Approved makes only, any channel partner or system house or authorized distributor will not be accepted.

2.1. Regulations, Guidelines and Standards:

Switchgear	IEC 62271-200 / EN 62271-200
Switchgear	IEC 60694 / EN 60694
Behaviour in the event of internal faults	IEC 62271-200 / EN 62271-200
Three-position disconnect and disconnector	IEC 62271-102 / EN 62271-102
Busbar earthing switch	IEC 62271-102 / EN 62271-102
Circuit-breaker	IEC 62271-100 / EN 62271-100
Current transformer	IEC 60044-1 / EN 60044-1
Voltage transformer	IEC 60044-2 / EN 60044-2
Voltage detection systems	IEC 61243-5
Protection against accidental contact, foreign	
Objects and water	IEC 60529 / EN 60529

Installation

HD 637 S1

2.2. Design Criteria:

Operating Conditions:

Operating Conditions according to	IEC 60694 / EN 60694
Temperature of ambient air:	
Maximum value	50 °C
Average value over 24 hours	35 °C
Minimum value "indoor"	- 5 °C
Installation altitude above sea level up to	1000 m

Rated Normal Current:

The rated normal currents of components are stated in the technical data and shall be valid for design ambient temperature of 40° C.

Internal Arc Fault:

Classifications to IEC 62271-200

Partition class PM

Internal arc classification - AFLR for 31.5 kA 3 sec

- IAC qualification AFLR, or compliance with the internal arc qualification at the outside of the reverse side of the switchgear,
- IAC qualification: AFL for 31.5 kA with duration of 1 second; the current-carrying capacity is 1250 A for 1250 A breaker. Derating calculation is acceptable as per design temperature but maximum allowable derating for 50 °C is 8%.

Insulating gas

Insulating gas Type Sulphur hexafluoride (SF6)

Design pressure *pre* at 20 °C MPa

For 36 kV Class - 70Kpa

2.3. General Requirement:

The switchgear shall be single busbar, SF6 gas insulated, single/ three phase encapsulated suitable for accommodation within a building and capable of continuous operation under the climatic conditions existing at the site.

The design of the switchboard shall be such as to enable bay extensions at either end with the minimum of disturbance to the installed equipment and without other bus section shutdown of the switchboard. The design shall allow high voltage testing of the extended busbar section and bays while the other busbar sections and bays are in normal operation.

The equipment offered shall be adequately protected from all types of system voltage surges and any equipment necessary to satisfy this requirement over and above what is specified, shall be included.

The design shall include all facilities necessary to enable the performance of the specified site checks and tests to be carried out. The Contractor shall state the test facilities provided and indicate any attachments or special equipment provided for this purpose.

Circuit breakers, disconnectors, cable termination chambers, and any other chambers and components must be capable of withstanding a gas overpressure of 130% of normal operating pressure continuously.

All grounding system, special tools and tackles, O & M manuals etc required for erection, operation, testing and maintenance of GIS shall be supplied within the contract price. The requirements of embedded plates and channels for the GIS foundations and maintaining floor tolerances shall be provided by GIS supplier in advance as per requirement of Electricity code and relevant IS, IEE and IEC codes. Anchoring bolts for fixing GIS shall be supplied by the GIS supplier.

A standard mechanical user interface, ergonomically Positioned at a convenient height. It must be visible directly without opening of doors etc

The user interface comprises all the mechanical, panel related interfaces and continuous interrogating interlocks

All the basic mechanical ON/OFF of CB, Isolator & earth switch operation, manual spring charge of CB must be possible without opening the HV door to ensure the operator safety.

Mechanical mimic directly linked to mechanism should be provided at the panel front door.

The basic switchgear unit is to be designed for free standing. All operating and maintenance procedures shall be performed from the front, for enhanced operator safety. The arrangement of the switchgear shall be such as to enable dismantling of a bay without affecting any adjacent bay. However to remove busbar or disconnect a bus shut down or relevant section of the busbar is envisaged.

Panel shall have communicable numerical relays with HMI and communicable trivector energy meter on Modbus TCP/IP protocol. Panel shall have Managed rugged Ethernet switch with Minimum 2 no. of Single mode LC type FO port. Breaker control and feedback shall be communicated through relay only. Managed Ethernet Switch shall be connected in PRP (parallel Redundant protocol) system for communication on panel side and SCADA (PLC) side both. All relay communication must be on IEC 61850. All breaker IO must be communicate to protection relay having inbuilt BI and BO and communicate to SCADA at IEC 61850 protocol.

Tri-vector Energy meter of 0.2S accuracy class along with metering CT of 0.2S accuracy shall be mounted on each outgoing feeders along with summation CTs as specified in SLD. PT signal relay shall be provided for energy metering purpose along with voltage presence relay. A converter can be used for RS485 to TCP/IP. Meter must be communicable on modbus TCP/IP.

33 kV GIS Panel shall be of 'OEM' (Approved make) only, channel partner or system house will not accepted.

2.4. Current Rating

Every current-carrying part of the switchgear including current transformers, disconnecting switches, busbars, connections and joints shall be capable of carrying its specified rated normal current continuously and in no part shall the temperature rise exceed the values specified in relevant Standards. Any derating to meet Site ambient conditions shall be taken into account and declared in the Schedules.

Every part of the switchgear shall also withstand, without mechanical or thermal damage the instantaneous peak currents and rated short-time currents pertaining to the rated breaking capacity of the circuit breaker. The primary rating of the current transformers shall not differ from that of the associated circuit breakers unless specified otherwise.

The design of sliding type current carrying connectors and joints shall be such that they meet the aforementioned conditions over the full permitted range of movement. Where such joints may be made or adjusted on site, full details of alignment procedure, together with any necessary alignment tools or gauges shall be described in the maintenance manual and included in the scope of supply of special tools.

2.5. Connections to Outgoing Circuits

The switchgear shall be so arranged that all outgoing main and auxiliary cables shall be taken from the bottom.

All outgoing feeders including Distribution transformer circuits, shall be suitable for connecting 2 Nos. 33kV three core armoured 300 or 400 Sq.mm, Al XLPE cable with plug-in terminations. However one cable shall be connected at present and the other cable termination shall be provided with H.V. dummy plugs within the quoted price. However dummy plugs shall be supplied for all termination facilities for spare circuits.

The outgoing compartment dimensions shall be enough to accommodate the required number of cable cores and shall be easily accessible to allow maintenance works and/or

quick replacement of the cable.

Sealing ends shall be provided with all fittings including flexible connections where necessary. Stress cones or other approved means for grading the voltage stress shall be provided for insulating the cable within the sealing end. Glands shall be insulated from the chamber.

The insulation between cable and the switchgear enclosure shall be capable of withstanding a dry high voltage test of 10 kV a.c. for one minute and 10 kV d.c. for one minute.

2.6. Gas Compartments

The switchgear units shall be divided into several gas-filled compartments, sealed from each other by gas- tight partitions so that any leakage may be quickly localized. Each Gas compartment must have repair opening to access primary part in case of emergency inside Gas tank at site.

Proposals for the partitioning of gas zones shall be clearly indicated on the drawings submitted with the tender.

The equipment and connections within each compartment shall be so arranged as to allow ready removal and replacement of any section with minimum isolation and disturbance of adjacent pressurized sections.

This feature should also permit the erection and testing of extension units alongside equipment already in service with the minimum of outage time being required for final connections.

Suitable arrangements shall be provided for the thermal expansion and contraction of the busbars and busbar chambers without detriment to the current carrying capacity or gas volume.

Special attention shall be paid to the sealing of housing joints so that leakage of SF6 gas is

kept to an absolute minimum.

Devices shall be provided for each gas compartment to allow for pressure relief to the switchgear room. All relief devices shall be located such that operation of the devices shall not endanger personnel working on the equipment or in the vicinity of the equipment. Where necessary the devices shall be fitted with cowls to deflect any gases or fragmented parts away from locations where personnel may be expected to be present. Inter-Connection between Buscoupler & Raiser must be inside SF6 gas.

Each separate compartment or gas zone must be provided with its own device for monitoring continuously the gas density. These devices shall be arranged to give individual compartment indication in the local control units and initiation of remote alarms. Means shall also be provided to facilitate the checking of moisture content and gas purity. All gas density monitors shall be temperature compensated type with sufficient No. of alarm and lockout contacts for local, remote and SCADA indications.

2.7. Circuit-Breakers

Circuit breakers shall be Vacuum type. The circuit breakers shall be suitable for an operating sequence of O-0.3 S CO 3 min CO. Circuit breakers shall comply with IEC standard 62271-100 and shall have valid type test report based on the above standard conducted on an independent test lab or witnessed by independent observers. Evidence of type test report as per the standard shall be submitted along with offer. The capacitive current switching, line charging and cable charging current, restrike performance, mechanical & electrical endurance, making and breaking current etc. shall be as per IEC 62271-100. The circuit breakers shall have first pole to clear factor of 1.5. The transient recovering voltage performance shall be as per IEC. All circuit breakers whether cable or OHL shall be suitable for auto reclose duty. All circuit breakers shall be suitable for switching 20 MVAR shunt reactor and also 20 MVAR capacitor banks. Evidence shall be submitted for circuit breaker switching duty for reactive compensation system. Any over voltage protection device included for such duty shall be clearly stated in the tender offer.

The offered circuit breakers along with operating mechanism shall preferably be type tested for mechanical endurance class M2. If the bidder does not have circuit breakers of class M2 in the production range, alternately class M1 may also be offered. If the circuit breakers are not type tested as per the IEC 62271-100, the new type tests shall be conducted preferably in an independent test laboratory. If tests are performed on manufacturer's premises, the tests shall be witnessed by independent observers. The above tests shall be conducted without any cost implication to GIFT PCL.

The three-pole vacuum circuit breaker with its maintenance-free maintenance vacuum interrupters is installed in the gas compartment.

The action of force on the movable switching contacts is exclusively effected in the required switching direction. The vacuum interrupter chambers and the metal bellows pertaining to them are protected by their supporting structure against inadmissible distortion and the action of force. All 3 vacuum interrupters are actuated together via 1 shaft from the circuit-breaker drive.

2.7.1. Vacuum Circuit-Breakers

Circuit breakers employing the vacuum interruption principle shall incorporate vacuum bottles of declared and established manufacturer. Each interrupter shall be capable of individual adjustment for correct operation and easy removal for maintenance or replacement. Full instructions for monitoring the contact life shall be provided to the approval of the Authority.

Vacuum bottles shall not require the addition of insulation or stress shielding to achieve the necessary dielectric strength externally and shall not be mechanically braced by components, which may reduce the integrity of the insulation across the open gap.

2.8. Circuit-Breaker Operating Mechanism

The circuit-breaker operating mechanism shall be power operated. Operation will normally be from a remote or supervisory position but facilities shall be provided for operation locally by electrical release and by direct manual release from stored energy devices. It shall be possible to lock each local control function when circuit breaker is in the open position. Operation counters of non resetable type shall be fitted to all circuit-breaker mechanisms.

The mechanism and its control scheme shall be such that, in the event of an electrical tripping pulse being applied to the circuit-breaker during the closing stroke, or of the mechanism failing to latch in the closed position, the circuit-breaker shall open fully and in such a manner as to be capable of interrupting its rated breaking current.

The mechanism and its control scheme shall be such that the mechanism shall not make repeated attempts to close the circuit- breaker when the control switch is held in the CLOSE position in the event of failure to latch on the first closing attempt or in the event of a trip signal being given to the circuit-breaker.

The electrical closing and tripping devices, including direct acting solenoid coils and solenoid operated valves, shall be capable of operation over the ambient temperature range when the voltage at their terminals is any value within the specified auxiliary voltage range.

The circuit breaker shall be driven by a single mechanism coupled to the three phases and suitable for rated operating sequence O-0.3 S CO-3 min-CO.

Spring operated mechanisms shall have the following additional features:-

(a) If the circuit breaker is opened and the springs charged, the circuit breaker can be closed and then tripped.

(b) If the circuit breaker is closed and the springs charged, there shall be sufficient energy to trip, close and then trip the circuit breaker.

(c) Mechanical indication shall be provided to indicate the state of the spring. This indication shall be clearly visible from the front of the breaker. In addition, suitable contacts shall be

provided which may be used for remote indication.

(d) Motor charged mechanisms shall be provided with means for charging the springs by hand, and also a shrouded push- button for mechanical tripping initiation.

(e) Under normal operation, motor recharging of the operating spring shall commence immediately and automatically upon completion of each circuit-breaker closing operation. The time required for spring recharging shall not exceed 30 seconds.

(f) It shall not be possible to close a circuit breaker, fitted with a motor charged closing mechanism, whilst the spring is being charged. It shall be necessary for the spring to be fully charged and the associated charging mechanism fully prepared for closing before it can be released to close the circuit-breaker.

All operating coils for use on the D.C. supply shall be connected so that failure of insulation to earth does not cause the coil to become energised.

Tripping and closing circuits shall be provided with MCBs on each unit and shall be independent of each other and all other circuits. The MCBs shall be equipped with auxiliary contacts for remote / SCADA signalling.

Auxiliary switches shall be provided in circuit-breaker tripping circuits to interrupt the tripping supply as soon as the circuit- breaker has completed the tripping operation, and to interrupt the closing supply as soon as the circuit breaker has completed the closing operation.

Approved mechanically operated indicating devices shall be provided to indicate whether a circuit-breaker is in the open or closed, isolated or earthed position.

Locking facilities with padlocks shall be provided so that the circuit breaker can be prevented from being closed when it is open. These facilities shall not require the fitting of any loose components prior to the insertion of the single padlock required. It shall not be possible to lock mechanically the trip mechanism so as to render inoperative the electrical tripping.

Where earthing through the circuit breaker is adopted the method of earth position selection shall be arranged to disconnect the trip supply in the earth position.

2.9. Disconnecting Devices and Remote Operation

All circuit-breakers shall be connected to their associated busbars through disconnectors of an approved design which shall be arranged for operation whilst the busbars or feeder circuits are live. The disconnecting devices shall be suitable for remote operation and status indication shall also be provided. Disconnectors shall comply with IEC 62271-102 standard. The motor operating mechanism shall be employed for disconnectors. Also emergency hand operation facility shall be provided.

2.10. Local Control

Each circuit-breaker shall be provided with local control facilities including local control switches and a mimic diagram for the operation and status indication of the circuit-breaker and all associated disconnectors and earth switches together with selector switches to prevent local, remote/supervisory controls being in operation simultaneously.

Local manual release facilities shall be provided for closing and tripping the circuit breaker. The operation of both releases shall be subject to lockout if insufficient stored energy is available. Local manual releases shall be provided with locking off facilities.

Sufficient electrical terminals shall be provided for the termination and interconnection of all cabling associated with remote and supervisory control, alarms, indications, protection and local ring main supplies.

The LV compartment shall have sufficient space to accommodate all components, wiring, terminals, MCBs, aux. Relays, control switches and position indicators etc. The terminals of CT circuits, VT circuits etc. shall be wired upto LV compartment from CTs and VTs etc. for field wiring.

The terminal block for each application ie, CT circuits of each function, VTs, control, status

and alarms, Scada circuits, AC supplies, DC supplies, bus wires etc. shall be properly segregated and labelled to suit the application.

The CT terminal blocks shall have shorting, isolation and injection test facilities whereas VT terminals shall have isolation and injection test facilities ie, two separate types complying the above requirement shall only be applied for CTs and VTs. VT terminal blocks shall not have any provision for shorting. Ferrule Nos. shall be provided for all wiring as per the specifications of small wiring and termination. The control switches to be provided for local operation of CBs, disconnectors, earth switches etc. shall be lockable, spring return to neutral position type ie, 3 positions 'close - neutral - open'. However the local/remote selector switch shall be supplied with two positions type, lockable, key free in remote positions only. LV compartment shall have door limit switches and panel illumination. Also a heater controlled by humidistat and heater on/off switch, 'heater on' indication lamp etc. shall be provided in the LV compartment. A separate lamp test push button (black colour) for testing all the indication lamps shall be provided. All CT circuit wiring of the LV compartment shall be with minimum 4 sq.mm colour coded multi stranded wires whereas other DC wiring shall be 1.5 sq.mm grey colour multi stranded wires. VT & AC circuit to be wired by 2.5sqmm wires.

2.11. Disconnecting and Earthing Switches

Disconnectors and earth switches shall have valid type test report as per IEC 62271-102 conducted on an independent test lab or witnessed by independent observers. Evidence of type tests as per IEC 62271-102 shall be submitted along with tender.

Disconnecting and earthing switches shall be arranged to permit safe maintenance of any section of the equipment when the remainder is live. Disconnecting switches shall be arranged for operation while the equipment is live, but will not be required to break current other than the charging currents of busbars and connections.

Switch mechanisms shall be so designed that the disconnector cannot be opened by forces

due to currents passing through it and shall be self-locking in both the "open" and "closed" positions. The mechanism shall open and close all three phases simultaneously. Busbar disconnectors shall have the capability of loop current breaking during on load bus transfer.

Local mechanical position indicators shall be provided on all switches and shall be visible from the front side of the panel.

For safe isolation and earthing of the busbars and feeders, fault-making spring driven disconnector/earth switches shall be provided. The contacts shall have the same fault making capability as that of the circuit breaker, As an alternative to the fault making earthing switches, circuit breakers may be used for the earthing, of the outgoing feeders and busbars. In such case adequate interlocking facilities shall be provided, subject to approval of GIFT PCL. In addition, emergency hand operation shall be provided.

2.12. Interlocking

An interlocking scheme shall be provided which takes into account the following basic requirements. All interlocking shall be submitted to GIFT for approval before starting the schematic diagram.

- (a) To safeguard maintenance personnel who may be working on one section of the equipment with other sections live.
- (b) To prevent incorrect switching sequences which could lead to a hazardous situation to plant, equipment and personnel.
- (c) To prevent earthing of live circuit.

The interlocking scheme shall be electrical for all operational interlocks and preferably of the mechanical/key type for maintenance safety interlocks but shall be effective when the equipment is being controlled locally, under emergency hand operation or from a remote position.

All mechanical interlocks shall be applied at the point at which hand power is used so that stress cannot be applied to parts remote from that point.

All electrical interlocks shall so function as to interrupt the operating supply and a system of interlocks shall be provided which shall cover the emergency hand operation of apparatus which is normally power operated. Failure of supply or connections to any electrical interlock shall not produce or permit faulty operation. Electrical bolt interlocks shall be energised only when the operating handle of the mechanism is brought to the working position. Visible indication shall be provided to show whether the mechanism is locked or free. Means, normally padlocking, shall be provided whereby the bolt can be operated in the emergency of a failure of interlock supplies.

Where key interlocking is employed tripping of the circuit breaker shall not occur if any attempt is made to remove the trapped key from the mechanism. Any local emergency-tripping device shall be kept separate and distinct from the key interlocking.

2.13. Auxiliary Switches and Contactors

Auxiliary switches shall be provided on all circuit breakers disconnectors and earthing switches for local, remote & SCADA indication, control and interlocking. With each circuit-breaker, disconnecting device, and earthing device, there shall be supplied all necessary auxiliary switches, contactors and mechanisms for indication, protection, metering, control, interlocking, supervisory and other services. All such auxiliary switches shall be enclosed in dust free housing. Not less than four spare auxiliary switch ways shall be provided with each circuit breaker, disconnectors and earthing switches. All auxiliary switches shall be wired up to a terminal board on the

L.V panel of the switchgear whether they are in use or not in the first instance and shall be arranged in the same sequence on all equipment.

Switches shall be provided to interrupt the supply of current to the tripping mechanisms of the circuit breakers directly, once the operation of the latter has been completed. All such

switches and mechanisms shall be mounted in approved accessible positions clear of the operating mechanism and shall be adequately protected. The contacts of all auxiliary switches shall be strong and shall have a positive wiping action when closing.

Direct acting auxiliary switch contacts shall be used in conjunction with busbar protection schemes in case of duplicate busbars.

If sufficient aux. Contacts are not available, the contacts shall be multiplied by using suitable latching relays (bistable relays) so that the failure of DC supply shall not cause a mal-operation or undefined position of circuit breakers, disconnectors or earth switches.

If any discrepancy between the aux. Contacts and latching relay contacts, this shall be monitored and alarmed locally and for remote indication. Master trip relay shall be auto reset type through SCADA signal.

All repeat relays are subject to approval of GIFT PCL.

2.14. Current Transformers

Current transformers shall be of the toroidal core type and shall be located on the feeder side of the circuit breaker and on both sides for bus section CB and shall be part of panel assembly. CTs shall be encapsulated and protected from the adverse effect of atmospheric conditions.

The rated short-time thermal current shall not be less than the through fault capacity of the associated circuit breakers.

The characteristics of current transformers shall be submitted to GIFT PCL for approval together with details of the protection, instrumentation and measuring equipment with which each current transformer is to be used. Each current transformer shall be capable of providing the necessary output to operate the related devices satisfactorily at the connected burden and accuracy class.

Each current transformer shall have a continuous maximum rating of at least 1.2 times the rated current as specified in single line diagram. The characteristics and capacities of current transformers used for protective gear circuits shall be calculated by the manufacturer who shall prove by calculation the suitability of the CT's provided in conjunction with the relay manufacturers requirements for the relays and equipment offered.

Where multi-ratio secondary windings are specified a label shall be provided at the secondary terminals of the current transformer indicating clearly the connections required for each ratio. These connections and the ratio in use shall also be shown on the diagram of connections. The secondary windings shall be earthed at one point through a removable link, which shall be in the relay/control panels and instrumentation. All different CT ratios terminals shall be wired upto terminal block LV compartment to facilitate easy selection. The CT ratio selection shall be possible without disturbing CT wires and on load.

Terminal boards shall have shorting, disconnecting and injection facility to allow testing with the circuit in service and on load.

The secondary windings of each set of current transformers shall be capable of being open circuited for one minute with the primary winding carrying the rated current.

All current transformers shall be installed with the P1 terminals adjacent to the busbars. The polarity of the primary and secondary windings of each transformer shall be clearly indicated at the respective terminals and in addition labels shall be fitted in a readily accessible position to indicate the ratio, class and duty of each transformer.

The current transformer particulars as specified in IEC 60044-1 and IEC 60044-2 shall be given on an accessible plate mounted external to the current transformer.

Where current transformers have to be supplied for mounting in apparatus provided under other contracts, the Contractor supplying the current transformers shall be responsible for making all necessary arrangements to ensure compatibility with the other Contractors, through the Authority.

2.15. Voltage Transformers

Voltage transformers shall be of electromagnetic type.

They shall be a part at the panel assembly. They shall be capable of discharging the capacitance of line, cables and switchgear, which may remain connected to them during switching operations. The Contractor shall declare any limitations of the equipment for this duty.

The neutral side of all voltage transformers shall be earthed.

Voltage transformer shall have two position disconnect switch, Voltage transformer secondary miniature circuit-breakers shall be provided as close to each voltage transformer as possible and shall be labelled to indicate their function, phase identification, etc. For single-phase voltage transformers separate earth links for each secondary shall be provided and each neutral lead shall be connected together at a single earth point in the local control cubicle. Earthing of the VT HV winding shall be through a link separate from the LV winding.

The ratio and phase angle errors of voltage transformers shall not exceed the permissible limits prescribed in the relevant Standard.

Voltage transformers shall be capable of carrying continuously without injurious heating 50% burden above their rated burden and shall withstand 1.9 times rated voltage for 30 seconds as specified in single line diagram.

It shall not be possible for the voltage transformer secondary circuits to be connected in parallel, except through interposing voltage transformers associated with synchronization scheme to prevent any possibility back energization through synchronizing circuits.

Busbar VTs shall be connected by using isolator/3 position switches. Line VTs shall have disconnecting facilities.

When meters are provided with voltage signals for VTs not connected directly to the same

circuit, as the current transformers then the voltage signals shall be wired through auxiliary contacts to break the circuit automatically when the circuit breaker is open.

The VT shall meet the requirements as per IEC-60044-2 IEC 60044-7 and IEC60044-8 or a combination of both are acceptable. Current & voltage Sensors are not acceptable.

2.16. SF6 Immersed Insulation

Busbars and items of switchgear shall be supported in the enclosures by insulators of materials compatible with SF6 gas and the products of gas decomposition.

Gas barrier insulators shall comply with the specified conditions for sealing of enclosures. GIFT PCL shall be advised of design pressures used and may require test evidence to substantiate performance under extremes of differential pressure and temperature.

The insulators shall be free at all times of partial discharges at all voltage levels within the working range and shall be tested for voids and partial discharges during manufacture.

2.17. Gas Losses

The Manufacturer should be prepared to guarantee the equipment for a gas loss of not more than 0.1% per annum in any single gas compartment. In case of extensive and repeated gas leakage at any time during the warranty period, the Authority will have the right to request the contractor to replace the part of the assembly, which caused the leakage. All costs associated with such works shall be borne by the contractor.

2.18. Earthing System

All metal parts other than those forming part of any electrical circuit shall be earthed to the earthing system. Any necessary terminals on any part of the equipment required for this purpose shall be provided by the Contractor.

Earthing conductor cross section shall be in accordance with the overall fault level calculation. Busbar sizing calculation shall be submitted for approval. The earthing shall be

at not less than two points.

2.19. Locking Devices

Locking devices shall be provided for securing each control switch in the "neutral" position, each control selector switch in all positions and for securing each disconnect and earthing switch operating handle in either the "open" or "closed" position.

2.20. Anti-Condensation Heaters/Lights

Anti-condensation heaters of an approved type shall be provided inside each control cubicle. They shall be shrouded and located so as not to cause injury to personnel or damage to equipment. The heaters shall have humidistat control and shall be arranged to cut off when the cubicle internal temperature/humidity exceeds safe value. 'Heater on' indication shall be provided. Also, door limit switch and internal lighting shall be provided for LV compartment.

2.21. Gas Handling Equipment

A mobile Gas handling unit with SF6 gas shall be provided for each new substation to permit emergency topping up of gas in the switchgear in the event of leakage.

The gas handling unit shall be capable of evacuating air from the switchgear compartments and replenishing them with gas.

All necessary pipe work, flexible hoses, couplings, valves, pressure and vacuum gauges shall be included to enable interconnection between the switchgear compartments and gas handling unit.

An approved portable SF6 gas leakage detector shall also be provided for each new substation.

2.22. Installation

Complete installation shall be done by OEM or OEM & GIFT PCL (both) authorized agency.
Only OEM supervision will not be acceptable.

2.23. Technical Data

2.23.1. Bus Rating

33 kV GIS, 31.5 kA 3s, Single Bus Bar 1250 A @ max. 50 °C

2.23.2. Required technical parameters

Electrical Data:

Rated voltage	36 kV
Rated operating voltage	33 kV
Rated frequency [Hz]	50
Rated power-frequency withstand voltage	70 kV
Rated lightning impulse withstand voltage	170 kV
Rated short-time withstand current	31.5 kA
Rated short-circuit duration	1 s
Rated peak current	63 kA
Rated operating current busbar	1250 A

Degree of Protection:

Main circuits	IP 65
Drives	IP 3X
Cable connection compartment	IP 3X
Low voltage cabinet	IP 4X

Auxiliary Voltage:

Control	110 V DC
Motor	110 V DC
Protection system	110 V DC
Remote control	110 V DC
Remote Signals	110 V DC
Socket/lighting/heating	230 V AC

IAC Classification acc. to IEC 62271-200

Classification IAC	AFLR
Internal arc	31.5 kA 1 s

Installation:

Minimum ceiling height	4000 mm
Minimum clearance front	1700/ 2100 mm
Minimum clearance to side left	100 mm
Minimum clearance to side right	100 mm
Minimum clearance to rear wall	1500 mm

Properties:

Pressure relief duct	Not Required
SF6 pressure control	IDIS
Voltage Indication System	Digital
Control panel	mechanical
Mech. Operation	Closed door Operation
Mechanical Endurance	M2

Electrical Endurance

E2

Rated short-circuit breaking current

31.5 kA

All panel shall have redundant managed ethernet Switch connecting with IEC 61850 relay through Ethernet cables as indicated in system architecture and provide fibre optic output, space provision is also required for LIU for fibre optic cable termination.

All SCADA signal cables shall be in conduit or any other shielding material for minimizing electromagnetic interference.

All control and feedback signal shall be connected to individual feeder panel relay, bus coupler control and feedback signal shall be connected to nearby feeder panel relay.

Auto Voltage selector switch shall be provided for summation metering from both side of bus coupler.

LV chamber shall have trivector meter of Secure make (model primer 500) and shall be communicable on NBIOT.

OEM have supply required 33 kV termination kit suitable for 33 kV gas insulated switchgear panel with all incoming and outgoing feeders.

Individual power bank shall be provided with each panel board for DC backup of all DC components including relay, coils, DC motors etc.

2.24. Low-voltage cabinet

The low-voltage cabinet, which is mounted on top of the basic module. The interfaces between the low-voltage end and the individual modules are to be achieved with a pluggable design.

The gas-insulated clad compartments for the circuit-breakers and bus bars shall have non-magnetic stainless steel housings.

Circuit-breaker and three-position switch drives are to be designed with mechanical interrogation interlocks and shall include all necessary auxiliary devices (auxiliary switches, releases etc.)

The two- or three-position disconnectors are to be designed with separate manual and/or

motorized drives for the disconnecter and earth switch functions.

By putting the earth switch in the “Earth” position, the circuit breaker shall be positively connected to the outgoing feeder earth (intertripping circuit; making additional switching operations unnecessary).

All switching device drives shall be located outside of the gas compartments, for easy access. Under normal operating conditions for indoor switchgear units in accordance with IEC 50594 and when complying with the specified number of operations, no maintenance is required.

2.25. Functional compartment:

Circuit-breaker clad compartment	– Gas insulated compartment
Busbar clad compartment	– Gas insulated compartment
Cable connection / transformer clad compartment are to be equipped with individual pressure relief devices.	- Air insulated Compartment
Low voltage cabinet	- Air Insulated Compartment

2.26. Tests

2.26.1. Type Tests

Type tests shall have been carried out on the switchgear components in accordance with the relevant IEC standards preferably in an independent test laboratory.

The performance of the components of the switchgear shall be substantiated by test data relevant to the particular designs offered. The type test certificates issued by Test Laboratories for the type of equipment offered or similar design shall be tabulated in the schedule enclosed with the tender.

Evidence of valid type tests shall be submitted with the Tender and shall include dielectric tests, temperature rise tests, short-time current tests and mechanical endurance tests

together with evidence of tests to verify the making and breaking capacity of the included switching devices and other primary components. All other test certificates as per relevant IEC standard shall also be included.

Evidence of Type Tests should be provided, including the hydraulic system or spring charge mechanism, for ambient temperature of 50°C and 100% humidity.

No additional costs will be allowed for type testing to meet specified requirements and should deficiencies in existing type test evidence occur then the cost of such additional or repeat tests as may be required by the Authority shall be deemed to be included in Contract Price, including the costs for witnessing the inspection/testing. GIFT reserves the right to ask for repetition of those type tests conducted in the manufacturers works (if such tests are not witnessed by independent observer from internationally accredited test lab) in presence of GIFT representatives and all the cost towards testing and witnessing by GIFT is deemed to be included in the tender price.

Clause reference of type tests and routine tests are listed below. Any other tests specified by the referred standard (current and future issues) but not listed shall be applicable as well.

2.26.2. Routine tests

Tests shall be carried out according to IEC requirements. The following minimum tests apply:

- Wiring and function tests
- Equipment verification tests
- Low voltage circuit insulation test
- High voltage power frequency test
- SCADA operation through terminals test

2.26.3. Factory inspection tests

Tests shall be carried out according to IEC requirements, notification for factory tests along with list of proposed tests shall be submitted for approval and tested at factory at bidder's

cost. Cost of travelling and stay of GIFT PCL representative shall be reimbursed by invitee/asset owner.

2.26.4. Site tests

The site tests shall include the following:

- Power frequency withstand test (at 80% of the rated power frequency withstand voltage)
- Insulation resistance
- Functional test of the fully installed and wired equipment delivered.

2.27. Protection and control system

All numerical relay shall be IEC 61850 communicable having PRP with inbuilt BI and BO for all breaker and allied component IO with remote reset facility. Following functions shall be available in the Protection Relay

- Current protection (Non-directional)
- Over current instantaneous (50)
- Over current IDMT (51)
- Earth fault instantaneous (50N)
- Earth fault IDMT (51N)
- Current protection (Directional)
- Over current directional (67)
- Earth-fault directional (67N)
- Voltage protection
- Overvoltage (59)
- Under voltage (27)
- Lock-out (86)
- Trip circuit supervision (95)
- Differential and REF whereas applicable

2.28. Communication Protocol

The protection relay shall have communication protocol on IEC 61850 or as per BMS requirement. Breaker SCADA controls and feedback shall have the provision for PRP connection to independent panel relay. Relay shall have integrated protection functionality with interconnection of breaker feedback and controls.

Relay setting should be done via the installed software in laptop and SCADA, Full back up program along with required connecting cables, training and documentation must be provided by contractor with all type of relays without any cost implication.

2.29. Capacitive voltage indication system:

The integrated Voltage Detecting System with integrated indicator unit preferably to be used to determine zero voltage. Logic flash arrow symbols on the indicators display the mains voltage still existing within the defined response thresholds. The voltage indication system does not require the electrical repeat tests common for voltage detection systems. The VIS system has to be designed for maximum operating reliability. It should features climate proof encapsulated electronics and is maintenance-free, with permanent monitoring of the indication thresholds. VIS shall satisfy the requirements of IEC 61243-5, VDE 0682, part 415, or EN 61243-5 for integrated voltage detection systems.

Voltage indication system must be provided on the panel front for easy monitoring of live line indication.

Approved MAKE for GIS panel and its components

Sl. No.	Item	Approved Make
1	33 kV GIS panel and switchgear	M/s Siemens M/s ABB
2	Batteries for power pack of electrical panel	M/s Exide Ltd M/s HBL Nife M/s Amco Power Systems Ltd.
3	33kV GIS Heat Shrinkable Terminations	M/s Pfisterer M/s NKT
4	Numerical Relays	M/s Siemens M/s ABB
5	Digital Multifunction Meters/ Load Manager	M/s Secure M/s Siatec
6	Potential & Current Transformers	M/s ECS, M/s NPT, M/s Ericon, M/s Zelisko, M/s Siemens
7	Trivector Meters	M/s Secure,
8	Managed ethernet switch for HT switchgear	M/s Siemens M/s Hirschmann M/s Ruggedcome

DRY TYPE TRANSFORMER

1. Scope:

The specification covers design manufacture, testing packing and delivery of 3 phase 50 Hz, Dry Type (VPI) distribution transformer of X ratings 33/0.415 kV (Indoor and Outdoor type) natural air cooled, conforming IS: 2026 Part (I TO IV), IS: 11171 1985 and IEC726/1982.

The equipment offered shall be complete with all necessary parts for effective and trouble-free operation in the distribution system. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.

It is not the intent to specify herein complete details of design and construction. The equipment offered shall conform to all relevant standards and be of high quality, sturdy, robust and of good workmanship and complete design in all respects. The equipment shall be capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements.

The manufactures attention is drawn to clause no. 3.2.3 of IS – 11171/1985 in respect to the restricted cooling/air circulations available and poor ventilation inside vaults/basement and enclosed rooms where the transformers are required to be installed. The maximum surrounding temperature at these locations is about 55 degC. The insulating materials shall be suitably processed such that in effect they act as fire retardant.

The bidder shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

The transformers shall be suitable for outdoor/indoor installation with 33 kV and should be suitable for service under fluctuations in supply voltage as permissible under Indian Electricity Act & Rules and GERC rules and regulations.

All GTA, GA and other document for transformers and CSS must be reviewed and approved by GIFT PCL and post manufacturing of equipment factory inspection shall be done by GIFT CPL representative based on GIFT PCL's approved drawings and QAP.

2. Tolerances:

Tolerances on all the dimensions shall be in accordance with provisions made in the relevant IEC/Indian standards and in these specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality of the product.

3. Design Criteria:

Equipment to be supplied against the specification shall be suitably design to work satisfactorily under following tropical conditions:-

Max. ambient air temperature	: 50 Deg. C
Max. relative humidity	100 %
Max. annual rain fall	800 mm
Max. wind pressure	150 kg/sq.m.
Max. altitude above mean sea level	1000 mtrs.
Seismic level	3
Climatic Condition	hot and humid tropical climate
Reference Ambient Temperature for temperature rise	50 degC

4. Regulations, Guidelines and Standards:-

1. The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes.

Nothing in this specification shall be construed to relieve the tenderer off his responsibilities.

2. The transformers shall conform to latest version of IS: 2026 & IS:11171/1985 amended upto date as amended up to date or other International Standards for equal or better performance.

3. IEC 60076-11

4. Unless otherwise specified, the equipment offered shall conform to the latest applicable Indian, IEC, British or U.S.A. Standards and in particular, to the following:-

IS 2026 amended upto date	Specification for power Transformer
IS:11171/1985 amended upto date	Specifications for Dry-type power transformers
IS:2099 amended upto date	Specification for Bushings for Alternating Voltages above 1000 Volts
IS:3347 amended upto date (part I to V)	Porcelain transformer bushings for use in normal and lightly polluted atmospheres
IS 5	Colours for ready mixed paints and enamels.

5. Unless otherwise modified in this specification the Distribution Transformers shall comply with the Indian Standard Specification IS: 2026 amended up to date.

In case of conflict arising out due to variations between the applicable standard and the standards specified herein the provisions of this specification should prevail.

5. CONSTRUCTIONAL DETAILS:

The Transformer shall be CAST RESIN dry type naturally air (AN) cooled suitable for indoor installation as asked in data sheet. This shall be provided with welded sheet steel, free-standing enclosures with expanded metal screens of suitable size or louvers backed by wire-mesh. Transformer and upper body shall be suitably reinforced to prevent distortion during handling. Base channels shall be provided with skids and pulling eyes to facilitate handling. All the fasteners and bolts shall be stainless steel or zinc passivated. The Transformer shall be double wound core type with cold rolled grain oriented (CRGO) silicon steel laminations perfectly insulated and clamped to minimize vibrations and noise. Core fastening bolts shall be insulated to reduce losses and avoid hot spots. All parts of the magnetic circuit shall be effectively connected to earth system. Winding temperature indicator of all phases shall be compatible for SCADA / IBMS connectivity & communicable over Modbus TCP/ip.

The winding shall be of copper and shall be designed for full load current to withstand the thermal and electromagnetic stresses arising due to maximum fault level. The current carrying winding joints shall be electrically brazed & bolted. The windings shall

be provided with Class-F insulation. as asked in data sheet applicable to cast resin dry type transformers as per IS- 2026 part II for dry type transformers. The transformer marshalling box shall be provided with anti-corrosive heaters controlled through a manually operated switch suitable for operation on 230V AC. Not required for distribution load /unless specified for Harmonic loading as specified in data sheet.

Noise level shall be prescribe as per NEEMA standard depending on the rating of transformers.

5.1 Core

1. The core shall be of high grade cold rolled grain oriented (C.R.G.O) annealed steel lamination, having low loss and good grain properties, coated with insulation, bolted together to the frames firmly to prevent vibration or noise. Core should be boltless design. The complete design of core must ensure permanency of the core losses with continuous working of the transformers.
2. Core insulation –C-Class grade insulation paper of thickness 20 mils (0.5 mm) shall be used and make should be clearly stated in the offer along with test certificates.
3. The core is to be securely clamped with heavy structural angle and should hold the entire core and coil assembly in place to ensure most efficient magnet circuit and quiet functioning of the transformer.
4. The manufacturer, shall be required to submit the manufacturer's test report showing the Watt Loss per kg and the thickness of the core plate, to ascertain the quality of Core materials.
5. The purchaser reserves the right to get tested at any Government recognized laboratory.
6. The transformer core shall not be saturated for any value of V/f ratio to the extent of 125% of the rated value of V/f ratio (i.e. 33000 / 50) (due to combined effect of voltage and frequency) upto 25% without injurious heating at full load conditions and will not

get saturated. The bidder shall furnish necessary design data in support of this situation.

7. Flux density:- Flux density should not be more than 1.55 Tesla at the rated voltage and frequency. The maximum flux density at 125 % voltage and frequency shall not Exceed 1.9 Tesla. The value of the flux density allowed in the design shall be clearly stated in the offer along with graph.
8. The No Load current shall not exceed 1.5 % of the full load current. The no load current shall not exceed 3 % of the full load current in L. V. Winding when the applied voltage is 112.5% and <5% at 125%.
9. 20 mm dia (or above), 2 nos High Tensile Bolts in parallel at each end will be used.
10. The top yoke channels to be reinforced by adequate size of M.S. flat with thickness not less than 6 mm, at equidistance if holes cutting is done for LT lead so as to avoid bending of channel.
11. MS channels are to be painted by heat resistant paint.
12. 8 nos. of tie rods of 20 mm. dia. high tensile steel in vertical formation.
13. All top and bottom yoke nut bolts, if any, shall be MS and painted with heat and corrosion resistant paint before use.
14. Drawing of the building of core to be approved before start of work.
15. The base channels of the core shall not be cut channel.

5.2 Winding

1. **Material – High conductivity Electrolytic copper. Test certificate will be required.**
2. Current density in HV and LV windings (Copper) should not be more than 1.4 A/sq.mm. (However, ± 5 % tolerance for LV winding is permissible).

3. LV Winding - Conventional spiral winding should be in even layers, so that Neutral shall be formed at top.
4. Coil Insulation (HV/LV) – Insulation shall be class „C“ conforming IS: 1271/1985 with vacuum pressure impregnated process in Varnish.
5. Coil spacers and duct – For sectional winding high temperature Epoxy fiberglass or porcelain and for disc winding epoxy fiberglass (Minimum class F insulation & above) shall be used.
6. The inter –turns and end –turns of the HV & LV windings shall be insulated for protection against surges and transients.

5.3 Losses:

The No Load & Full Load losses of transformers of 1000 ,1250,1600,2000 &2500 KVA, 33 kV class transformers at rated voltage at rated frequency are specified as shown in Table -1 as below subject to tolerance as per relevant latest IS: 2026.

Rating in kVA	Max. Losses at 50% loading W*	Max. Losses at 100% loading W*
630	2150	6295
800	2644	7848
1000	3225	9675
1250	3870	11556
1600	4838	14513
2000	5805	18275
2500	6998	21500

The values given in G.T.P. for flux density, no load current at rated voltage, no load current at 112.5% & 125% of rated voltage and no load loss at rated voltage shall be individually met.

5.4 Transformer Enclosure

The T/F enclosure shall be of robust construction and shall be built of electrically welded MS sheet wire mesh or perforated sheet for ventilation. All joints of enclosure and fitting shall be tight. The enclosure design shall be such that the core and winding can be lifted freely. The enclosure plates shall be of such strength that the complete transformer may be lifted bodily by means of the lifting lugs provided. The top cover shall have no cut at point of lifting lug.

The shape of the enclosure shall be rectangular only. No other shape will be accepted. The enclosure will be fabricated by welding at corners. The enclosure should comply with IP 43 protection as per IS: 2147 amended up to date. Horizontal or vertical joints in the enclosure side walls or its bottom or top cover will be allowed. The bottom plate of the enclosure shall be 3mm thick min and holes of 2.5 mm of diameter punched sheet for free air circulation.

Side wall thickness (panels with louvers)	2.5 mm.
Top and bottom plate thickness	3 mm.
Lifting lugs	4 Nos. of heavy-duty eye bolt/lifting lugs suitable reinforces by vertical support shall be provided to main transformer core and winding assembly. 2 Nos. of heavy-duty eye bolt/lifting lugs of adequate size to transformer enclosure shall be provided.
Pulling lugs	4 Nos. of heavy duty pulling lugs shall be provided to pull the transformer horizontally.
Top cover-fixing bolts	GI nut bolts of ½" dia./screws with one plain washers shall be used for top cover fixing, spaced at 9" apart.
Bi- directional rollers of	200 mm dia& -75 mm width

mild steel	
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5.5 HT/LT Cable Boxes:

1. H. T. & L. T. terminal for cable connections shall be brought out through side wall mounted Bushing to a cable end box.
2. Cable end box shall be self-supporting, weatherproof, air filled type with sufficient space inside for termination and connection of cables.
3. In general, the arrangement shall be such as to permit of core & coil assembly without dismantling the cable installation.
4. The H. T. and L. T. cable box shall be fixed on the opposite sides. Rectangular shaped, M.S. Sheet thickness 2 mm , weather , vermin and dustproof HV/LV Cable box shall be fitted on opposite sides of the tank of transformer.
5. For HV 33 kV Air filled cable box suitable for 3 core XLPE aluminum cables up to 300 sq.mm. & glands suitable for above cables.
6. For LV cable box shall be suitable for busduct connection of required rating.

6. TAPPINGS AND CONTROL:

The tap changer shall be ON LOAD TAP CHANGER TYPE. These shall be provided on high voltage side to get constant voltage on LV side and connected to on load tap changing gear. Under conditions of external short circuit, the tap changing equipment must be capable of carrying the same current as the winding.

The OLTC gear shall be designed to complete successfully tap changes for the maximum current to which transformer can be loaded i.e., 120% of the rated current. Devices shall be incorporated to prevent tap change when the through current is in excess of the safe current that the tap changer can handle. The OLTC gear shall withstand through fault currents without injury. When a tap change has been commenced it shall be completed independently of the

operation of the control relays and switches. Necessary safeguard shall be provided to allow for failure of auxiliary power supply or any other contingency, which may result in the tap changer movement not being completed once it is commenced OLTC driving mechanism and its associated control equipment (Local) shall be mounted on transformer enclosure, weather-proof cabinet as specified in data sheet which shall include:

1. Driving motor (415V, 3 Phase, 50 Hz. AC squirrel cage)
2. Motor starting contactor, thermal overload relays and MCB.
3. Control Switch : Raise / off / Lower (Spring return to normal type)
4. Remote / Local selector switch (maintained contact type)
5. Mechanical tap position indicator showing rated tap voltage against each position and resettable maximum and minimum indicators.
6. Limit switches to prevent motor over-travel in either direction and final mechanical stops.
7. Brake or clutch to permit only one tap change at a time on manual operation.
8. Emergency manual operating device (hand crank or hand wheel)
9. A five digit operation counter.
10. Electrically interlocked reversing contractors. (Preferably also mechanically interlocked)
11. 240V, 50 Hz. AC space heaters with MCB.
12. Interior lighting fixture with lamp, door switch and HRC fuses.
13. Gasketted and hinged door with locking arrangement.
14. Terminal blocks, internal wiring, earthing, terminals and cable glands for power and control cables.
15. Necessary relays, contactors, current transformers etc.

6.1 Control Requirements for OLTC

1. The following electrical control features shall be provided.
2. Positive completion of load current transfer, once a tap change has been initiated, without stopping on any intermediate position, even in case of failure of external power supply.

3. Only one tap change from each tap change impulse even if the control switches or push button is maintained in the operated position.
4. Cut-off of electrical control when manual control is resorted to. Cut-off of a counter impulse for a reverse tap change until the mechanism comes to rest and resets the circuits for a fresh operation.
5. Cut-off of electrical control when it tends to operate the tap beyond its extreme position.

6.2 Automatic Control of OLTC

1. Automatic OLTC Control shall include the following items:
2. Voltage setting device.
3. Voltage sensing and voltage regulating devices.
4. Line drop compensator with adjustable R and X elements. (if asked for in data sheet for longer distance RTCC placement).
5. Timer for delaying the operation of the tap changer in the first step for every tap change operation.
6. Adjustable dead band for voltage variation.

6.3 RTCC Panel:

The OLTC remote control equipment shall be suitable for A.C supply and shall be housed in an indoor sheet steel cubicle to be located on the Transformer or to be installed separately as per manufacturer standard design. The RTCC shall comprise of rigid welded structural frames made of structural steel section or of pressed and formed cold rolled steel and frame enclosures, doors and partitions shall be of cold rolled steel of thickness 2mm. Stiffeners shall be provided wherever necessary. All doors, removable covers and plate shall be gasketed all around with neoprene gasket. Panel shall be dust, weather and vermin proof providing degree of protection suitable for INDOOR/OR as asked in data sheet. Colour of finish shade for interior and exterior shall be glossy white and Siemens greyRAL-7032 respectively. Earthing bus shall be of 25 x 6 mm copper. Following (not limited), equipment/ components shall be provided in RTCC.

1. Control switch: Raise/Off/Lower. (Spring return to normal type)
2. Master /Follower Switch & Auto/Manual selector switch (maintained contact type) (If asked for in data sheet for parallel operation suitability)
3. Tap position indicator (potentiometer type or solid-state electronic type)
4. Facia type alarm annunciators with “Accept”, “Reset” and “Lamp Test” facilities.
 - a. A.C. supply failure
 - b. Drive motor auto tripped
 - c. Tap change delayed
5. Out of step relay, time delay relay, voltage sensing relay and necessary auxiliary relays (If asked for in data sheet for parallel operation suitability)
6. Out of step buzzer (If asked for in data sheet for parallel operation suitability)
7. Lamp indications for:
 - a. Tap change in progress
 - b. Lower limit reached
 - c. Upper limit reached
 - d. Out of step (If asked for in data sheet for parallel operation suitability)
8. Cable glands for power and control cables.
9. 240V rated panel space heater with ON-OFF switch
 - a. Fluorescent type interior lighting fixture with lamp and door switch
 - b. HRC fuses.
 - c. Terminal blocks.
 - d. Internal wiring.
 - e. Earthing terminal.

6.4 AVR :

1. Auxiliary Supply: 110/230 V AC $\pm 15\%$, 50 Hz, 15 VA
2. PT Supply: 110 V AC, 50Hz, 1.5 V
3. Lower setting(LS): Adjustable between 95V to 125V and readable on display
4. Raise setting(RS): Adjustable between 90V to 120V and readable on display

5. Time delay setting: Fixed(Voltage Independent) Time delay continuously adjustable from 10 to 120 sec
6. Time delay Resetting: Instantaneous resetting with voltage deviation occurring in opposite direction
7. Undervoltage Blocking: Internal blocking at 80V,Restoration at 85V
8. Control operation: Single pulse operation with approx. 2Sec ON time
9. Control Relays: A pair of normally open potential free contacts of rating 5A at 240V AC or 24V DC resistive load for each lower and raise control relays
10. Operating Temp.: 0°C to 50°C

7. Testing and Inspection:-

There will be 2 stage testing of transformer, 1st stage inspection will be done after construction of transformer winding for verification of winding material and core material. 2nd stage inspection and testing will be done after complete manufacturing of transformer i.e. routine test.

7.1 Routine Tests:-

All transformers shall be subjected to the following routine tests at the manufacturer's works. The tests are to be carried out in accordance with the details specified in IS 2026 & IS:11171.

1. Measurement of winding resistance.
2. Ratio, polarity and phase relationship.
3. Impedance voltage.
4. Load losses.
5. No-load losses and No-load current.
6. Insulation resistance.
7. Induced over voltage withstand.
8. Separate source voltages withstand.

All the routine tests shall be conducted in the suppliers' laboratory at their cost.

7.2 Type Tests:-

In addition to routine test as above Impulse voltage Withstand test and Dynamic Short Circuit Test as under shall be successfully carried out at laboratories accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with IS: 11171/1985 as amended upto date and this technical specifications, within the last 5 (five) years prior to the date of offer. The bidder shall furnish the following type tests reports (along with Rating and Diagram Plate, General arrangement drawing, Internal Constructional drawing & Technical details (Core & Core Assembly)) along with the offer.

1. Impulse Voltage with stand Test on all three HV phases.
2. Dynamic Short circuit Test

The following balance type test should be carried at the manufacturer's works invariably in the presence of GIFT PCL's representative at the time of inspection from the first lot.

1. Temperature Rise Test.
2. Unbalanced current test – unbalanced current should not be more than 2% of full load current

7.3 Site testing :-

Following test shall be done at site after installation of transformer at plinth:

1. Magnetic balance
2. Ratio test on all taps
3. Ten-delta
4. Insulation resistance test

8. Drawings :-

A set of following drawings shall be submitted by the Bidder along with the offer:

1. General Arrangement drawing.
2. Internal construction
3. Technical Details (Core & Coil assembly details) drawing.

4. Rating & Diagram Plate Drawing.
5. OLTC drawing and wiring diagram
6. BMS signal list and terminal details
7. Details drawings of HV/LV Bushings indicating creepage distances.
8. Dimensional drawings showing the HV & LV cable boxes.
9. Transportation dimensions

9. Guaranteed Technical Particulars

Fixed Electrical data of transformer are as follows:

No. of windings	Two
Phase	Three
Frequency	50 +/- 3%
Voltage ratio	33 kV / 0.415 kV
Vector group	DYn 11
Efficiency	More then 97%

Developer need to submit all document mentioned above along with GTP in given below format with all mentioned data for review and approval.

Sr. No.	GTP PARAMETERS	REMARK
1	Name of Manufacturer	TEXT
2	Reference Standards	TEXT
3	Transformer shall be Dry (VPI) Air Natural Air Natural (ANAN) type Yes/No	BOOLEAN
4	Transformer shall be suitable for Outdoor/ Indoor installation Yes/No	BOOLEAN
5	KVA rating of the transformer	NUMERICAL
6	Primary Voltage in KV	NUMERIC
7	Secondary Voltage in KV	NUMERIC
8	Method of connection for H.V. Winding shall be Delta : Yes/No.	BOOLEAN
9	Method of connection for L.V. Winding shall be Star : Yes/No	BOOLEAN
10	Connection Symbol shall be Dyn-11 (Yes/No)	BOOLEAN
11	By resistance method Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C	NUMERIC
12	The temperature shall in no case reach a value that will	BOOLEAN

Sr. No.	GTP PARAMETERS	REMARK
	damage the core itself ,other parts or adjacent materials (Yes/No)	
13	Estimated maximum hot spot Temperature in deg. Centigrade	NUMERIC
14	Whether neutral is solidly earthed (Yes /No)	BOOLEAN
15	Magnetizing current (in amps) at rated voltage and rated frequency & its % with full load current	TEXT
16	Magnetizing current at maximum voltage (112.5% of rated voltage) and rated frequency (in amps) & its % with full load current	TEXT
17	Flux density at normal voltage and frequency in Tesla	TEXT
18	Approximate length of the Transformer in mm	NUMERIC
19	Approximate breadth of the Transformer in mm	NUMERIC
20	Approximate height of the Transformer in mm	NUMERIC
21	Approximate length of the Transformer tank in mm	NUMERIC
22	Approximate breadth of the Transformer tank in mm	NUMERIC
23	Approximate height of the Transformer tank in mm	NUMERIC
24	Minimum thickness of the side of transformer tank plates in mm	NUMERIC
25	Minimum thickness of the bottom of transformer tank plates in mm	NUMERIC
26	Minimum thickness of the cover of transformer tank plates in mm	NUMERIC
27	Shape of main enclosure of transformer	TEXT
28	Current density of HV winding at any Tap, in Amps/sq. mm.	TEXT
29	Current density of LV winding, in Amps / sq.mm.	TEXT
30	Minimum cross section of Copper used in HV Winding	TEXT
31	Minimum cross section of Copper used in LV Winding in sq. mm	TEXT
32	Approximate Weights of Core Laminations kgs	NUMERIC
33	Approximate Weights of Copper (Windings): kgs	NUMERIC
34	Approximate Weights of Transformer core and windings :kgs	NUMERIC
35	Approximate Weights of Tank & fittings: kgs	NUMERIC
36	Type of Core	TEXT
37	No. of H.V. disc (coils) per phase (per limb)	TEXT
38	Colour of transformer enclosure	TEXT
39	Name plate provided with all details as per the specifications (Yes/No)	BOOLEAN
40	No of steps used in CRGO Core	NUMERIC
41	Thickness of core lamination inmm	TEXT
42	Diameter of the core (in mm)	TEXT
43	Core material & grade of laminations used	TEXT
44	Effective Core Area (Sq.mm)	TEXT

Sr. No.	GTP PARAMETERS	REMARK
45	Overload capacity of transformers for 2 hrs.	TEXT
46	No load losses at normal voltage and frequency in Watts	NUMERIC
47	Load Losses at rated voltage at 75 deg. Centigrade in Watts	NUMERIC
48	Total losses (No Load + Load Losses at 75 deg C)	NUMERIC
49	Resistance of HV winding at 20 ° C in Ohm/phase	TEXT
50	Resistance of LV winding at 20 ° C in Ohm/phase	TEXT
51	No of HV Turns	NUMERIC
52	No of LV Turns	NUMERIC
53	Voltage per turn used in HV/LV winding for design	NUMERIC
54	Whether end insulation is provided to the end turns	BOOLEAN
55	Percentage of voltage of end turns with reinforced insulation	TEXT
56	Type of insulation on HV conductors	TEXT
57	Type of insulation on LV conductors	TEXT
58	Type of insulation on LV to core	TEXT
59	Type of insulation on Core Bolts	TEXT
60	Type of insulation on Core Bolt Washers	TEXT
61	Type of insulation on Core Lamination	TEXT
62	Manufacturer's name of HV Bushings:	TEXT
63	Material of HV Bushings	TEXT
64	Rating of HV Bushing	TEXT
65	Min. clearance between phase to earth of secondary winding	TEXT
66	Min Width of the duct between LV & HV windings (in mm)	TEXT
67	1 Minute Power frequency withstand voltage (Dry) at 50 Hz of HV Bushings	TEXT
68	1 Minute Power frequency withstand voltage (Wet) at 50 Hz of HV Bushings	TEXT
69	Impulse Flash over voltage kV (stating the wave form adopted) of HV winding	TEXT
70	Minimum Creepage Distance of HV Bushings in mm	
71	Material of LV Bushings:	TEXT
72	Rating of LV Bushing : 1 kV, 250 A.	TEXT
73	Manufacturer's name of LV Bushings:	TEXT
74	Minimum Creepage Distance of LV Bushings in mm	TEXT
75	Efficiency at 75 deg. centigrade at unity p.f at 100 % Load	TEXT
76	Efficiency at 75 deg. centigrade temperature at unity p.f at 75 % Load	TEXT
77	Efficiency at 75 deg. centigrade temperature at unity p.f at 50 % Load	TEXT
78	Efficiency at 75 deg. centigrade temperature at unity p.f at 25 % Load	TEXT
79	Efficiency at 75 deg. centigrade temperature at unity p.f at 125 % Load	TEXT
80	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at	TEXT

Sr. No.	GTP PARAMETERS	REMARK
	100 % Load	
81	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 75 % Load	TEXT
82	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 50 % Load	TEXT
83	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 25 % Load	TEXT
84	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 125 % Load	TEXT
85	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 100 % Load	TEXT
86	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 75 % Load	TEXT
87	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 50 % Load	TEXT
88	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 25 % Load	TEXT
89	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 125 % Load	TEXT
90	% impedance at 75 deg C	TEXT
91	Regulation at 0.8 p.f. lag (in %)	TEXT
92	Regulation at 0.8 p.f. leading (in %)	TEXT
93	Lifting Lugs provided to transformer and transformer enclosure	Text
94	Pulling Lugs provided to transformer	Text
95	Transformer Earthing terminals size and no	Text
96	Transformer Rollars size and nos	Text
97	Overall Dimensions of HV Cable box	Text
98	Overall Dimensions of LV Cable box	Text
99	The test certificates of copper conductors, core material, insulation paper, porcelain Bushings, steel plate used for enclosure of the offered transformer are enclosed with the offer in physical format with soft copy (Yes/No)	BOOLEAN
100	All type test reports of type tests carried out on transformer as per IS:2026 & tech. specifications at NABL laboratory shall be submitted with the offer in physical format & with soft copy (Yes/No)	BOOLEAN
101	Unbalanced current test & temperature rise test shall be conducted at your works format enclosed with the technical specification & IS:2026 alongwith the offer with soft copy (Yes/NO)	BOOLEAN

Sr. No.	GTP PARAMETERS	REMARK
102	Testing facility, Plant & machinery , list of order executed /under execution shall be furnished separately in physical format & with soft copy alongwith the offer (Yes/No)	BOOLEAN
103	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy (Yes/No)	BOOLEAN
104	The cost data in prescribed format shall be submitted with the offer in physical format & soft copy (Yes/No)	BOOLEAN
105	The performance Guarantee of the transformers in years	NUMERIC

10. Approved make for Transformer:

Item	Make
Dry type Transformer	M/s ABB, M/s Voltamp, M/s Areva T&D, M/s Kirloskar, M/s Telawane M/s Schneider
Compact Substation RMU 33 kV with FPI and metering unit	M/s ABB, M/s Siemens M/s Luci
Compact Substation Transformer 33/0.415 kV	M/s ABB, M/s Voltamp, M/s Areva T&D, M/s Kirloskar, M/s Telawane M/s Schneider
Compact Substation 33/0.415 kV	M/s ABB, M/s Voltamp, M/s Siemens, M/s Luci

BUSDUCT & RISING MAINS

1. SCOPE :

The scope of cover includes design, Supply, installation, Testing and commissioning of Compact sandwich type Busduct / Rising Mains for use on 3 phase 4 wire 415 volts, 50Hz A.C. supply with enclosure having IP-55 rating after fixing the tap off boxes and all accessories, with all-aluminium housing in convenient sections complete with AL Busbar Grade : AL-63401 / 6101 4 EA aluminium bus bars having current density of 130 A/ sq cm at nominal current rating, necessary joints & expansion joints, Phase change over , Expansion joints, Vertical / horizontal supports, Thrust pad , fire barrier at each floor, provision of tapping at every metre, continuous integral earthing on both side with aluminium strip of suitable size (one on each side) including, G.I. clamping brackets, angle iron bracket, steel fasteners, connecting to earthing system etc. as required. Product should comply seismic zone 3 requirement with valid type test. . Scope of work also includes preparation of shop drawings, factory acceptance testing and site testing as per approved QAP. It shall comply to Non-flame propagation property as per IEC60332-3, Resistance to fire in building penetration as per ISO834.

Complete installation shall be done by OEM or OEM & GIFT PCL (both) authorized agency and after installation same shall be certified by OEM. Transformer to LT panel and all vertical distribution shall be done through bus duct only.

Before manufacturing clearance of Bus duct, GTP, GA and QAP shall be approved by GIFT PCL and post manufacturing of equipment factory inspection shall be done by GIFT PCL representative on based of GIFT PCL's approved drawings and QAP. Shop drawing which includes horizontal and vertical run, there bending quantity and length shall be reviewed by developer only.

2. STANDARD :

The busduct shall conform to latest revision of relevant IEC / Indian Standards. The bus bar shall be designed and manufactured in accordance with the Following international standards for bus bar trunking:

- BS 5486 part : Particular requirement of bus bar trunking systems
- IEC 60439 -6 : Particular requirement of bus bar trunking systems
- IEC 60529 : Degree of protection
- IEC 61439-1&6

The bus duct shall conform to IEE/NEMA/BUI/JIS for seismic protection Certification

3. CONSTRUCTION :

The bus bars shall be of sandwich construction, non-ventilated design. It shall be Possible to mount the bus bar system in any orientation, without affecting the Current rating.

The enclosure shall be made of Aluminium. The design of the bus duct enclosure shall be of sturdy construction such that it shall withstand the internal or external forces resulting from the various operating conditions.

The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminium sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and outdoor portion of bus ducts. Bus duct enclosure shall have a Degree of protection of IP-55. Only SS 304 or higher nutbolt shall be use for housing. Reducer should be integral part of Busduct, Reducer should be factory made

The sandwich type Busduct / Rising Mains shall be of box frame construction of sheet steel enclosure suitably braced to withstand the maximum mechanical and electrodynamic forces.

The busduct enclosure shall be fabricated from Aluminium. Eddy current heating, if applicable, shall be taken into account. The degree of protection shall be as specified in Technical Data Sheets.

The busduct enclosure shall be suitable for indoor / installation as specified. The outdoor portion of busduct shall be suitable for outdoor installation with cast rasing.

The busduct shall be provided with removable joint covers fitted with gaskets secured by sufficient no. of nuts, bolts to ensure that these covers are dust-proof. All joints and covers shall be provided with non-deteriorating type gaskets of neoprene between joints. These covers shall be of suitable length for ease of removal and shall be arranged to give complete accessibility to the Busbars, joints, bends and supports, etc. The entire busduct shall be dust and vermin proof. Louvers shall not be provided. Suitable filter type drain holes with plugs shall be provided for natural draining of any water collections within the enclosure due to moisture condensation. The filter element shall be such that it will allow escape of moisture but prevent ingress of dust. This shall be removable type for cleaning purposes. Unless otherwise specified the section of the busduct shall be rectangle.

The busduct shall be provided with flanged ends to connect the busduct to transformer at one end and panel / switchgear at other end. These flanges shall match with the dimensions of corresponding flanges in the equipment to which these are connected. Bus bar disposition for termination at transformer or PCC end will be as per IS. The transformer and the switchgear flanges are generally top-top connection. Termination arrangement for switchgear and transformer shall be provided by bidder. Proper alignment and co- ordination between the busduct and power transformer / switchgear terminations shall be the responsibility of the busduct manufacturer. The bus duct shall be supplied complete with all the hardware necessary for making the terminations inclusive of copper flexible. The flexible shall be made of thin copper strips. The ends of the flexible shall be clamped/ welded by copper plate. The ends of flexible shall be tinned plated.

Enclosure nut bolt shall be made of stainless steel with test certificate. The bolts shall be full threaded and high tensile quality. Bellied washers for all current carrying conducting parts of the Busbars and plain washers shall be provided for every bolt.

4. SUPPORTING ARRANGEMENT :

Busduct supplier shall indicate arrangement for busduct support with details of the supporting members and quantity being required. The supports offered shall be as specified below.

- Supporting structure shall be fabricated from standard steel sections and shall be suitably painted.
- Support structures shall be designed to withstand the dead weight of the busduct and the short circuit forces under maximum fault conditions.
- Support structures shall include support members like bricks, hangers, vertical / longitudinal beams, channels, nuts, bolts, washers hardware required for erection and support of entire busduct.
- Indoor portion of the busduct may be supported from wall or ceiling as per site requirement. Outdoor portion of the busduct shall be supported from ground below on suitable foundation in ground.

5. BUSBARS :

The busbars shall be of electrical high grade Aluminium / channels adequately sized to carry maximum current of maximum site temperature. The final temperature of busbars and connectors at joints between connector and busbar should not exceed 55 deg. Centigrade when carrying rated currents. Also the final busbar temperature shall not exceed 250 deg. Centigrade when short circuit current for specified duration flows through.

Busbar size per phase shall be suitable for maximum specified continuous rating at maximum specified site ambient temperature hygroscopic temperature.

Bimetallic strips covering full joint surface shall be provided wherever copper to aluminum connections are envisaged.

Wherever required for long run of busduct, expansion joints with flexible strips shall be provided to allow for expansion and contraction due to temperature variations arising out of normal continuous current flow and short circuit current flow for specified duration. Minimum one expansion joint shall be provided for each 3000(or 40000) mm long straight length of busduct. If not provided bidder shall give the calculation supporting that expansion joint is not required.

Each busbar shall be insulated with Class B insulation. Busbar shall be of sufficient cross section so that a current density of 100 A/ Sq.cm is not exceeded at nominal current rating for Aluminium bus bars. There shall be no bolts passing through the busbars of the busway.

6. Plug-in Opening

The connecting jaw of the plug-in unit shall plug directly onto the busbar and have full contact with busbar itself. Welded tab at plug-in busbar is not allowed. All contact on joint and plug-in opening should be silver plated copper.

On plug-in busbar trunking there shall be three dead front, hinged cover type plug-in openings on each side. All openings shall be usable simultaneously.

Busbar trunking shall be installed so that plugs are side mounted to permit practical use of all plug-in openings. It shall be possible to inspect the plug-in opening and busbars prior to the installation of the plug-in units.

7. BUSBAR SUPPORTS :

The busbars shall be supported by solid core resin cast epoxy insulators of adequate electrical / mechanical strength. The insulators of 3.3 KV grade shall be used for 415 V systems. The mechanical strength shall be sufficient to withstand forces arising out

of peak short circuit current. Each shipping section shall meet this requirement separately.

Adequate creepage distance shall be available on insulator to operate under high humid conditions and effects of condensed moisture due to variations in temperature within busduct due to different conditions of loading. Minimum creepage distance shall be 100 MM.

The insulating material shall be non-deteriorating type (non-hygroscopic, non carbonizing, corrosion resistance material). The spacing of the insulating supports shall be decided on the basis of the fault withstand capacity.

Hanger spacing shall be noted on layout drawings and shall not exceed manufacturer's recommendations.

Indoor feeder and plug-in busbar trunking shall be approved for hanger spacing of up to 1.5 meters for horizontally mounted run and 3 meters VERTICAL SPRING hanger spacing for vertically mounted runs. Outdoor feeder busbar trunking shall be approved for spacing of up to 1.5 meters for horizontally or vertically mounted run.

8. Plug-in Units

The plug-in jaw shall be spring design composed of different metal to ensure the firm and tight contact with the busbar. Plug-in Units should be type tested in accordance with IEC 61439-6 (Annex D: Part 1-5 and 9-13)

The earthing contact of the plug-in unit shall always be made before that of the live conductors and the last to break during removal. And it must connect to the earth bar of busway to ensure the safety.

Covers of all plug-in units must have interlocks to prevent the cover from being opened when the switch is in the ON position.

Plug-in units (circuit breaker type or fusible switch type) shall be operated with visible blade quick-make and quick-break mechanism. Presence of Transparent shield shall be inside to avoid direct contact of human.

9. EARTH BUS :

There shall be integral earthing of busduct on both side. One earth bus of adequate size of copper/ aluminium shall run on the both external side of the busduct for whole length of the busduct and shall be positively connected to the body of the busduct. At both ends earth bus provision shall be made to connect it to main earthing system.

10. MARKINGS :

All busduct parts like enclosure, adopter box, rainhoods, enclosure covers, supports, busbars, busbar fish plates shall be identified distinctly by clear numbers. These shall also be indicated in drawings submitted by bidder.

11. DRAWING AND DATA SCHEDULE :

Following drawing / documents for approval:

Technical data schedule complete in all respects with values filled up wherever asked. Entry " as per IS " for the information asked is not acceptable. Cross section details of the busduct with details of insulator, busbar clamps, spacing of busbar phases, spacing of insulators.

All valid type test reports of proposed model, Design calculation for :

- Final temperature of busbars when carrying rated current continuously in still air.
- Final temperature of busbar when 3 phase short circuit current flows for one second.
- Final temperature of busbar enclosure for conditions (i) and (ii) specified above.
- Suitability and spacing of the busbar supports for withstanding short circuit forces.
- Busbar Sizing Calculation.

Following drawing shall be reviewed by developer:

- Plan view of busduct connecting two equipments with dimensions from center to center of the equipment.
- Side elevation for above with all levels or dimensions marked.
- Cross section view of busduct.
- End view of busduct with busbars and flexible connecting the transformer. The clearance between bolt / nut of adjacent phases shall be clearly indicated.
- Same as above but for PCC or switchgear end.
- Flange details of connecting adopters at both ends.
- Wall sealing frame.
- Expansion joint details.

12. INSPECTION AND TESTING :

The sandwiched type bus duct shall be full type tested specified in IEC 61439 Part 6 (or latest) tested at a reputed national/international test laboratory. Tests shall be performed over a range of current ratings, covering the different frame sizes of the manufacturer. A valid type test report shall be provided of proposed model along with GTP and GA submission for validation. Type test certificates of following mandatory tests as per IEC 61429-6:2012 will be required for review:

- Strength of material and parts
- Degree of protection of enclosures
- Protection against shock & integrity of protective circuits
- Incorporation of switching devices and components
- Internal electrical circuits and connections
- Terminals for external conductors
- Dielectric properties
- Power-frequency withstand voltage
- Impulse withstand voltage
- Temperature-rise limits
- Short-circuit withstand strength
- Electromagnetic compatibility (EMC)
- Mechanical operation
- Resistance to flame propagation
- Fire resistance in building penetration
- Type tests for tap off boxes

Degree of ingress protection (IP rating) shall also be tested at any reputed Independent laboratory. This test shall be for IP55 or proposed rating for indoor application for sandwiched bus bars.

The busduct shall be subjected to routine tests in accordance with the appropriate standards. The routine tests shall be witnessed by purchaser or by an agency authorized by the purchaser. Following minimum tests shall be carried out on fully assembled busduct at bidder's works.

- Dimensional checks and other physical requirements.
- HV tests.
- Insulation test.
- Heat run test, Not required.
- MV drop test, if required.

13. TECHNICAL DATA SHEET FOR LV BUSDUCT

ITEM DESCRIPTION	REQUIREMENT
Busduct enclosure	all-aluminium housing or combination with Aluminium
No. of bends(Total)	As required
Provision for phase cross over chamber	As required.
Tentative location of phase cross over chamber	Transformer Room / Panel room
Degree of protection of enclosure	IP-55
Thickness of main enclosure	2 mm Aluminium of combination of aluminium and Minimum 1.6 mm thick powder coated sheet steel (CRCA)
Type of gasket used for joints.	Neoprene Rubber.
Continuous current rating in AMP.	As per BOQ
Voltage	415 Volts. FP
Short circuit rating	50 kA
Design ambient temp.	50 Deg. Cent.
Maximum temperature rise above design ambient temperature of 50 Deg. Cent.	40 Deg. Cent.
BUSBARS :	
Busbar material	High Grade Aluminium
Busbar Type (section)	Flat

No. of busbars per Phase	As Approved
Size of busbar	As Approved
Effective cross sectional area of busbars per phase in mm x mm.	As Approved (should be approx 0.8 A /Sqmm)
Neutral busbar included	Required (Full capacity as phase bar)
Neutral busbar cross sectional area in mm x mm.	As Approved (Full capacity as phase bar)
Earth busbar material	Aluminium
Earth busbar size (min)	25 mm x 6 mm or above as per design
No. of earth busbar	2
Earth busbar location on enclosure	External side of the busduct throughout the length
Busbar colour identification	Required as per IS
Minimum Air Clearance between	
Phase - Phase	As per IS
Phase - Neutral	As per IS
Phase - Enclosure	As per IS
Provision for busbars expansion joints.:	Required at every 3000 mm.
Provision of flexible connection.	Required
No. of flexible connections shall be provided.	At Transformer and Switchgear end.
Material of flexible connections	Aluminium
Type TPN / FP	FP
BUSBAR SUPPORTS :	
Type of busbar supports	Solid Core, resin cast epoxy insulators of 3.3 kV rating
Distance between busbar supports in mm.	500 mm (min)

14. Approved make for Bus duct / Rising main:

Rising Mains / Bus Trunking / Bus duct	M/s C&S, M/s Legrand, M/s Siemens, M/s Entraco M/s Schneider
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List of Approved Make		
Sl. No.	Item	Approved Make
1	33 kV GIS panel and switchgear	M/s Siemens
		M/s ABB
2	Batteries for power pack of electrical panel	M/s Exide Ltd
		M/s HBL Nife
		M/s Amco Power Systems
3	33kV GIS Heat Shrinkable Terminations	M/s Pfisterer
		M/s NKT
4	Numerical Relays	M/s Siemens / M/s ABB
5	Digital Multifunction Meters/ Load Manager	M/s Secure
		M/s Siatec
6	Potential & Current Transformers	M/s ECS, M/s NPT, M/s Ericon, M/s Zelisko, M/s Siemens
7	Managed ethernet switch for HT switchgear	M/s Siemens
		M/s Hirschmann
		M/s Ruggedcome
8	Rising Mains / Bus Trunking / Bus duct	M/s C&S,
		M/s Legrand,
		M/s Siemens,
		M/s Entraco
		M/s Schneider
9	Dry type Transformer	M/s ABB,
		M/s Voltamp Electricals & Voltamp Vadodara
		M/s Areva T&D,
		M/s Kirloskar,
		M/s Telawane
		M/s Schneider

List of Approved Make		
Sl. No.	Item	Approved Make
10	Compact Substation RMU	M/s ABB,
		M/s Siemens
		M/s Luci
11	Compact Substation Transformer 33/0.415 kV	ABB, Voltamp Electricals, Voltamp Vadodara
		M/s Areva T&D, M/s Kirloskar,
		M/s Telawane M/s Schneider
12	Compact Substation 33/0.415 kV	M/s ABB, M/s Voltamp electricals
		M/s Siemens, M/s Luci
13	LT Panel	M/s Swati switchgear
		M/s Active Power
		M/s Astek Electrical
		M/s Shiv shakti
		M/s Soham Elec Infra
		M/s G sons power
		M/s Pragati switchgear
		M/s Lauritz Knudsen
		M/s Hi-Tech Engineers
14	LT Switchgear Air circuit breaker, MCCB	M/s ABB, M/s Siemens, M/s Schneider, M/s Lauritz Knudsen
15	HT Cable	M/s Finolex / M/s Universal / M/s KEI
16	LT Cable	M/s Finolex, M/s Universal, M/s KEI, M/s havells, M/s polycab, M/s Apar
17	Earthing	M/s Cape Earthing, M/s JEF earthing, M/s Soham Elec Infra

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