Annexure-1 MEMORANDUM OF UNDERSTANDING ("MOU")

MEMORANDUM OF UNDERSTANDING ("MOU") This Memorandum of Understanding (MOU) entered on ____day of at Between (Name of Company), a company having principal office at _____(Herein after referred to as Associate Partner) having registered office atWhich expressions shall include its legal representatives, successors and assigns. And ____, a company having its registered office at -__ (herein after referred to as Bidder) which expressions shall include its legal representatives, successors and assigns. **AREAS OF COLLABORATION** DESCRIBE AREAS OF COLLABORATION BETWEEN BIDDER AND ASSOCIATE PARTNER **RESPONSIBILITIES OF ASSOCIATE PARTNER** DESCRIBE ASSOCIATE PARTNER'S RESPONSIBILITIES UNDER THIS AGREEMENT **RESPONSIBILITIES OF BIDDER** DESCRIBE THE RESPONSIBILITIES OF BIDDER UNDER THIS AGREEMENT

To the extent context requires, Associate Partner and Bidder shall be individually referred to a "Party" and collectively referred to as "Parties"

- A. WHEREAS [Ropeway and Rapid Transport System Development Corporation HP Limited. RTDC] has invited bids for Design, Supply, Construction, Installation, Testing, Commissioning and Operation & Maintenance for 5 (five) years of Seamless Innovative Urban Transportation (Ropeways, Lifts & Escalators Etc.) Network in Shimla City (Himachal Pradesh) on Engineering Procurement and Construction (EPC) Mode." hereafter referred as "Project".
- B. WHEREAS Bidder is submitting their proposal for the said Project as lead bidder of consortium.
- C. AND WHEREAS the Parties have discussed to provide technical support for the said Project and have had reached an understanding on the following points with respect to their obligations.

NOW THEREFORE AS MUTUAL UNDERSTANDING OF THE PARTIES IT IS AGREED AND DECLARED AS FOLLOWS:

- O1) That Associate Partner shall provide technical support to Bidder for the said Project in terms of assistance in design and engineering, supply, Installation and Commissioning of all Ropeway components to meet performance parameters, operations and other scope of work as mutually agreed till the completion of the said Project and also to give technical assistance in execution of the project till expiry of Defect Liability Period for said project.
- O2) The Bidder acknowledges that in case it emerges as successful bidder, the Bidder shall bid and execute the project as Lead Member. It is further agreed that upon the award of the Project to the Bidder, the Bidder shall collaborate with the Associate Partner for successful completion of the project.
- That Parties further confirm and agree that this shall be non-exclusive arrangement. This MOU is considered to be irrevocable for the present project
- 06) It is further agreed between both parties, that this MOU shall continue to remain valid for providing services as per the agreed scope as per mutually agreed terms and conditions in respect of the Project.
- 07) Nevertheless, the obligations and liability of Associate Partner Provider shall be limited to the final agreed scope of work and agreed contract value in all cases. Upon successful award of project to Bidder, the parties shall execute a valid contract.
- 08) Each Party throughout the period of review and evaluation of Project under this MOU may supply the other with confidential or proprietary information and copies of documentation relating to any of its technology, business, or business practices ("Confidential Information"), as required for successful evaluation of the Project(s), if not prohibited from legally doing so. Both parties agree to keep confidential; all written and verbal information received by them and agree not to make use of such information for any other purpose other than for the purpose of the Project.
- 09) Both Parties shall comply with all applicable laws dealing with improper or illegal payments, gifts or gratuities. Both Parties agree not to pay, promise to pay, or authorize payments of any money or anything of value, directly or indirectly to any person for the purpose of illegally or improperly inducing a decision or obtaining or retaining business in connection with this MOU.

- 10) Each of the Parties will be responsible for its own costs and expenses in connection with the performance of this MOU.
- 11) If there are any, disputes arising between the parties shall be resolved mutually in an amicable manner through discussions failing which shall be settled by Arbitration.
- 12) This MOU will be governed by laws of Republic of India.
- 13) This MOU is prepared in two Originals in English with one Original retained by each party.
- 14) Binding Agreement: Except as otherwise provided herein, this MOU shall be binding upon, and inure to the benefit of, the parties hereto

IN WITNESS WHEREOF, both the parties to this MOU through their respective authorized representatives, having signed these presents on the day, month and year first mentioned above.

Signed and accepted by: Associate Partner	Signed and accepted by: Bidder
Associate Partilei	Biddei
Name :	Name :
Designation:	Designation:
Company Seal :	Company Seal :
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Witness:	Witness:
Name :	Name :

Annexure-2

TECHNICAL SPECIFICATIONS PASSANGER LIFTS

TECHNICAL SPECIFICATIONS OF PASSENGER LIFTS

1.0 SCOPE OF WORK

These specifications cover the details of Passenger lifts to be designed supplied, inspection as may be necessary before dispatch, delivery at site, installation, testing, commissioning and handing over and the defects liability for a period.

These specifications shall be read in conjunction with the General Conditions of Contract, Particular Conditions of Contract.

2.0 GENERAL

The equipment and installation covered by these specifications shall conform to codes of practice in force and highest standards of workmanship and materials. This work shall be done in accordance with the provisions of the Local Lifts Authority rules and shall also conform to requirements of local municipal by laws, and subsequent provisions, as also any state or local Act in force and latest Indian Standard 14665 and all latest applicable BIS, NBC code and "CPWD General Specifications for Electrical Works (Part III, Lifts & Escalators) 2003".

The Entire electrical installation shall be done in accordance with the Indian Electricity Act 2003, Indian Electricity Rules 1956 as amended to-date. The Electrical wiring shall strictly comply with IS:732 and latest applicable BIS and NBC code. The electrical works shall also conform to CPWD General Specification for Electrical Work Part-I (Internal) 1994 and Part-II (External) 1994 as amended up to date.

The Contractor shall follow all Statutory Requirements as well as best trade practices in the manufacture & installation of lifts. The Contractor shall arrange to obtain the statutory approval of the Inspectorate of Lifts as may be required for commissioning of the lifts and handover for operation after satisfactory tests.

3.0 DRAWINGS

Before commencing work, the Contractor shall prepare and submit all drawings for individual lifts in required nos. necessary to show the general arrangement and details of lift installation, electrical etc. These drawings must be approved by the competent

authority before installation and shall become part of the contract.

The Contractor shall submit all working drawings showing pit, hoistway and machine room layouts clearly indicating and specifying all connected structural, electrical and architectural works including imposed structural static / dynamic loads (including breaking load on guides, reaction of buffers on lift pits, reaction on support points in

machine room, lift well etc.) and electrical ratings including calculations for selection of kW rating of motor. The Contractor shall obtain from the competent authority all the information he needs to prepare his drawings and shall have any interaction with the authority to finalise all parameters and data for design. The Contractor will be responsible for any discrepancies, errors and omissions in the drawings or particulars submitted by him even if these have been approved by the Authority. On approval of these drawings, the Contractor shall submit approved working drawings incorporating corrections / comments, if any, and shall immediately commence work.

On completion of work, the contractor shall supply CD"s and the detailed wiring diagram, "As built" drawings and equipment operation & maintenance manuals and original certificates from "Inspector of Lifts" for all the lifts. Further, a copy of such detailed diagram and a set of instructions for evacuation of passengers in case of breakdown of the lifts shall be framed and installed in the respective machine room by the Contractor.

The Contractor shall carry out all the work strictly in accordance with drawings, details and instructions of Authority.

4.0 WORKS TO BE PERFORMED

The following items shall be performed under instructions of the Department to suit the requirements of the installation.

- i. Hoistways, machine rooms and pits of specified dimensions (within normal building tolerances).
- ii. Floor, wall and ceiling finishes in hoistways, pits and machine rooms; including painting (except painting of equipment and materials supplied by lift Contractor) and waterproofing, as well as doors and windows in machine room.
- iii. Cables from main L.T. Panel Board through the hoistways terminating in and including individual Main Switches of required rating for 3 phase and single phase supply in Machine Rooms including necessary earthing.
- iv. Free 3 phase power supply for group testing and commissioning of lifts after erection is completed.
- v. Lighting installation within machine rooms as required by the lift Contractor including 1-phase main switch with ELCB at machine room.
- vi The equipment shall be suitable to operate on 415 Volts 3 phase, 4 wires, 50 Hz. A.C. supply with a variation of ±10% in Volts and ±5% in frequency respectively. The supply for illumination and single phase equipment shall be 230 Volts A.C.
- vii Lighting installation within hoistways and pits as required by the lift Contractor including 1-phase main switch at machine room.
- viii. Ventilation system of machine rooms with minimum 18" heavy duty exhaust fan in each machine room as per the requirement of NBC / BIS codes.

ix. Providing of hoisting beam in the machine room for hoisting of equipment during erection and to facilitate maintenance in future.

5.0 CONTRACTOR'S RESPONSIBILITIES: ANCILLARY WORKS

- i. All cabling, wiring and earthing from 3 phase main DB in machine room to Lift Contractor"s equipment.
- ii. All steel items i.e. machine beam/bases, pedestals/ bearing plate in the machine room, separators wherever required and buffer support channels, vertical iron ladder in lift and structural steel supports and brackets for the installation in etc., to suit the sizes of the hoistways.
- iii. Sill tracks including sill supports, supporting protection at all landings.
- iv. Screen guards, facia plates and other protection for installation.
- v. To carry out minor civil work, such as chipping & making openings in slabs, grouting of foundation bolts in shaft, pit and machine room, modification and making rail bracket, hall buttons indicators and laying of sills in positions. Or any other work required for smooth operation/ commissioning of lifts. All chiselling and cutting of pockets and making good. (All cutting shall be as approved by Authority).
- vi. Ensuring safety against accidents including barricading all openings and caution signs.
- vii. Scaffolding and other Tools & Tackles required for installation in the hoistway required for erection of lifts.
- viii. All other items necessary for satisfactory execution & completion of works, whether specified or not.
- ix. Power shall be provided at incoming of main DB for lifts. Main DB in the machine room shall be provided by the lift contractor. From main DB to lifts, cables shall be in the scope of lift contractor. However, lighting for machine room shall be done by others.
- x. Trap doors, floor gratings, steps / ladders and openings in machine rooms and ladders for pits as required by the lifts Contractor. Contractor shall furnish the details of these items in the layout drawing for lifts to submitted after award of the job.
- xi. Temporary power supply connection(s) for erection work shall be arranged by the lift Contractor.

6.0 SOUND REDUCTION

The Contractor shall provide necessary sound reduction materials, such as rubber pads/ anti vibration pads of proper density to effectively isolate the machine from the machine beams and/or flooring.

Noise level inside cars and in the machine room shall be maintained at minimum levels as laid down in the relevant codes and in any case not more than specified under PERFORMANCE PARAMETERS.

7.0 TRACTION MACHINE

The machine shall be worm geared traction type with motor (steel worm, bronze gears, steel sheave shaft & Ferro molybdenum sheave), electro-mechanical type of brake and driving sheave mounted in proper alignment on a single heavy cast iron base or steel bedplate.

The worm shaft shall be fitted with roller bearings to take end thrust. The sheave shaft shall also be fitted with roller bearings to ensure proper alignment. All shafts shall be provided with well-designed keys.

Rotating parts shall be statically and dynamically balanced.

The drive sheave shall be designed with machined V-grooves to ensure adequate traction with minimum wear on rope. All sheaves including deflector sheaves, where used, shall conform to I. S. 14665 (Part 4 section 3)

Adequate and dust – proof lubrication shall be provided for all bearings and worm gears.

The brake shall be suitably curved and provided with fire proof friction lining. The operation of brake shall be smooth, gradual and with minimum noise. The brake shall be designed to be of adequate size and strength to stop and hold the car at rest with rated load. The brake shall be capable of operation automatically by various safety devices, current failure and by the normal stopping of the car. The brake shall be released electrically. It shall also be possible to release the brake manually so as to move the lift car in short stops. Suitable Brake release tools (total 3 nos.) shall be supplied and stored in the machine rooms.

For manual operation of lifts, up & down direction of the movement of the car shall be clearly marked on the motor or traction machine. A warning plate in bold signal red colour to switch off the mains supply before releasing the brake and operating the wheel shall be prominently displayed.

8.0 HOIST MOTOR

The motor shall be suitable for 415 Volts +10% to -20%, 50 Hz. \pm 5%, 3 Phase A.C. Supply. The motor must be designed for arduous lift duty, rapid reversals and constantly repeated starts & stops as defined in the relevant codes of practice. All windings must be heavily insulated, adequately impregnated for tropical climate and mechanically strengthened and must be specifically designed to have a high starting torque and low starting current characteristics within the limits acceptable to electricity supply co. requirements and I.E. Rules. The motor shall be designed in such a way as to withstand occasional overloading above its rated capacity and shall have overload protection. The motor shall have good speed regulation under different conditions of load and shall be designed to give a noiseless and vibration- free operation. Insulation shall be class F.

9.0 MOTOR CONTROL AND DRIVE

The lift motor shall be controlled by a variable voltage variable frequency (V.V.V.F.) micro-processor control system which shall control and monitor every aspect of lift operation at all stages of the car motion cycle on real time basis.

The A.C. V.V.V.F. drive system shall control A.C. voltage and frequency concurrently with the hoist motor to regulate the lift"s actual performance to match closely the ideal speed pattern, obtain maximum efficiency of operation and provide a very smooth ride.

Frequency shall range fully between zero and rated value.

The Controller shall be provided with a self diagnostic programme to keep downtime to a minimum possible.

The controller shall intelligently adjust door times in response to car calls, hall calls and "Door Open" button operation.

An Inspector's changeover test switch and set of test buttons shall be provided in the controller. Operation of the Inspector's changeover switch shall make both the car and landing buttons inoperative and permit the lift to be operated in either direction from machine room for test purposes by pressing corresponding test buttons in the controller. It shall not, however, interfere with the emergency stop switches inside the car or on the top of the car.

10.0 GUIDES AND FASTENINGS

- Guide-rails for car and counterweight shall consist of machined mild steel Tee sections, erected plumb, and securely fastened to the lift well framing by heavy steel brackets, suitably spaced, to limit deflection of guide rails to 3 mm under normal working conditions.
- ii. The guide-rails shall be of suitable section with ends tongued and grooved, forming matched joint and shall be connected with steel fish plates.
- iii. Guide-rails shall cover the full height of the hoistway and pit, such that It shall be not be possible for any of the car or counter weights shoes to run off the guides.
- iv. Guides shall be designed to withstand the action of safety gear when stopping a counter weight or fully loaded car.
- v. The max. deviation from true plumb and alignment of guide rails shall be 2 mm.
- vi. All support framing shall be rigid and shall be designed to restrict displacement of the point of support of brackets to 3 mm under normal working conditions.
- vii. The whole guide rail installation, including expansion joints, shall be designed for a smooth ride.

- viii. The guide-rails shall be protected during storage and installation with a rust inhibiting coating which shall be cleaned off on completion of installation.
- ix. Guide-shoes shall be adjustable type & mounted so as to provide continuous contact with guide rails under all conditions.

Guide shoes shall be provided at top and bottom of each side of car and counterweight and shall be designed for quiet operation.

Additional guide shoes shall be provided on each side of buffer frame in case of oil buffers.

Each lift shall be equipped with roller guides for up and down travel. There shall not be any metal-to-metal contact between Car and rail. Roller shall be mounted on ball bearings to provide quiet operation and excellent ride quality. (It is not required in case the design varies however the ride quality shall not be compromised for any other design).

11.0 SAFETY

In addition to other specifications, the lift shall be provided with safety devices as follows:-

- i. Against overload
- ii. Safety gear on car so that in the event of rope breaking or loosening, the car will be brought to rest immediately by means of grips on the guides.

The over speeding car shall be automatically brought to a gradual stop on guide rails and power supply to the hoist motor shall be switched off.

- iii. Over speed centrifugal governor operating the safety gear in case of over speeding of car in the down direction.
- iv. Car gate lock so that in the event of car gate being opened when passengers are in the car, the lift will be brought to rest.
- v. Overtravel limit switches at top and bottom limits of travel to disconnect the power supply and apply brakes to stop the car within a defined safe distance in case of overtravel in either direction
- vi. Ultimate terminal switches to stop the car automatically within top & bottom clearances independently of normal overtravel limit switches but with buffers operative.
- vii. Protective guards to counterweights in pit, rope sheaves and wherever required.
- viii. Toe guard apron to the car platform.

12.0 CAR

a. Cabin Size

The internal clear dimensions of the cabin shall not be less than those specified in IS 14665-Part I, NBC & CPWD General specifications for electric work (Lifts) . The car shall be so mounted on the frame that vibration and noise transmitted to the passengers inside is minimised.

b. Frame and Safety Device

The car frame shall consist of mild steel channel/structural steel top and bottom securely riveted or bolted and substantially reinforced and braced so as to relieve the car enclosure of all strains when the safety device comes into action due to overspeed or when the capacity loaded car is run on the buffer springs at normal speed.

The safety device mounted on the bottom members of the frame operated by a centrifugal speed governor shall be arranged to bring the car to a gradual stop on the guide rails in the event of excessive descending speed; and provision shall be made to shut off the power supply to the motor.

c. Buffers

Substantial spring buffers (2 Nos.) shall be furnished and installed in the pit under the car and counterweight. These buffers shall be mounted on RCC Pedestals in the pit. The car buffer spring must be of correct design to sustain the car with capacity load without damage should the car terminal limits become inoperative. The car buffers must be located symmetrically with reference to centre of car.

The Contractor may alternatively offer oil type buffers. The plunger shall be mild steel, designed for a very high factor of safety and accurately machined. A toughened rubber bumper shall be fitted to the plunger top to cushion the impact of steel buffer plates attached under the car and the counterweight. An oil gauge shall be provided to check the oil level.

d. Counterweight

The lift shall be suitably counter-balanced for smooth and economical operation. Cast iron weights shall be contained in a structural steel frame properly guided with suitable guide shoes (minimum 4 Nos). It shall be equal to the total weight of lift plus approx. 50% of the contract load.

Substantial expanded metal counter-weight screen guard shall be furnished and installed at the bottom of hoist way, as required by Lift Inspector.

e. Hoisting and Governor Ropes

Bright steel wire ropes with fibre cores suitable for Lift duty as per BIS Code shall be used for hoisting ropes.

Not less than 3 independent suspension ropes shall be provided and designed to share load equally by means of adjustable shackle rods with equalizer springs at each end of hoisting ropes.

Each rope shall have adequate section to provide a minimum factor of safety of 4 based on the max. force on the rope.

Governor ropes shall be similar to hoisting ropes. Their ends shall be securely attached to the car and to the safety gear. The governor ropes shall be tensioned by a weight loaded device in the pit.

The contractor shall submit the technical details and source of supply of ropes to the Authority as well as a certificate of performance of ropes from an approved test laboratory or Authority.

Compensation for travel shall be provided for all lifts having a travel of more than 30m.

f. Enclosure

The car enclosure shall be as specified in technical data sheet. The cabin floor, roof and walls shall be free of distortion and undue deflection as per IS 14665 – Part 4, Section 3.

g. Brakes

D.C. brakes will be spring-applied and electrically released. They shall be designed to provide smooth stops under variable loads.

h. Doors

Provision shall be made for vertical and horizontal fine adjustment of doors as per the specifications given in technical data sheet.

i. Door Operators

The door operators shall be VVVF inverter controlled heavy duty A. C. motor, allowing variable opening and closing speeds, and full synchronization of car and landing doors.

j. Travelling Cables

The traveling cables shall be multi-core with high conductivity stranded conductors specifically designed for lift duty. The cables shall be provided with retaining straps and individual cable clamps.

k. Emergency Lighting

A self-contained, non-maintained emergency light with a trickle boost charger shall be provided.

I. Intercom

An Intercom system shall be provided between the car, main landing, machine room and Fire Console room linked to EPABX located at Admn. Bldg.

m. Manual Cranking Facility

Manual cranking facility shall be provided in the machine room to facilitate evacuation of passengers in case of power failure. The manual mode shall be in addition to automatic car failure operation specified elsewhere.

n. Emergency Stop Switch

A stop switch in the machine room / top of car shall be provided for use by maintenance crew to cancel all car and landing calls for a particular lift.

o. Maintenance Switch

On operation of the maintenance switch located on top of the car by the maintenance crew, the car shall travel at slow speed not exceeding $0.85\,\mathrm{m}$ / sec by continuous operation of a button

p. Landing Door Interlocks

Electrical interlocks shall be provided to ensure that the car does not operate unless all doors are closed and unless the car reaches a landing zone.

q. Overload Indicator (Only in Passenger elevator)

An overload indicator with buzzer shall be provided in the cabin to indicate to the passengers that the car will not start as it is overloaded.

r. Other Features

All features specified in the BIS/NBC/CPWD and in the enclosed technical specifications shall be provided.

s. Lift for Disabled

All the Passengers lifts shall be suitable for use by disabled persons. The following additional facilities shall be provided in this lift:

- i. Full length handrails shall be provided on the rear and side wall panels.
- ii. The door closing time shall be set for min. 5 seconds and the door closing speed shall not exceed 0.25 m/sec.
- iii. The "door open" and "door closed" announcements shall be audibly made in the car.
- iv. Braile signs / buttons.
- v. Al based CCTV system for person counting connected to buzzer. As a stand-by support feature other than standard safety and overload feature of the lift.

t. Operating Panels, Buttons & Switches

Main and secondary car operating panels, buttons and switches shall be located on one of the two front wall panels next to the car door and as specified in the Schedule of lifts & as per approved G.A. drawings.

All buttons and switches shall be clearly legible with fade-proof text and figures, and shall be easily accessible, (especially for disabled persons in the lift designated for them).

13.0 ELECTRIC WIRING

Necessary insulated wiring to connect all parts of the equipment shall be furnished and installed. Insulated wiring shall be flame retardant and moisture resistant and shall be run in G.S. conduits. All cables shall be flame – retardant with copper conductors.

Trailing cables shall be PVC sheathed copper conductor multi-core ribbon type designed for lift service and shall be flame retardant and moisture resistant. They shall be flexible and shall be suitably suspended to relieve strains on individual conductors. All copper conductors shall be of appropriate gauge copper to avoid excessive voltage drop. All wires, cables, conduits, metal boxes, fittings and earthing shall comply with statutory requirements and BIS specifications.

The controller unit comprising of the MCCB, 25KA, adjustable overload and phase reversal and phase failure protection, all the circuit elements, transformer, rectifier for D.C. control supply, inverter power pack, terminal blocks etc. shall be enclosed in an insect vermin proof, sheet steel floor or wall mounted cabinet with hinged doors at front or at both front and rear. Proper warning boards and danger plates shall be provided on both sides of the controller casing. Sheet steel used for controller cabinet shall not be less than 14 gauge and shall be properly braced, where necessary. Suitable gland plate shall be provided for cable entry. The battery for the charger unit shall be suitably placed in the machine room. Degree of protection of Enclosure shall be IP54. Enclosure shall have provision of earthing studs.

All sheet steel work shall be painted with two coats of synthetic enamel paint of suitable shade both inside and outside over two coats of zinc primer.

Apart from lift controller enclosure, 7 distribution boards (3 Main DB + 4 DB) are required as per BOQ. Cables to incomer of these DB"s shall be terminated by others, whereas outgoing cables for lift shall be in the scope of lift contractor. Contractor shall furnish the sizes of cables alongwith KW rating of motors.

14.0 PAINTING

All exposed metal work furnished in these specifications, except as otherwise specified, shall be given one shop coat of anti-corrosive primer after approved surface treatment of metal surfaces and two coats of approved enamel paint of approved shade. After installation of Lifts, a final Touch-up Coat of paint shall be applied.

15.0 WORKS TESTS

The following tests shall be carried out at Works. A u t h o r i t y shall be given notice of the time and procedure of the tests before they are carried out, and shall be given facilities for observing the tests at Works.

- a. High voltage works tests of equipment which is not already tested in accordance with appropriate IS codes.
- b. Buffer test.

16.0 TESTS ON COMPLETION

The following tests shall be carried out to the satisfaction of the Authority.

- i. Insulation resistance and earth test for all electrical apparatus.
- ii. Continuous operation of the lift under full load conditions and simulated starts and stops (150 nos. per hour each) for one hour at the end of which time the service temperature of the motor and the operating coils shall be tested. This shall be as per B.I.S. specification.
- iii. The car shall be loaded until the weight on the rope is twice the combined weight of the car and the specified load. The load must be carried on for about 30 minutes, without any sign of weakness, temporary set or permanent elongation of the suspension rope strands.
- iv. The following items shall be tested:
 - a. Levelling accuracy at each landing in conditions of fully loaded and empty
 - b. No load current and voltage readings both on "Up" and "Down" Circuits.
 - c. Full load current and voltage readings both on "Up" and "Down" Circuits.
 - d. One and quarter load current and voltage readings both on "Up and "Down" Circuits.
 - e. Stalling current and voltage and time taken to operate overload.
 - f. Overload protection.
 - g. Gate sequence relays, if provided and installed.
 - h. Car and landing door interlocks.
 - i. Collective control and priority sequences, if installed.
 - j. Safety gear mechanism for car and counterweight with fully loaded car and also with only 68 kg load.
 - k. Speeds on Up and Down travel with full load, half load and empty car.
 - I. Door contacts.
 - m. Final terminal stopping device.
 - n. Normal terminal stopping device.
 - o. Car and counterweight buffers with contract load and contract speed.
 - p. Operation of controllers.
 - q. Manual operation of lift at mid-way travel.
 - r. Emergency operation.
- v. Tests on completion shall also be performed to the satisfaction of Inspector of Lifts and a certificate will be obtained from the "Lift Inspector" by the contractor.

17.0 STATUTORY APPROVALS

All statutory approvals from commencement to commissioning of lifts shall be obtained by the Contractor from the Inspector of Lifts and / or other authorities.

However, the client will provide all necessary assistance for providing documents, drawings and certificates pertaining to other contractors, if required.

The contractor shall pay necessary fees in connection with the approval of installation of lifts.

18.0 FEATURES REQUIRED FOR VVVF LIFTS

(a) **Group / Independent / Attendant Operation**

It shall be possible to group specified cars in a group wherever required with dynamic disposition of cars as required by the traffic pattern. A smart car dispatching system with ring communication shall be provided for optimum passenger comfort and lift performance under all traffic conditions. Any defective car shall be automatically eliminated from the group.

Each car shall be provided with a keyswitch for independent operation housed in a service cabinet. In this mode, the lift shall respond only to car calls. Hall calls will not be registered.

It should be possible for an attendant to operate any car.

(b) Fireman's Switch

A fireman"s toggle switch shall be provided in a break glass for the specified lift at ground floor to enable firemen to bring the lift non-stop to ground floor from any location and to cancel hall calls until the car is operated on attendant control.

(c) Emergency Power Operation

In case of power failure, standby power equipment shall enable lifts to reach a pre-determined floor, in a pre-determined sequence, and then permit operation of one or more lifts on emergency power.

A trickling battery shall be provided to supply power to light fixtures, fan, alarm and intercom.

(d) **Profile Generator**

A profile generator or similar device shall be provided to use the car at an optimum speed level and to improve levelling accuracy.

(e) Predictive Car Selection

Once a hall call is registered, a dynamic car algorithm shall transfer the call to an optimally selected car to provide the maximum traffic efficiency.

(f) Home Landing Facility

A car shall return to a pre-determined landing after the last call is answered.

(g) **Door Safety**

Multi-beam infrared / ultrasonic electronics curtains shall be provided to scan the doorway and reverse the door closing in case of any obstruction.

(h) **Double Door Operation**

If both up and down calls are registered at a hall which is the last registering hall in the direction of the car, the lift shall travel to that hall and open / close the doors. After this, the car shall reverse its travel and shall open / close the doors again unless no car calls are registered at that floor.

(i) Nudging Door Operation

When the doors remain open for more than a predetermined period, a buzzer shall sound and the door shall close automatically. The door sensing device shall be rendered inoperative but the Door Open button and the safety shoe shall remain operative

(j) Selective floor Service

Programming for selective floors services shall be software driven.

(k) Manual Cranking & Slow speed Travel

A manual cranking facility shall be provided.

Slow speed operation shall be possible from machine room and car top.

(I) Auto Fan Off

In case no calls are registered for a pre-set time, the cabin fan shall be automatically switched off.

(m) Automatic Rescue Device

In case of mains power failure and Lift control system failure, the Lift's own rechargeable and maintenance free battery power shall move the car to the nearest floor and the door shall open automatically for automatic rescue of passengers. A battery run-down indicator shall be provided.

19.0 PERFORMANCE PARAMETERS

The following parameters shall be achieved in the installation:

* Levelling Accuracy <u>+</u> 3 mm for 1.5 m/s speed + 4 mm for 0.75 m/s speed

* Jerk level $0.9 - 1.5 \,\mathrm{m/s^3}$

Noise level in car
 Noise level at 1 M in machine room
 60 dB

* Acceleration rate 0.6 - 1.0 m/s² (adjustable)

20 milli gals.

20.0 SUBMITTALS

- (A) The following items are required to be submitted
 - i. Catalogues with offered items highlighted.
 - ii. List of imported components, if any.
 - iii. Compliance Statement for guaranteed performance parameters given in Specification 19.0 above.
 - iv. Confirmation that offer submitted meets the technical specifications & scope of work and there are no deviations and exclusions from NIT.
 - v. The contractor shall specify in his offer the full capability of his system in this regard.
- (B) The contractor shall furnish following technical particulars of the equipment/devices for the approval of Authority.
- i) Single line/ schematic diagram of electronic control panel, lift & equipment etc.
- ii) Layout of Hoistway, Lift machine room, showing foundation details in the pit, machine room, electric control panel, Lift & equipment etc.
- iii) Earthing layout.
- iv) Inspection manual for equipment & accessories covered in the scope of supply
- v) Technical literature of operation, control and maintenance etc. along with CDS.
- vi) Schedule of scope of maintenance service during defect liability period and AMC.

The technical parameters furnished by the tenderer would be examined in detail during design submission stage. All improvements considered necessary to meet the tender Technical Specifications would have to be incorporated without any additional cost to Authority with objective of providing high performance and safety Lifts.

21.0 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

Comprehensive maintenance during Defects Liability Period inclusive of periodic servicing, prompt attention to client (RTDC) complaint, prompt rectification of all malfunctions and equipment failures, replacement of defective equipment / parts, replacement of light fittings, lubrication including lubricants, maintaining correct alignment and levelling of cars and ensuring smooth running, starts and stops etc. all complete to Authority"s satisfaction shall be done.

I.S.I. FOR MATERIAL USED IN LIFT

1	Outline dimension	:	3534 : 1979 outline dimensions of electric lifts
2	Passenger Lifts	:	1860 : 1980 Code of Practice for installation, operation & maintenance of Passenger & Goods Lifts
3	Service Lifts	:	6620 : 1972 Code of Practice for Installation, operation & maintenance of Service Lifts.
4	Safety rules for passenger and Goods Lifts	:	4566:1980 Electric Passenger & Goods Lift. 6335: 1971 Electric Service Lifts
5	Thimbles for Wire ropes	:	IS.2315: 1978 Thimbles for wire ropes.
6	Grips for Wire	:	IS 2361 : 1994 Bulldog grips ropes
7	Steel Wire Ropes	:	IS 2365: 1977 Steel Wire suspension ropes for lifts Elevators & Hoists.
8	Socket for wire ropes	:	IS 2485: 1979 Prop. Purged Sockets for wire ropes for General Engineering purposes.
9	Worm gears	:	IS 3734: 1983 Dimensions for Warm gearing.
10	Capping metal for wire ropes.	:	IS 3937 : 1974 Recommendations for Socketing of wire ropes.
11	Steel eyebolts	:	IS 4190 : 1984, Eyebolts with Collars

12	Lift Buffers	:	9803 : 1981 Buffers for Electric
			Passenger and Goods Lifts.
13	Lift Guide Rails and Guide Shoes	:	10191 : 1982 Car and Counter
			weight guide rails, guide rail
			supports and fastenings for lifts and
			11615 : 1986 Car and counter
			weight guide shoes for electric
			passenger and goods lifts.
14	Lift Car Frame, Car Counter Weight and	:	11706: 1986 General requirements
	suspension.		for Car frame for electric passenger
			and goods lift.
15	Lift safety gears and Conveners	:	9878 : 1981 safety gears and
			Governors for electric passenger
			and goods lifts.
16	Lift retiring Cam	:	10448 : 1983 Retiring Cam for
			Passenger and Goods Lifts
17	Lift door & locking device and contacts	:	7759: 1975 Lift door locking device
			& contacts
			IS 11633 : 1986 Lift Door
18	Lift Machine and breakers.	:	10913 : 1984 Breakers for Lift.
19	Electric traction Lifts.	:	
	a) Code of practice for installation,	:	IS.14665 (Part.2 / Sec 1) 2000
	operation and maintenance		
	b)Electric traction safety rules	:	IS. 14665 (Part 3 / Sec. 1 & 2) 2000
	c)Components of lifts car frame, car	:	IS.14665 (Part.4/Sec.3) 2000
	counter weight and suspension		
	d)Lift doors and locking devices and	:	IS.14665 (Part.4/Sec.5) 2000
	contacts.		

Annexure-3

TECHNICAL SPECIFICATIONS FOR ROOFTOP SOLAR PLANTS INSTALLED UNDER SIMPLIFIED PROCEDURE

The projects under simplified procedure shall be commissioned as per the technical specifications given below. The vendor will be solely responsible for any shortcomings or negligence/malpractice and will lead may lead to blacklisting of the firm/vendor from participation in any programme of the Ministry. Domestic Modules are to be used failing which it will be assumed that system is not matching the requirement of the scheme and appropriate action would be taken against the vendor.

1. DEFINITION

A Roof Top Solar (RTS) Photo Voltaic (PV) system shall consist of following equipment/components:

- 1. Solar Photo Voltaic (SPV) modules consisting of required number of Crystalline PV modules
- 2. Inverter/PCU
- 3. Module Mounting structures
- 4. Energy Meter
- 5. Array Junction Boxes
- 6. DC Distribution Box
- 7. AC Distribution Box
- 8. Protections Earthing, Lightning, Surge
- 9. Cables
- 10. Drawing & Manuals
- 11. Miscellaneous

1. Solar PV modules

- 1.1. The PV modules and Solar Cell used should be made in India.
- 1.2. The PV modules used must qualify to the latest edition of IEC standards or equivalent BIS standards, i.e. IEC 61215/IS14286, IEC 61853-Part I/IS 16170-Part I, IEC 61730 Part-1 & Part 2 and IEC 62804 (PID). For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701/IS 61701.
- 1.3. The rated power of solar PV module shall have maximum tolerance up to +3%.
- 1.4. The peak-power point current of any supplied module string (series connected modules) shall not vary by +1% from the respective arithmetic means for all modules and/or for all module strings (connected to the same MPPT), as the case may be.
- 1.5. The peak-power point voltage of any supplied module string (series connected modules) shall not vary by + 2% from the respective arithmetic means for all modules and/or for all module strings (connected to the same MPPT), as the case may be.

- 1.6. The temperature co-efficient power of the PV module shall be equal to or better than -0.45%/°C.
- 1.7. Solar PV modules of minimum capacity 250 Wp to be used.
- 1.8. The PV Module efficiency should be minimum 16%.
- 1.9. Solar PV modules of minimum fill factor 75%, to be used.
- 1.10. All electrical parameters at STC shall have to be provided
- 1.11. The PV modules shall be equipped with IP 65 or better protection level junction box with required numbers of bypass diodes of appropriate rating and appropriately sized output power cable of symmetric length with MC4 or equivalent solar connectors. The IP level for protection may be chosen based on following conditions:
 - i. An IP 65 rated enclosure is suitable for most outdoor enclosures that won't encounter extreme weather such as flooding.
 - ii. An IP 67 rated enclosure is suitable at locations which may encounter temporary submersion at depths of up to one meter.
 - iii. An IP 68 enclosure is recommended if there may exist situations of submergence for extended periods of time and at substantial depths.
- 1.12. All PV modules should carry a performance warranty of >90% during the first 10 years, and >80% during the next 15 years. Further, module shall have performance warranty of >97% during the first year of installation—degradation of the module below 1 % per annum.
- 1.13. The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than five (05) years from the date of commissioning:
- 1.14. Defects and/or failures due to manufacturing.
- 1.15. Defects and/or failures due to quality of materials.
- 1.16. Nonconformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the Owners sole option.
- 1.17. PV modules must be tested and approved by one of the NABL accredited and BIS approved test centres.
- 1.18. Modules deployed must use a RF identification tag laminated inside the glass. The following information must be mentioned in the RFID used on each module:
 - i. Name of the manufacturer of the PV module
 - ii. Name of the manufacturer of Solar Cells.
 - iii. Month & year of the manufacture (separate for solar cells and modules)
 - iv. Country of origin (separately for solar cells and module)
 - v. I-V curve for the module Wattage, Im, Vm and FF for the module
 - vi. Unique Serial No and Model No of the module
 - vii. Date and year of obtaining IEC PV module qualification certificate.
 - viii. Name of the test lab issuing IEC certificate.

- ix. Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001.
- x. Nominal wattage +3%.
- xi. Brand Name, if applicable.
- 1.19. Other details as per IS/IEC 61730-1 clause 11 should be provided at appropriate place. In addition to the above, the following information should also be provided:
 - i. The actual Power Output Pmax shall be mentioned on the label pasted on the back side of PV Module.
 - ii. The Maximum system voltage for which the module is suitable to be provided on the back sheet of the module.
 - iii. Polarity of terminals or leads (colour coding is permissible) on junction Box housing near cable entry or cable and connector.
- 1.20. Unique Serial No, Model No, Name of Manufacturer, Manufacturing year, Make in India logo and module wattage details should be displayed inside the laminated glass.

2. Inverter/PCU

- 2.1. Inverters/PCU should comply with applicable IEC/equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683/IS 61683, IS 16221 (Part 2), IS 16169 and IEC 60068-2(1,2,14,30) /Equivalent BIS Std.
- 2.2. Maximum Power Point Tracker (MPPT) shall be integrated in the inverter/PCU to maximize energy drawn from the array. Charge controller (if any) / MPPT units environmental testing should qualify IEC 60068-2(1, 2, 14, 30)/Equivalent BIS standard. The junction boxes/enclosures should be IP 65 or better (for outdoor)/ IP 54or better (indoor) and as per IEC 529 Specifications.
- 2.3. All inverters/PCUs shall be IEC 61000 compliant for electromagnetic compatibility, harmonics, Surge, etc.
- 2.4. The PCU/ inverter shall have overloading capacity of minimum 10%.
- 2.5. Typical technical features of the inverter shall be as follows
 - i. Switching devices: IGBT/MOSFET
 - ii. Control: Microprocessor/DSP
 - iii. Nominal AC output voltage and frequency: as per CEA/State regulations
 - iv. Output frequency: 50 Hz
 - v. Grid Frequency Synchronization range: as per CEA/State Regulations
 - vi. Ambient temperature considered: -20°C to 60°C
 - vii. Humidity: 95 % Non-condensing
 - viii. Protection of Enclosure: IP-54 (Minimum) for indoor and IP-65(Minimum) for outdoor.
 - ix. Grid Frequency Tolerance range: as per CEA/State regulations
 - x. Grid Voltage tolerance: as per CEA/State Regulations

- xi. No-load losses: Less than 1% of rated power
- xii. Inverter efficiency (Min.): >93% (In case of 10 kW or above with in-built galvanic isolation) >97% (In case of 10 kW or above without inbuilt galvanic isolation)
- xiii. Inverter efficiency (minimum): > 90% (In case of less than 10 kW)
- xiv. THD: < 3%
- xv. PF: > 0.9 (lag or lead)
- xvi. Should not inject DC power more than 0.5% of full rated output at the interconnection point and comply to IEEE 519.
- 2.6. The output power factor of inverter should be suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustain fault in feeder line and against the lightning on feeder.
- 2.7. All the Inverters should contain the following clear and indelible Marking Label & Warning Label as per IS16221 Part II, clause 5. The equipment shall, as a minimum, be permanently marked with:
 - i. The name or trademark of the manufacturer or supplier;
 - ii. A model number, name or other means to identify the equipment,
 - iii. A serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a twelvemonth time period.
 - iv. Input voltage, type of voltage (a.c. or d.c.), frequency, and maximum continuous current for each input.
 - v. Output voltage, type of voltage (a.c. or d.c.), frequency, maximum continuous current, and for a.c. outputs, either the power or power factor for each output.
 - vi. The Ingress Protection (IP) rating
- 2.8. Marking shall be located adjacent to each fuse or fuse holder, or on the fuse holder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and voltage rating for fuses that may be changed at the installed site.
- 2.9. In case the consumer is having a $3-\phi$ connection, $1-\phi/3-\phi$ inverter shall be provided by the vendor as per the consumer's requirement and regulations of the State.
- 2.10. Inverter/PCU shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
- 2.11. For CFA calculation, minimum of following two shall be considered:
 - i. Solar PV array capacity in KWp
 - ii. Inverter Capacity in KW
- 2.12. Integration of PV Power with Grid & Grid Islanding:
 - i. The output power from SPV would be fed to the inverters/PCU which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization.
 - ii. In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short

period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "islands." Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided, if not available in inverter.

iii. MCB/MCCB or a manual isolation switch, besides automatic disconnection to grid, would have to be provided at utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel.

3. Module Mounting Structure (MMS):

- 3.1. Supply, installation, erection and acceptance of module mounting structure (MMS) with all necessary accessories, auxiliaries and spare part shall be in the scope of the work
- 3.2. Module mounting structures can be made from three types of materials. They are Hot Dip Galvanized Iron, Aluminium and Hot Dip Galvanized Mild Steel (MS). However, MS will be preferred for raised structure.
- 3.3. MMS Steel shall be as per latest IS 2062:2011 and galvanization of the mounting structure shall be in compliance of latest IS 4759. MMS Aluminium shall be as per AA6063 T6. For Aluminium structures, necessary protection towards rusting need to be provided either by coating or anodization.
- 3.4. All bolts, nuts, fasteners shall be of stainless steel of grade SS 304 or hot dip galvanized, panel mounting clamps shall be of aluminium and must sustain the adverse climatic conditions. Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts.
- 3.5. The module mounting structures should have angle of inclination as per the site conditions to take maximum insolation and complete shadow-free operation during generation hours. However, to accommodate more capacity the angle of inclination may be reduced until the plant meets the specified performance ratio requirements.
- 3.6. The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed. The PV array structure design shall be appropriate with a factor of safety of minimum 1.5.
- 3.7. The upper edge of the module must be covered with wind shield so as to avoid build air ingress below the module. Slight clearance must be provided on both edges (upper & lower) to allow air for cooling.
- 3.8. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed. The Empanelled Agency shall be fully responsible for any damages to SPV System caused due to high wind velocity within guarantee period as per technical specification.

- 3.9. The structures shall be designed to allow easy replacement, repairing and cleaning of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels. Necessary testing provision for MMS to be made available at site.
- 3.10. Adequate spacing shall be provided between two panel frames and rows of panels to facilitate personnel protection, ease of installation, replacement, cleaning of panels and electrical maintenance.
- 3.11. The structure shall be designed to withstand operating environmental conditions for a period of minimum 25 years.
- 3.12. The Rooftop Structures maybe classified in three broad categories as follows (drawings at **Annexure-X**):

i. Ballast structure

- a. The mounting structure must be Non-invasive ballast type and any sort of penetration of roof to be avoided.
- **b.** The minimum clearance of the structure from the roof level should be in between 70-150 mm to allow ventilation for cooling, also ease of cleaning and maintenance of panels as well as cleaning of terrace.
- c. The structures should be suitably loaded with reinforced concrete blocks of appropriate weight made out of M25 concrete mixture.

ii. Tin shed

- a. The structure design should be as per the slope of the tin shed.
- b. The inclination angle of structure can be done in two ways
 - b.1. Parallel to the tin shed (flat keeping zero-degree tiling angle), if the slope of shed in Proper south direction
 - b.2. With same tilt angle based on the slope of tin shed to get the maximum output.
- c. The minimum clearance of the lowest point from the tin shade should be more then 100mm.
- **d.** The base of structure should be connected on the Purlin of tin shed with the proper riveting.
- e. All structure member should be of minimum 2 mm thickness.
 - iii. **RCC Elevated structure:** It can be divided into further three categories:

A. Minimum Ground clearance (300MM – 1000 MM)

- a. The structure shall be designed to allow easy replacement of any module and shall be in line with site requirement. The gap between module should be minimum 30MM.
- **b.** Base Plate Base plate thickness of the Structure should be 5MM for this segment.
- c. Column Structure Column should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.

- d. Rafter Structure rafter should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web side (y-axis) and 40MM in flange side (x-axis).
- e. Purlin Structure purlin should be minimum 2MM in Lip section. The minimum section should be 60MM in Web side and 40MM in flange side in Lip section.
- f. Front/back bracing The section for bracing part should be minimum 2MM thickness.
- g. Connection The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.
- h. For single portrait structure the minimum ground clearance should be 500MM.

B. Medium Ground clearance (1000MM – 2000 MM) (for reference only)

- a. Base Plate Base plate thickness of the Structure should be Minimum 6MM for this segment.
- b. Column Structure Column should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.
- c. Rafter Structure rafter should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- d. Purlin Structure purlin should be minimum 2MM in Lip section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- e. Front/back bracing The section for bracing part should be minimum 2MM thickness.
- f. Connection The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

C. Maximum Ground clearance (2000MM – 3000 MM) (for reference only)

- a. Base Plate Base plate thickness of the Structure should be minimum 8 MM for this segment.
- **b.** Column Structure Column thickness should be minimum 2.6MM in square hollow section (minimum 50x50) or rectangular hollow section (minimum 60x40) or 3MM in C-Channel section.

- c. Rafter Structure rafter should be minimum 2MM in Lip section / 3MM in Channel section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.
- d. Purlin Structure purlin should be minimum 2MM in Lip section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.
- e. Front/back bracing The section for bracing part should be minimum 3MM thickness.
- f. Connection The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

D. Super elevated structure (More than 3000 MM) (for reference only)

D.1. Base structure

- a. Base Plate Base plate thickness of the Structure should be 10MM for this segment.
- b. Column Structure Column minimum thickness should be minimum 2.9MM in square hollow section (minimum 60x60) or rectangular hollow section (minimum 80x40).
- c. Rafter Structure Rafter minimum thickness should be minimum 2.9MM in square hollow section (minimum 60x60) or rectangular hollow section (minimum 80x40).
- d. Cross bracing Bracing for the connection of rafter and column should be of minimum thickness of 4mm L-angle with the help of minimum bolt diameter of 10mm.

D.2. Upper structure of super elevated structure –

- a. Base Plate Base plate thickness of the Structure should be minimum 5MM for this segment.
- b. Column Structure Column should be minimum 2MM in Lip section / 3MM in Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- c. Rafter Structure rafter should be minimum 2MM in Lip section / 3MM in Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- d. Purlin Structure purlin should be minimum 2MM in Lip section. The minimum section should be 60MM in Web side and 40MM in flange side in Lip section.
- e. Front/back bracing The section for bracing part should be minimum 2MM thickness.
- f. Connection The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and

- purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.
- D.3. If distance between two legs in X-Direction is more than 3M than sag angle/Bar should be provide for purlin to avoid deflection failure. The sag angle should be minimum 2MM thick, and bar should be minimum 12Dia.
- D.4. Degree The Module alignment and tilt angle shell be calculated to provide the maximum annual energy output. This shall be decided on the location of array installation.
- D.5. Foundation Foundation should be as per the roof condition; two types of the foundation can be done- either penetrating the roof or without penetrating the roof.
 - a. If penetration on the roof is allowed (based on the client requirement) then minimum 12MM diameter anchor fasteners with minimum length 100MM can be used with proper chipping. The minimum RCC size should be 400x400x300 cubic mm. Material grade of foundation should be minimum M20.
 - b. If penetration on roof is not allowed, then foundation can be done with the help of 'J Bolt' (refer IS 5624 for foundation hardware). Proper Neto bond solution should be used to adhere the Foundation block with the RCC roof. Foundation J bolt length should be minimum 12MM diameter and length should be minimum 300MM.

3.13. Material standards:

- i. Design of foundation for mounting the structure should be as per defined standards which clearly states the Load Bearing Capacity & other relevant parameters for foundation design (As per IS 6403 / 456 / 4091 / 875).
- ii. Grade of raw material to be used for mounting the structures so that it complies the defined wind loading conditions (As per IS 875 III) should be referred as follows (IS 2062 for angles and channels, IS 1079 for sheet, IS 1161 & 1239 for round pipes, IS 4923 for rectangular and square hollow section)
- iii. Test reports for the raw material should be as per IS 1852 / 808 / 2062 / 1079 / 811.
- iv. In process inspection report as per approved drawing & tolerance should be as per IS 7215.
- v. For ascertaining proper welding of structure part following should be referred:
 - a. D.P. Test (Pin Hole / Crack) (IS 822)
 - b. Weld wire grade should be of grade (ER 70 S 6)

- vi. For ascertaining hot dip galvanizing of fabricated structure following should be referred:
 - a. Min coating required should be as per IS 4759 & EN 1461.
 - b. Testing of galvanized material
 - Pierce Test (IS 2633)
 - Mass of Zinc (IS 6745)
 - Adhesion Test (IS 2629)
 - CuSO4 Test (IS 2633)
 - Superior High-Grade Zinc Ingot should be of 99.999% purity (IS 209)
 (Preferably Hindustan Zinc Limited or Equivalent).
- vii. Foundation Hardware If using foundation bolt in foundation then it should be as per IS 5624.

4. Metering

- 4.1. A Roof Top Solar (RTS) Photo Voltaic (PV) system shall consist of following energy meters:
 - i. Net meter: To record import and export units
 - ii. Generation meter: To keep record for total generation of the plant.
- 4.2. The installation of meters including CTs & PTs, wherever applicable, shall be carried out by the respective DisComs as per the terms, conditions and procedures laid down by the concerned SERCs/DISCOMs.

5. Array Junction Boxes:

- 4.1 The junction boxes are to be provided in the PV array for termination of connecting cables. The Junction Boxes (JBs) shall be made of GRP/FRP/Powder Coated aluminum /cast aluminum alloy with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JBs shall be such that input & output termination can be made through suitable cable glands. Suitable markings shall be provided on the bus-bars for easy identification and cable ferrules will be fitted at the cable termination points for identification.
- 4.2 Copper bus bars/terminal blocks housed in the junction box with suitable termination threads Conforming to IP 65 or better standard and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry, Single /double compression cable glands should be provided.
- 4.3 Polyamide glands and MC4 Connectors may also be provided. The rating of the junction box shall be suitable with adequate safety factor to interconnect the Solar PV array.
- 4.4 Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
- 4.5 Junction boxes shall be mounted on the MMS such that they are easily accessible and are protected from direct sunlight and harsh weather.

5 DC Distribution Box (DCDB):

- 5.1 May not be required for small plants, if suitable arrangement is available in the inverter.
- 5.2 DC Distribution Box are to be provided to receive the DC output from the PV array field.
- 5.3 DCDBs shall be dust & vermin proof conform having IP 65 or better protection, as per site conditions.
- 5.4 The bus bars are made of EC grade copper of required size. Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the inverter along with necessary surge arrestors. MCB shall be used for currents up to 63 Amperes, and MCCB shall be used for currents greater than 63 Amperes.

6 AC Distribution Box (ACDB):

- 6.1 AC Distribution Panel Board (DPB) shall control the AC power from inverter, and should have necessary surge arrestors, if required. There is interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- 6.2 All switches and the circuit breakers, connectors should conform to IEC 60947:2019, part I, II and III/ IS 60947 part I, II and III.
- 6.3 The isolators, cabling work should be undertaken as part of the project.
- All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air -insulated, cubical type suitable for operation on $I-\phi/3-\phi$, 415 or 230 volts, 50 Hz (or voltage levels as per CEA/State regulations).
- 6.5 The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
- 6.6 All indoor panels will have protection of IP 54 or better, as per site conditions. All outdoor panels will have protection of IP 65 or better, as per site conditions.
- 6.7 Should conform to Indian Electricity Act and CEA safety regulations (till last amendment).
- 6.8 All the 415 or 230 volts (or voltage levels as per CEA/State regulations) AC devices / equipment like bus support insulators, circuit breakers, SPDs, Voltage Transformers (VTs) etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.
 - i. Variation in supply voltage: as per CEA/State regulations
 - ii. Variation in supply frequency: as per CEA/State regulations
- 6.9 The inverter output shall have the necessary rated AC surge arrestors, if required and MCB/ MCCB. RCCB shall be used for successful operation of the PV system, if inverter does not have required earth fault/residual current protection.

7 Protections

The system should be provided with all necessary protections like earthing, Lightning, and Surge Protection, as described below:

7.1 Earthing Protection

- i. The earthing shall be done in accordance with latest Standards.
- ii. Each array structure of the PV yard, Low Tension (LT) power system, earthing grid for switchyard, all electrical equipment, inverter, all junction boxes, etc. shall be grounded properly as per IS 3043-2018.
- iii. All metal casing/ shielding of the plant shall be thoroughly grounded in accordance with CEA Safety Regulation 2010. In addition, the lightning arrester/masts should also be earthed inside the array field.
- iv. Earth resistance should be as low as possible and shall never be higher than 5 ohms.
- v. For 10 KW and above systems, separate three earth pits shall be provided for individual three earthing viz.: DC side earthing, AC side earthing and lightning arrestor earthing.

7.2 Lightning Protection

- i. The SPV power plants shall be provided with lightning & over voltage protection, if required. The main aim in this protection shall be to reduce the overvoltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc. Lightning arrestor shall not be installed on the mounting structure.
- ii. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors (LAs). Lightning protection should be provided as per NFC17-102:2011/IEC 62305 standard.
- iii. The protection against induced high-voltages shall be provided by the use of Metal Oxide Varistors (MOVs)/Franklin Rod type LA/Early streamer type LA.
- iv. The current carrying cable from lightning arrestor to the earth pit should have sufficient current carrying capacity according to IEC 62305. According to standard, the minimum requirement for a lightning protection system designed for class of LPS III is a 6 mm² copper/ 16 mm² aluminum or GI strip bearing size 25*3 mm thick). Separate pipe for running earth wires of Lightning Arrestor shall be used.

7.3 **Surge Protection**

- i. Internal surge protection, wherever required, shall be provided.
- ii. It will consist of three SPD type-II/MOV type surge arrestors connected from +ve and –ve terminals to earth.

8 CABLES

- 8.1 All cables should conform to latest edition of IEC/equivalent BIS Standards alongwith IEC 60227/IS 694, IEC 60502/IS 1554 standards.
- 8.2 Cables should be flexible and should have good resistance to heat, cold, water, oil, abrasion etc.

- 8.3 Armored cable should be used and overall PVC type 'A' pressure extruded insulation or XLPE insulation should be there for UV protection.
- 8.4 Cables should have Multi Strand, annealed high conductivity copper conductor on DC side and copper/FRLS type Aluminum conductor on AC side. For DC cabling, multi-core cables shall not be used.
- 8.5 Cables should have operating temperature range of -10°C to +80°C and voltage rating of 660/1000 V.
- 8.6 Sizes of cables between array interconnections, array to junction boxes, junction boxes to Inverter etc. shall be so selected to keep the voltage drop less than 2% (DC Cable losses).
- 8.7 The size of each type of AC cable selected shall be based on minimum voltage drop. However; the maximum drop shall be limited to 2%.
- 8.8 The electric cables for DC systems for rated voltage of 1500 V shall conform to BIS 17293:2020.
- 8.9 All cable/wires are to be routed in a RPVC pipe/ GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable is easily identified.
- 8.10 All cable trays including covers to be provided.
- 8.11 Thermo-plastic clamps to be used to clamp the cables and conduits, at intervals not exceeding 50 cm.
- 8.12 Size of neutral wire shall be equal to the size of phase wires, in a three phase system.
- 8.13 The Cable should be so selected that it should be compatible up to the life of the solar PV panels i.e. 25 years.

9 DRAWINGS & MANUALS:

- 9.1 Operation & Maintenance manual/user manual, Engineering and Electrical Drawings shall be supplied along with the power plant.
- 9.2 The manual shall include complete system details such as array lay out, schematic of the system, inverter details, working principle etc.
- 9.3 The Manual should also include all the Dos & Don'ts of Power Plant along with Graphical Representation with indication of proper methodology for cleaning, Operation and Maintenance etc.
- 9.4 Step by step maintenance and troubleshooting procedures shall also be given in the manuals.
- 9.5 Vendors should also educate the consumers during their AMC period.

10 Miscellaneous:

- 10.1 Connectivity: The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the SERC regulation for Grid connectivity and norms of DISCOM and amended from time to time.
- 10.2 Safety measures: Electrical safety of the installation(s) including connectivity with the grid must be taken into account and all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA Safety Regulation 2010 etc. must be followed.

10.3	Shadow analysis: The shadow analysis report with the instrument such as Solar Pathfinder or professional shadow analysis software of each site should be provided and the consumer should be educated to install the system only in shadow free space. Lower performance of the system due to shadow effect shall be liable for penalty for lower performance.	
Qua	Quality Certification, Standards and Testing for Grid-Connected Rooftop Solar PV Systems/Power Plants	
	Solar PV Modules/Panels	

IEC 61215 and	Design Qualification and Type Approval for Crystalline Silicon	
IS 14286	Terrestrial Photovoltaic (PV) Modules	
IEC 61701:2011	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules	
IEC 61853- 1:2011 /	Photovoltaic (PV) module performance testing and energy rating –	
IS 16170-1:2014	:Irradiance and temperature performance measurements, and power Rating.	
IEC 62716	Photovoltaic (PV) Modules – Ammonia (NH3) Corrosion Testing	
	(as per the site condition like dairies, toilets etc)	
IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1:	
	Requirements for Construction, Part 2: Requirements for Testing	
IEC 62804	Photovoltaic (PV) modules – Test method for detection of potential-	
	induced degradation. IEC 62804-1: Part 1: Crystalline Silicon	
	Solar PV Inverters	
IEC 62109 or	Safety of power converters for use in photovoltaic power systems –	
IS: 16221	Part 1: General requirements, and Safety of power converters for	
	usein photovoltaic power systems	
	Part 2: Particular requirements for inverters. Safety compliance	
	(Protection degree IP 65 or better for outdoor mounting, IP 54 or	
	better for indoor mounting)	
IS/IEC 61683 latest	Photovoltaic Systems – Power conditioners: Procedure for	
(as applicable)	MeasuringEfficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)	
IEC 60068-2 /IEC	Environmental Testing of PV System – Power Conditioners and	
62093	Inverters	
(as applicable)		
IEC 62116:2014/ IS16169	Utility-interconnected photovoltaic inverters - Test procedure of	
	islanding prevention measures	
	Fuses	
IS/IEC 60947 (Part	General safety requirements for connectors, switches, circuit breakers	
1, 2 & 3), EN	(AC/DC):	
50521	1)Low-voltage Switchgear and Control-gear, Part 1: General rules	
	2)Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers	
	3)Low-voltage switchgear and Control-gear, Part 3: Switches, disconnectors switch-disconnectors and fuse-combination units	
	4) EN 50521: Connectors for photovoltaic system-Safety requirements and tests	
	Low-voltage fuses - Part 6: Supplementary requirements for fuse-	
IEC 60269-6:2010	linksfor the protection of solar photovoltaic energy systems	
Solar PV Roof Mounting Structure		
Solul 1 / Mool Mounting Structure		

IS 2062/IS 4759/AA6063	Material for the structure mounting	
T6		
	Surge Arrestors	
BFC 17-102:2011/ NFC	Lightening Protection Standard	
102:2011/ IEC 62305		
IEC 60364-5-53/ IS	Electrical installations of buildings - Part 5-53: Selection and	
15086-5 (SPD)	erectionof electrical equipment - Isolation, switching and control	
IEC 61643- 11:2011	Low-voltage surge protective devices - Part 11: Surge protective	
	devices connected to low-voltage power systems - Requirements	
	and test methods	
Cables		
IEC 60227/IS 694, IEC	General test and measuring method for PVC (Polyvinyl chloride)	
60502/IS 1554 (Part 1&	insulated cables (for working voltages up to and including 1100 V,	
2)/ IEC69947 (as	andUV resistant for outdoor installation)	
applicable)		
	Electric cables for photovoltaic systems (BT(DE/NOT)258),	
BS EN 50618	mainly for DC Cables	
	Earthing /Lightning	
IEC 62561/IEC	IEC 62561-1: Lightning protection system components (LPSC) -	
60634 Series	Part:Requirements for connection components	
(Chemical earthing)	IEC 62561-2: Lightning protection system components (LPSC) –	
(as applicable)	Part 2:Requirements for conductors and earth electrodes	
	IEC 62561-7: Lightning protection system components (LPSC) -	
	Part 7:Requirements for earthing enhancing compounds	
Junction Boxes		
	Junction boxes and solar panel terminal boxes shall be of the	
	thermo-plastic type with IP 65 or better protection for outdoor use,	
IEC 60529	and IP 54 or better protection for indoor use	

Annexure-4

Technical Specifications and Scope of Work

Section I: Technical Specifications

(1) EPABX System:

Sl. No.	Specification	Requirement
1.	IPPBX System Implementation	IP@CORE Server
	Technology/Architecture	Gateway Solution Product
		Compliance as per Latest TEC
		GR No.:- TEC/GR/SW/PBX- 005/01/SEP-16
		· ·
2.	Gateway with Analogue Extensions /FXS ports	64 or higher
3.	Gateway Expandable up to (TDM ports/FSX	128 or higher
<i>J</i> .	ports)	120 of flighter
4.	Gateway should have Digital Extensions	4 or higher
5.	Gateway should have Analogue Junction/FXO	4 or higher
	ports	
6.	MDF (Number of Pair)	100
7.	if yes, Number of Integrated	100
	Protection Module (IPM)	
8.	Gateway Types supported	GSM
9.	Type of Operator Console	Digital key phone based
10.	Number of Operator Console	1 or higher
11.	Supply Voltage	48 VDC
12.	Float cum Boost Charger	Yes
13.	If yes, minimum current Rating of	10 A
	FCBC at charging voltage of 48V	
	(Ampere)	
14.	Comprehensive Warranty (In Years)	1 year
15.	Installation & Commissioning	With

(2) Feature Requirements for EPABX System:

Sr. No.	Specifications
1	The IP@Core IP-PBX Server Media Gateway based Communication System shall employ IP at its core with IP switching technology and 100% non-blocking. (Valid TEC GR Certificate No. TEC/GR/SW/PBX-005/01/SEP-16 to be attached)
2	The system should be IPV6 ready.
3	The manufacturer should have DSIR recognized R&D.

	local supplier. Document to be submitted with %LC.
5	The system should have SIP and Voicemail at its core which should be inbuilt part of Server OS. No additional Module designed will be considered.
6	The system shall provide IP functionality at its core to support SIP/IP extensions and trunks over SIP protocol. It should support license-free 100 SIP trunks and 1000 SIP/IP users (SIP/IP Phone, Mobile softphones, UC Client).
7	It should be possible to reach the capacity of system to 128 analog and 1000 IP Users without any add-on CPU or chassis/ hardware platform.
8	The architecture of the gateway shall be capable of seamless migration to its maximum capacity by simply adding peripherals cards/modules in the same chassis without compromising function/features of the system.
9	The Gateway should build on a universal slot architecture and modular in design to enable seamless growth, by adding the desired necessary cards as and when required. Any interface peripheral card can be inserted in any slot of the platform, whereby it is possible to increase or decrease the trunk lines or subscriber lines of the system as per the requirement.
10	SIP Ext./Trunks and Voicemail should be inbuilt part of Server CPU OS. No slots should be utilized for it. VoIP module(s) should support up to 150 VoIP channels, 100 SIP trunks and 1000 SIP/IP users (SIP/IP Phone, Mobile soft phones, UC Client) with same Server CPU.
11	System power supply should be inbuilt and SMPS type with input ranges from 48VDC +/- 15%
12	The Server CPU must have 19" Rack Mounted with minimum Configuration of LINUX based OS, 8GB RAM, Quad Core Pentium Processor, 64GB minimum storage expandable upto 1TB by addition of HDD/SSD. There should be option of Redundant Fan and Redundant Power Supply if required.
13	The Server CPU and multi Protocol gateway must be of Same OEM.
14	The system should support UC Clients with following UC features: (i) Presence and IM (ii) Video Calling (iii) Auto Sign-in (iv) IM to SMS and vice versa (v) SMS to email and vice versa

The product should be a Make in India product from Class I

- (vi) Bulk Messaging
- (vii) Busy Lamp Field and SMS on No Reply(viii) Drag and Drop conference on Windows UC Client

15	The system should support SNMP, which helps to manage and monitor network elements, audit network usage and detect network faults.
16	It should support SIP over TLS and SRTP to ensure VoIP call security over IP network.
17	System should have two Gigabit Ethernet ports for LAN and WAN to separate out local and VoIP traffic on external network.
18	It should be suitable for DTMF as well as the FSK type of telephone instruments.
19	The EPABX capacity shall be suitable to scale up to 100 VoIP (SIP) Trunks and 1000 SIP/IP Users.
20	It should have built-in 128 multi-party audio conferencing without any software licensing. It should be possible to carry out 16 conferences of 8- participants at a time. The maximum number of participants supported in single conference would be 64.
21	The system shall have the inbuilt Auto-attendant facility and shall be able to answer minimum 18 calls simultaneously.
22	The system shall be compatible with ISDN PRI line of Local Service Provider.
23	The PRI card should be software programmable for TE/NT mode.
24	The Gateway system shall have multiple port interfaces such as analog extension lines, digital key phone, GSM for voice, T1E1 PRI, RADIO, CO and E&M.
25	The Gateway System should support Radio Connectivity in the form of card which should be pluggable to the system.
26	The Gateway should have in-skin GSM card so that the multiple SIMs can be inserted on the GSM card plugged on to the PBX platform. Hence, the calls on GSM mobile can be routed through this SIMs and contribute in reduction of overall telecom bill.
27	The Gateway should have combo cards (PSTN + DIGITAL) to have flexible configuration and save on the resources of universal slots.
28	The Server CPU must have at least 2 Gigabit Ethernet Ports, 2 USB Ports, 1 HDMI Port & 1 Display Port for different types of connectivity Interface.
29	The system shall have built-in web-based software programming tool for system administration.
30	The system shall have a built-in remote maintenance facility. The system can be programmed remotely over the internet without any modem required on the system side.

31	The call ringing sequence would be programmable and have options such as simultaneous, hunting off, round robin and delayed simultaneous.
32	Detail reports of all system parameters should be available.
33	The Server should have built-in 100% Audio/Video Codec for provided SIP Users Licenses. No additional Video Codec Licenses required for implementing 100% IP Video Phone if required.
34	The offered system should be QSIG ready (for PRI) for Networking and Feature Transparency between two or more exchanges.
35	Each port of the system shall be programmable. It shall have programmable features port-wise/extension-wise.
36	The system shall support flexible numbering for extensions such as it may have extensions with 1 digit, 2 digits and up to 6 digits numbers as well as in combination of all.
37	Access codes, system timers and access to features shall be programmable.
38	Storage of outgoing, incoming and internal call reports shall be generated in the system. It shall also be available online through Ethernet Port.
39	The system should have built-in outgoing Call Log buffer of 10,000 calls, incoming call log buffer of 7500 and call log buffer of 2000 internal calls.
40	System should support dial from the corporate directory. There shall be minimum 1500 numbers possible to store in corporate directory and shall also possible to dial it as an abbreviated number.
41	Features given to an extension shall be accessed from any other extension by dialing the secret codes.
	The Server + Gateway System must have following features: (i) Call Budget on Trunk
	(ii) CLI based DISA (Mobile Extension) (iii) GSM Trunk Connectivity (iv) Multi-stage Dialing
	(v) Returned Call to Original Caller (RCOC)(vi) Automatic Call to Missed (Predefined) Calls on Trunks
	(vii) Dual Ring (viii) Routing of calls to only permissible legal networks (Logical Partitioning)
	(ix) SMDR/CDR through Ethernet Port
42	Extension features shall have an extension-to-extension call, extension to central office, extension to operator, automatic call back, call transfer, call forward, follow me, executive/secretary, do not disturb, barge-in, raid, Boss ring, Priority shall be supported.

43	Operator features shall have the assistance to extension, attended call
	transfer, call intercept, indication of call waiting, night service control etc.
	should be available by default.
44	The IPPBX System shall have features as CLI based routing, call duration
	control, least cost routing i.e. time, number or combination of both.

	Ŭ	
45	The Server CPU shall have a conversational recording Facility. Conversation recording should be possible on Analog/Digital/IP as well as Mobile SIP Smartphones (Android/iPhone) without any additional software licenses.	
46	Various type of open SIP Terminals such as IP Phone, SIP softphone, Mobile SIP Client and UC Client shall be supported.	
47	System's UC Client should support 1000 DSS, 500 BLF and drag & drop conference.	
48	The OEM should also have UC Client application for Android and iPhone and on Windows PC so that the mobility can be extended for the Smartphone users.	
49	The system must support following features of IP telephony: Dynamic DNS, Registrar Server, Proxy Server, Presence Server, NAT and STUN.	
50	The system should support Voice Mail System with following features:	
	Attend as much as 64 calls simultaneously with flexibility of routing callers to	
	desired extension or delivering information depend upon the selection	
	Selectively allocate voicemails to users with the flexibility of customizable mailbox size and greetings for All/Selective users	
	Group mailbox to share messages between departmental groups	
	Anywhere access to voice mail with just a phone call	
	Password protected secured voice mail access	
	Record important conversations for future reference and record maintenance	
	Record up to 3000 hours of Voicemail	
	Redirection of voice mails to another extension in case of	
	non-availability	
	Tag voicemails while Forwarding Messages to Another Mailbox	
	Broadcast voice message to a group of personnel, at a go	
	Distribution lists for delivery of voice mails to different set of users or groups	
	Message wait indication via ring, change in dial-tone, voice message or message wait lamp	
	Notification of a new voicemail via email alert or a phone call	
51	The hardware should be 19" rack mountable with not more than	
	6U max size so that it can be accommodate with the standard rack.	

52	Conformity to dry heat for 16 hours at maximum specified temperature degree C in accordance with IS:9000/part-3/ section-5/1977 latest
53	conformity to Cold Test for 4 hours at minimum specified temperature degree C in accordance with IS:9000/part-2/section-4/1977 latest
	degree C in accordance with 15.7000/part-2/ section-4/17/7 latest
54	conformity to Damp Heat (Cyclic)Test for 2 Cycles of 24 hours
	each at a temperature of 40 Degree C & 95% RH in accordance with
	IS:9000/part-5/section-1/1991 latest

(3) Push Button CLI Phone:

Sr. No.	Specification	Requirement
1.	Hands-free two-way speaker phone	Yes
2.	Mute	Yes
3.	Caller ID	Yes
4.	Display	With
5.	No. of digits in display	14

(4) MDF box - 100 Pairs:

Sr. No.	Specification Name	Requirement
1.	Switch board boxes for installation of Modular Type of electrical accessories	With Frame Plate
2.	Materiel of switch board boxes	Galvanized Iron Sheet
3.	Minimum size of the box (L x W x H)	200 mm x 145 mm x 290 mm
4.	Matching Cover Plate	With
5.	Matching Frame Plate	With

Section II: Scope of Work

• Scope of installation and Commissioning for a IPPBX System:

- (1) Mounting/Fitting of the IPPBX System on a wall or in a rack as applicable.
- (2) Suitable electric wiring between PBX and Power Socket.
- (3) Suitable connection of extension and trunk lines for termination on MDF/PBX.
- (4) Bidder to install 100 pair MDF for PBX end.
- (5) Connection of telephone instruments and demonstration of extension features/ working of PBX to the buyer.
- (6) A bidder has to provide all the accessories required for a digital phone and any further required accessory to make it operational.
- (9) Tenderer would provide PRI Line, which needs to be terminated in EPABX.
- (10) Tenderer would install the necessary 2 Pair cable from the server room to the end-user side.
- (11) Should have the facility to export monthly call log with internal logs till 1 year.
- (12) The device should have a feature for generating extension-wise monthly billing reports.
- (13) Bidder to ensure any further requirement to make the system operational is quoted with a bid and no further cost increment would be entertained.
- (14) Training to be arranged about operation & maintenance of the system, further for any configuration related changes bidder needs to provide support during the warranty period. Further no additional expenses to be levied on the tenderer.
- (15) The bidder is responsible for any damage due to the power surge and should be covered under warranty.

Annexure – 5

Finishings at Stations

1	Electrical Work- Internal
1.1	Internal Electric Installation
1.2	Power Wiring & Plugs
1.3	Lightning Conductors
-	
1.4	Telephone Conduits
2	Electrical Work- External
2.1	External service connections and local body approval charges shall be as hereunder or as
0.0	per estimates given by the local body whichever is higher.:
2.2	Civil External Service Connection
2.3	Supplying, installation, testing and commissioning of 33 kV/0.433 kV or 11 kV/0.433 kV
	substation equipment comprising HT panel, dry type. Oil type transformers, HT cable, bus
	trunking from transformer to LT panel, LT panels, automatic power factor correction panel,
	active harmonic filters, TVSS (transient voltage suppression system), SPD (surge protection
	system), essential panel, earthing, required inter-connections, substation safety
	equipment's including LT cabling from substation to the buildings fed by the substation.:
2.4	Electrical Substation Equipment (@9000 per KVA) Supplying, installation, testing and commissioning of DG sets, AMF panel, bus ducting/
2.4	
	cables from DG sets to essential panel, DG set enclosure room sound insulation/ventilation/smoke exhaust as required, earthing of DG set system, control cabling, fuel
	tank/piping, DG set exhaust piping/ exhaust chimney as per CPCB norms, civil works
	connected with DG sets including foundation as required and Extra for synchronizing panels
	wherever required.:
3	PHE Work- Internal
3.1	Internal Water Supply & Sanitary Installations.
3.1	Underground sump-Water Supply
3.3	Underground sump-Fire Fighting
3.4	Underground sump-Treated Water
3.4 4	
4.1	Baggage Scanners Baggage scanner big: computer based multi energy X- Ray baggage inspection system
4.1	capable of passing through bags/parcels of dimension 940mm (W) x 640mm (H) with Belt
	Height- 750mm-850mm with 22/24" LCD Monitor, input/ Output rollers with frames etc. as
	required.: (One per entry station)
5	IBMS (Integrated Building Management System)
5.1	Supplying, installation, testing and commissioning of integrated building management
] 3.1	system for digital/electronic display and monitoring of all E&M systems like substation, DG
	sets, UPS, solar power, lifts, AC plants, ventilation systems, tire protection systems, pumps
	etc. to include cabling, monitors, recording, display system, hardware, software support (up
	to 10,000 sqm) (Rate applicable on total plinth area).: Integrated Building Management
	System.
6	Door Frame Metal Detector
6.1	20 zone or above door frame metal detector nominal size: 760 mm (W) x 2050 mm (H) x 700
	mm (D) loaded with necessary software.: Door Frame Metal Detector (Two per entry
	station)
7	Access Control System
7.1	Supplying, installation, testing and commissioning of access control system for building
	security comprising of controller, E&M locks, reader, smart cards, cabling, recording,
	display system, hardware and software support as required (Rate applicable only on plinth
	area of high security area in the building).:
8	IP Based EPABX System

Annexure – 5

Finishings at Stations

8.1	Supplying, installation, testing and commissioning of IP based EPABX system comprising of core switches & L2 switches with 10 G, 10 giga SFP modules, industry standard appliance server, cloud-based, enterprise-grade UC solution, MID/ENTRY level IP/SIP phone with, dual 1 gig ports, racks, CAT 6A cable, patch panels, OFC etc. (Rate applicable on plinth area excluding service/common areas).:
9	Fire Fighting & Alarm System
9.1	Automatic Fire Alarm System
9.2	Fire Fighting with Wet Riser & Sprinkler System.:
10	Boom Barrier
10.1	Electromechanical boom barrier with all accessories. (Two per parking facility)
11	Other Building Services
11.1	CCTV SYSTEM - 80% of Total B.U.A
11.2	Supplying, installation, testing and commissioning of IP based CCTV system for building security comprising of PTZ / fixed camera, cabling, digital recording, HD display system with minimum display of 5" x 8" per camera and hard ware software support -for indoors only {Rate applicable on total plinth area but CCTV coverage shall be limited to 15% of the total plinth area as per requirement}.: CCTV SYSTEM - EXETRNAL SUVEILLANCE on total plot area
11.3	LIFTS with power operated center opening doors and AC variable voltage & variable
	frequency controls Passenger Lift (As per attached specifications)
12	Solar
	(As per attached specifications)

ANNEXURE-6



ANNEXURE-7























































































