ADDENDUM 1

Name of Work:-“Construction of Super Structure (G+15) for Unified Academic Campus of Bose Institute at Plot No. 80, JL No. 3, Block-EN, Mouza-Mohisbathan, Sector-V, Salt Lake, Kolkata, West Bengal.”

Tender No.: RITES/CP/TC/ ROC-II/SS (G+15) /Bose Institute /Financial Bid/2014

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Note : (1) All other terms and conditions of the tender document shall remain unchanged.

(2) The Bidder shall submit all the corrigendums/addendums duly signed & stamped along with the Tender.
Name of work: Construction of Super Structure (G+15) for Unified Academic Campus of Bose Institute at Plot No. 80, JL No. 3, Block– EN, Mouza- Mohisbathan, Sector-V, Salt Lake, Kolkata, West Bengal”.

Tender No. - RITES/CP/TC/ ROC-II/SS (G+15) /Bose Institute /Financial Bid/2014

**Additional Approved Makes List (Civil Works)**

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SPECIFICATION OF UPS & INVERTER SYSTEM

The Scope
The scope of work shall cover supply, erection, testing and commissioning of a static Uninterrupted Power System meeting the performance criteria under equipment schedule ES05.

System features
The UPS Shall be a true online input 3-ph. 415 V & output 3-ph 415V complete with all modules like converter, Inverter, Bypass modules with battery backup as called in BOQ with charging arrangement and other standard accessories.

Each unit shall be modular in construction to facilitate unit replacement and all electronic control cards shall permit plug-in type replacement. The enclosure shall be dust & vermin proof provided with IP-20 degree protection, designed for minimum space requirements for maintenance and installation.

All the modules, accessories shall provide controls, metering and monitoring system and fault diagnostic/annunciation system for healthy/faulty status through LEDs, data logger with power monitoring software for operational status locally.

UPS shall be compatible to take non-linear loads and capable to handle high crest load. UPS shall be provided with harmonics filter and input & output power actor correction features.

UPS shall be compatible to work on 2 sources of supply with reverse phase sequence protection and correction.

The system shall be standard tried out product of an established manufacturer and shall comprise minimum number of components with maximum MTBF & MTTR. The system shall have high operating efficiency, front access and self-diagnostics. There shall be sufficient redundancy in all vital parts achieving a breakdown-free operation of the system.

The System shall essentially consist of following major components.

Solid-state PWM converter with insulated gate bipolar transistor/intelligent power module.
Converter input system battery contractor, system battery, maintenance bypass, static bypass input with circuit breakers.

A Battery system (explained below)
Microprocessor based Menu driven software for operation, control and management as well as microprocessor controlled diagnostics. Ventilation for the system shall be
provided with a adequate redundancy to maintain component temperature within the limits. All air entries shall be protected with cleanable filters. All heat producing devices shall be mounted on ample heat sinks. UPS shall be mounted as a whole on a heavy duty fabricated steel base frame constructed from folded channel sections with suitable mounting pads.

The converter & inverter shall work in cross redundancy.

The UPS shall be designed to work in following environmental conditions:

- **Operating temperature**: 0-50°C
- **Relative Humidity**: 0-95%RH

UPS shall be designed for low impedance, less than 50V touch voltage, limited ripple content (1% with battery & 2% without battery), efficiency not less than 90% at full load, less than 55dB acoustic level.

The UPS shall have Expandable feature. The UPS units can be connected in parallel up to 8 units to increase power availability or redundancy. The system can be expanded at any time. For the expandability there shall be “Hot System Expansion” feature, the additional unit can be connected in parallel while the other units are on-line and supplying regular power to the load. The new UPS is on-line and will receive the updated information automatically.

For Advanced communication there shall be software system which displays the most important information such as the input and output Voltage, the load applied, the remaining back-up time, etc. It should also be able to provide information even in the event of a failure, to support the fault diagnostics.

It should also contain the following hardware interfaces:

- RS232 serial port
- Dry contacts
- EPO (Emergency Power Off)
  Contact for UPS shutdown using the remote emergency button.

To allow easy and intuitive operation of the UPS there should be Mimic Panel. This helps in accessing the most important parameters: status and alarm, control and commands, input, output, battery measurements (power, current, voltage, frequency and temperature) and settings.

UPS shall be designed for minimum following over load of

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<tr>
<td>25%</td>
<td>10 min. duration</td>
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<td>50%</td>
<td>60 sec. duration</td>
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</table>
Static PWM Converter
The converter should be solid state Static PWM converter with insulated gate bipolar transistor or intelligent power module. The converter should have the following important features.

- Power conversion
- Battery charging
- Power factor improvement
- Current harmonic reduction
- Voltage regulation
- Transient recovery
- Over current protection
- Over temperature protection
- Control power failure protection
- Short circuit protection
- High speed switching to reduce heat dissipation (6 kHz)
- Input current limiting through two line slide current transformers
- Current limiting function of battery charging to prevent the battery from being damaged.

The converter should meet with the following specification in addition to other requirements stated herein.

Input Voltage
The converter will be fed from the commercial source.

The converter will meet the following specifications in addition to other requirements stated herein:

a) Nominal voltage: 415VAC (352-478V), 3 phase.
b) Voltage range: ±15%/-30% AC
c) Nominal frequency: 50HZ ±5%
d) Frequency range: ± 5% (± 2.5 Hz)
e) Input power factor: 0.98 lagging or more at full load (PF improvement)
f) Input harmonic current THD: 3# typical at 100% load 6% maximum at 50% Load
g) Duty: Continuous at 50 deg. C
h) Cooling: Forced cooling using fans with thermal relays using a latched cut out re-setting as protection for cooling fans.

Each individual fan has its own thermal relay.
i) Ambient operating temperature: 0 to 50°C Range
j) Operating Relative Humidity: 0-95% non-condensing
k) Operating altitude: Sea level to 1,000 meters
l) Magnetized sub-cycle inrush: Typically 8 times normal full load current
m) Converter walk-in timer: 1 through 60 seconds (every 1 second selectable, (0 to 100% rated load) Default setting: 20 seconds.
n) Input: Suitable terminals are provided for termination of cables from the AC distribution board supplied by owner.

Static Inverter
The static inverter should be solid state type with proven pulse width modulation technique. The inverter should utilize insulated gate bipolar transistor.

The inverter should incorporate following essential features.

- Voltage regulations
- Transient recovery
- Over current protection
- Over temperature protection
- Short circuit power protection
- High speed switching (6 kHz)
- Frequency control through an isolator internet to the UPS module logic
- Inviting of output voltage harmonic distortion
- Inverter overloads protection through MCB’s.

The inverter should meet the following specifications in addition to other requirements stated herein.

Voltage Input: Three Phase UPS  
415 V three-phase + N

Voltage tolerance: ± 20%+
Frequency: 45-65 Hz
Current distortion: <4% with active filter
Power factor: 0.99 with active filter

Nominal Voltage Output: 415 V three-phase + N
Rated power: As per BOQ
Active power: As per BOQ
Waveform: Sinewave
Rated voltage: 415V
Frequency: 50 Hz
Dynamic stability: ± 5%
Static stability: ± 1%
Crest factor: 3 : 1

Inverter capacity: As per BOQ

Voltage Regulation

a) For 0 to 100% loading: <± 1%
b) Inverter DC input voltage varies from max. to mini.: <± 1%
c) Environmental conditions given below: <± 1%

Transient voltage regulation

a) At 100% step load change: <± 3%
b) At loss or return of AC input: <± 3%
c) At load transfer from Bypass to Inverter: <± 3%
Time to recover from transient to normal voltage : 20 milli seconds

Wave Form

a) Normal frequency : 50 Hz
b) Frequency regulation for all conditions of input supplies, loads and temperature occurring simultaneously or in any combination (automatically controlled).
c) Synchronization limits for synchronism between the inverter and standby AC source : 49 Hz to 51 Hz
d) Field adjustment range for above : 50 ± 0.25 Hz to 50 ± 1.5 Hz
Total voltage harmonic distortion : <2% THD for 100% linear load
<4% THD for 100% non-linear load
Phase voltage displacement : 180° ± 2°
Duty : Continuous
Cooling : Forced cooling using fans
Ambient operating temperature range : 0 to 50°C maximum continuous
Operating Relative Humidity : 0-95% non-condensing
Operating altitude : Sea level to 1,000 meters

Bypass & Static Transformer switch

Bypass circuit is provided as an alternate source of power other than the inverter. A high speed switch and wrap around contractor should be used to assume the critical load during automatic transfers to the bypass circuit. The static switch & wrap around contractor drives power from an upstream bypass feed circuit breaker internal to the UPS module provided for overload protection. The wrap around contractor should be electrically connected in parallel to static switch and should be at the same time as a static switch energized and upon closure, maintains the bypass source. The bypass circuit should be capable of supplying the UPS rated load current and also provide fault clearing current. UPS system logic should employ sensing which causes the static switch to energies within 150 microseconds thus providing an uninterrupted transfer to the bypass source when any of the following limitations are exceeded.

Rated voltage : 400 V three-phase + N
Phases number : 3 + N

Voltage tolerance : ± 15%

Rated frequency : 50 Hz

Frequency tolerance : ± 2%

By-pass : Static and manual for maintenance

Transfer time : nil

- Inverter output under voltage or over voltage
- Overload beyond the capability of the inverter
- DC circuit under voltage or over voltage
- Final end voltage of system battery is reached
- (Bypass source present and available)
- System failure (e.g.: logic fail, fuse blown, etc.)

The **static switch** should also confirm to the following minimum requirements:

- Capacity continuous equal to 100% of continuous rating of the inverter.
- Capacity overload equivalent to overload characteristics specified for UPS.
- Nominal bypass input voltage: 230V,R40V, 1 phase
- Voltage range : ±10% nominal
- Nominal frequency : 50 Hz
- Frequency range : ± 2%
- Current : 100%
- Duration : 20 milli seconds
- Ambient operating : 0 to 40 degree C. continuous temperature
- Operating Relative Humidity : 0-95% non-continuous
- Operating altitude : Sea level to, 1000 meters
- Cooling : Natural convection
- Duty : Continuous

**Automatic Retransfer**

In the event, if the critical load has to be transferred to the bypass source due to an Overload the UPS system logic monitors the overload conditions and upon the overload being cleared, automatic retransfer back to the Inverter output should be possible.
**Manual transfer**
UPS should be capable of transferring the critical load to/from the bypass source via LCD touch panel. When performing manual transfers to inverters or automatic retransfer, the UPS system logic should force the inverter output voltage to match the bypass input voltage and then parallel the inverter & by-pass source providing a make before break transition allowing a controlled load current to inverter.

**Maintenance Bypass switch**
UPS should include a maintenance bypass switch with required interlocks to enable maintenance inside the UPS.

**Battery System**
Twin Battery banks supplying 100% rated load suitable for **back up mentioned in BOQ** over its full service life complete with heavy duty, high discharge valve regulated lead-acid type batteries, battery racks and interconnecting cables shall be provided.

The battery capacity shall be designed for long life with uniform charging and discharging rates. The battery shall consist of sealed lead-acid recombination cells, thus obviating the specific need for flameproof equipment in the UPS room. These shall be mounted in at least two cabinets such that:

- Those in one cabinet shall be disconnected for maintenance while the rest provide a full service for a shorter time.
- Those so disconnected shall be isolated into groups such that no touch voltage exceeds 50v.

Such isolation shall be interlocked with the cabinet doors to prevent access unless isolated.

On restoration of grid power, the converter should automatically reactivate and provide DC power to the inverter, simultaneously recharging the system battery.

**Protection / Annunciation**
UPS system shall be designed with protection & annunciation system for monitoring following:

- Overload and short circuit trip.
- Earth fault.
- Reverse power relay
- Low battery voltage
- Fault indication alarm through suitably designed hooter
- Self diagnostic annunciation system

**System Earthing & Equipment Earthing**
Two independent and distinct earth electrodes shall be provided for equipment earthing of UPS connections comprising 40 x 6-mm GI strips. Each of these earth electrodes shall comprise a GI plate as per Code of Practice for Earthing IS 3043-1987 (latest version).

**Finish**
All cubicles shall be fabricated from cold rolled closed annealed mild steel sheet 1.6-mm with dead-front access and load bearing members of 2.0 mm thickness. The sheet steel shall be pre-treated for rust inhibition through a 7-tank process of degreasing and phosphate and adequately treated before being powder coated in an approved colour. All modules shall be designed for front access for ease of maintenance.

**Testing & Commissioning**
The UPS shall be thoroughly checked for correct operation and load tested in supplier works before dispatch. All faults, control functions and site load conditions shall be simulated, checked and proved. The equipment shall be dispatched after testing in presence of authorized representative of purchaser.

**Safety Standards**
- Safety EN 62040-1
- EMC IEC 62040-2
- EN 50091-2 lev. A
- Directives 73/23, 93/68, 89/336 EEC
- EN 62040-3.

**INVERTER**
**SCOPE**
This section covers supply, installation, testing and commissioning of Inverter for Emergency lighting.

**Inverter**

| a) Input | : 170 TO 270 Volts |
| b) Output Voltage: - | : As per incoming Voltage |
| c) Output Frequency: - | : Inverter 220V Nominal |
| d) Output Wave Form: - | : Mains Sine Wave |
| e) Overall Efficiency | : Inverter Stepped approximate to Sine wave |
| f) Power Factor | : Minimum 80% |
| g) Back up Time | : 0.8 |

**BUILT IN ELECTRONIC PROTECTION**
Reverse Battery polarity protection shall be provided with an audio signal. Electronic Controller shall prevent overcharging or deep discharge of batteries. The unit shall be protected against overload, short circuit and reverse phase connection. Isolators shall be provided at the mains and battery inputs for instances of short circuits.

FILTERS
Suitable filters shall be provided inside the inverter to prevent damage to lighting fixtures and to avoid noise generation.

COMPONENTS RATING
All the components including the Transformer shall be of 24 hour rating.

TECHNOLOGY
MOSFETs shall be used for switching devices. The charging of batteries shall be SCR Controlled giving Constant charging for the entire input voltage range of 170-270 Volts.

TESTING AND COMMISSIONING

i) Back-up Time
This should be measured with a fully charged battery (same Voltage and specific gravity). The cut-off voltage should be taken as 10 Volts per battery system on the inverter side. The same load should be connected to each Equipment to be tested and any unusual level of noise in fans should be recorded.

ii) Low battery cut off
The battery should not be discharged below 10 Volts. When the inverter is ON and the battery has discharged to this voltage, it should automatically switch off. This control is a must because if the battery is allowed to discharge further it will become deep discharged and its life will drastically reduce.

iii) Reverse Polarity Protection
This protection is normally required when untrained persons do installation. However, many times this protection is provided in such a way that it does not allow a battery, which has gone very low to be charged. Even if the battery voltage has gone down to 6 volts, the system should come on and the batteries should be charged without calling the technicians.

iv) Charging Current
With a fully discharged battery, at 10 Volts, during the entire AC mains voltage range of 160 to 270 Volts the charging current should be nearly constant and should not exceed 6% of the AH rating of the battery. When the battery is fully charged (approx. 14.2 Volts), the inverter should go into trickle charge with the charging rate not exceeding 1% of the AH rating of the battery. During the testing, by adjusting the input voltage, the charging should be done at the highest rate and the battery temperature measured. The
maximum charging rate and the maximum temperature permitted by the battery manufacturers should be compared with the readings obtained.

v) **Transformer**
The temperature rise of the transformer during the charging and inverter phases should be measured. If the temperature goes beyond 105 degrees Centigrade, the transformer insulation will start to become brittle and will breakdown after a year or so.

vi) **Output Voltage**
For proper functioning of the equipment, for most of the time, the output voltage should remain between 200-220 Volts. It should not drop below 185 Volts under any circumstances. It should be possible to switch on tube-lights even when the other load is on.

vii) **Wave form**
The inverter output wave form should be observed to find out if it has spikes and whether it is square or has been filtered for necessary protection to the equipment.
NAME OF WORK: Construction of Super Structure (G+15) for Unified Academic Campus of Bose Institute at Plot No. 80, JL No. 3, Block- EN, Mouza- Mohisbathan, Sector-V, Salt Lake, Kolkata, West Bengal

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Lift Details</th>
<th>Location</th>
<th>Nos. of Lift Considered</th>
<th>Dimension of Lift Shaft at site (in mm)</th>
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<tr>
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<td>TOTAL LIFT = 9 Nos.</td>
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</table>
**Annexure-4**

**Additional Special Condition for Electrical Work**

**19.00**

The Electrical work should be executed by a Class-I Electrical contractor registered with CPWD/MES/Railway/any Central/State Govt. PSUs or any other Govt. Department possessing a valid electrical contractor’s license employing licensed supervisors and skilled workers having valid permits as per the regulation of Indian Electricity Rules and Local Electrical Inspector’s requirements.
TECHNICAL SPECIFICATIONS OF LIFTS

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 bylaws, and subsequent provisions, as also any state or local Act in force and latest Indian Standard 14665, IS 15785:2007 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 up 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) 2013 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.

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 Engineer-in-charge/Consultants before installation and shall become part of the contract.

The Contractor shall, within 3(three) weeks of receipt of a Letter of award of contract, submit 4(four) copies of all working drawings showing pit, hoist way 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. Within 10 days of receipt of letter of award of contract, the Contractor shall obtain from the Engineer- in-charge/Consultants all the information he needs to prepare his drawings and shall have any interaction with the Engineer-in-charge/Consultants to finalize 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 Engineer-in-charge/Consultants. On approval of these drawings (within 2 weeks of submission of full documentation), the Contractor shall submit 6 (six) copies of approved working drawings incorporating corrections / comments, if any, and shall immediately commence work.
On completion of work, the contractor shall supply four sets of CD’s and 6 (six) copies of 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 Engineer-in-charge/Consultants.

**Works to be arranged**

The following items shall be provided to the Lift Contractor under instructions of the Department to suit the requirements of the lift Contractor.

i. Hoist ways, machine rooms and pits of specified dimensions (within normal building tolerances).

ii. Floor, wall and ceiling finishes in hoist ways, 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 Panel Board through the hoist ways terminating in and including individual Main Switches of required rating for 3 phase and single phase supply in Machine Rooms including necessary earthing.

iv. Lighting installation within hoist ways and pits as required.

v. Ventilation system of machine rooms with heavy duty exhaust fan in each machine room as per the requirement of NBC / BIS codes.

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

**LIFTS 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 hoist ways.

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.

vi. Ensuring safety against accidents including barricading all openings and caution signs.

vii. Scaffolding and other Tools & Tackles required for installation in the hoist ways 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 submit after award of the job.

xi. Temporary power supply connection(s) for erection, testing and commissioning work shall be arranged by the lift Contractor.

**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.

**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 IS: 14665 (Part 4 sections 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.

**HOIST MOTOR**

The motor shall be suitable for 415 Volts +10% to –20%, 50 Hz +/- 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.

**MOTOR CONTROL AND DRIVE**

The lift motor shall be controlled by a variable voltage variable frequency (V.V.V.F.) microprocessor 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 programmed 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.

GUIDES AND FASTENINGS

i. 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 hoist way 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).

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.

iii. 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.

iv. Over speed centrifugal governor operating the safety gear in case of over speeding of car in the down direction.

v. Car gate lock so that in the event of car gate is opened when passengers are in the car, the lift will be brought to rest.

vi. Over travel 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 over travel in either direction

vii. Ultimate terminal switches to stop the car automatically within top & bottom clearances independently of normal over travel limit switches but with buffers operative.

viii. Protective guards to counterweights in pit, rope sheaves and wherever required.

ix. Toe guard apron to the car platform.

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 minimized.
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 over speed 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 fiber 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.

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.

l. **Intercom**

An Intercom system shall be provided between the car, machine room and Fire Console room linked to EPABX.

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 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**

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.

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).

**ELECTRIC WIRING**

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

**WORKS TESTS**

The following tests shall be carried out at works.

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

b. Buffer test.

**TESTS ON COMPLETION**

The following tests shall be carried out to the satisfaction of the Engineer-in-Charge.

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 car.

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.

l. 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.

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.
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 key switch 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 leveling 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.

l. **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.

**PERFORMANCE PARAMETERS**

The following parameters shall be achieved in the installation:

* Jerk level \[0.9 – 1.5 \text{ m/s}^3\]
* Noise level in car 58 dB
* Noise level at 1 M in machine room 60 dB
* Acceleration rate 0.6 – 1.0 m/s² (adjustable)
* Max. car vibration 20 milli gals.

MAINTENANCE DURING DEFECTS LIABILITY PERIOD

Comprehensive maintenance during Defects Liability Period inclusive of periodic servicing, prompt attention to client complaint, prompt rectification of all malfunctions, renewal of licenses and equipment failures, replacement of defective equipment / parts, replacement of light fittings and fans, lubrication including lubricants, maintaining correct alignment and leveling of cars and ensuring smooth running, starts and stops etc. all complete to the client satisfaction shall be done.
AREA STATEMENT FOR
PROPOSED UNIFIED CAMPUS OF BOSE INSTITUTE
AT PLOT-80, BLOCK- EN, SECTOR-V, SALTLAKECITY, KOL-91

PHASE I: BUILT UP AREA OF MAIN BUILDING (UPTO B+G+8TH FLOOR)

<table>
<thead>
<tr>
<th>SL.NO.</th>
<th>FLOOR</th>
<th>BUILT UP AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BASEMENT FLOOR</td>
<td>6356.56 SQ.M.</td>
</tr>
<tr>
<td>2</td>
<td>GROUND FLOOR</td>
<td>5601.35 SQ.M.</td>
</tr>
<tr>
<td>3</td>
<td>1ST FLOOR</td>
<td>5486.68 SQ.M.</td>
</tr>
<tr>
<td>4</td>
<td>2ND FLOOR</td>
<td>5639.69 SQ.M.</td>
</tr>
<tr>
<td>5</td>
<td>3RD FLOOR</td>
<td>5637.61 SQ.M.</td>
</tr>
<tr>
<td>6</td>
<td>4TH FLOOR</td>
<td>3014.86 SQ.M.</td>
</tr>
<tr>
<td>7</td>
<td>5th FLOOR</td>
<td>2931.86 SQ.M.</td>
</tr>
<tr>
<td>8</td>
<td>6th FLOOR</td>
<td>2927.76 SQ.M.</td>
</tr>
<tr>
<td>9</td>
<td>7th FLOOR</td>
<td>1695.21 SQ.M.</td>
</tr>
<tr>
<td>10</td>
<td>8th FLOOR</td>
<td>1695.21 SQ.M.</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>40986.79 SQ.M.</strong></td>
</tr>
</tbody>
</table>

PHASE I: BUILT UP AREA OF OTHER MISCELLANEOUS BUILDING

<table>
<thead>
<tr>
<th>SL.NO.</th>
<th>BUILDING</th>
<th>BUILT UP AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>SUB STATION &amp; DG BUILDING</td>
<td>300 SQ.M.</td>
</tr>
<tr>
<td>12</td>
<td>GATE COMPLEX AND SECURITY KIOSKS</td>
<td>50 SQ.M.</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>350.00 SQ.M.</strong></td>
</tr>
</tbody>
</table>

**TOTAL BUILT UP AREA OF PHASE I : 41336.79 SQ.M. (A+B)**
**PHASE II: BUILT UP AREA FOR 9TH TO 15TH INSTITUTIONAL BUILDING**

<table>
<thead>
<tr>
<th>SL.NO.</th>
<th>FLOOR</th>
<th>BUILT UP AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9th FLOOR</td>
<td>1764.86 SQ.M.</td>
</tr>
<tr>
<td>2</td>
<td>10th FLOOR</td>
<td>1802.96 SQ.M.</td>
</tr>
<tr>
<td>3</td>
<td>11th FLOOR</td>
<td>1802.96 SQ.M.</td>
</tr>
<tr>
<td>4</td>
<td>12th FLOOR</td>
<td>1709.39 SQ.M.</td>
</tr>
<tr>
<td>5</td>
<td>13th FLOOR</td>
<td>1538.95 SQ.M.</td>
</tr>
<tr>
<td>6</td>
<td>14th FLOOR</td>
<td>1541.74 SQ.M.</td>
</tr>
<tr>
<td>7</td>
<td>15th FLOOR</td>
<td>1599.00 SQ.M.</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>11759.87 SQ.M. (C)</td>
</tr>
</tbody>
</table>

**PHASE II: FUTURE BLOCK(G+5)**

<table>
<thead>
<tr>
<th></th>
<th>FUTURE BLOCK OF G+5 STORIED HAVING GROUND COVERAGE OF 450 SQ.M.</th>
<th>BUILT UP AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td></td>
<td>2900 SQ.M. (D)</td>
</tr>
</tbody>
</table>

**TOTAL BUILT UP AREA OF PHASE II:** 14659.87 SQ.M. (C+D)
### OVERALL AREA STATEMENT (INCLUDING PHASE I & PHASE II)

<table>
<thead>
<tr>
<th>SL.NO.</th>
<th>DESCRIPTION</th>
<th>AREA OR AMOUNT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AREA OF LAND</td>
<td>20369 SQ.M.</td>
<td>5.033 ACRE</td>
</tr>
<tr>
<td>2</td>
<td>PERMISSIBLE GROUND COVERAGE</td>
<td>8147.73 SQ.M.</td>
<td>40% OF TOTAL LAND AREA</td>
</tr>
<tr>
<td>3</td>
<td>PROPOSED GROUND COVERAGE (PHASE I: MAIN BUILDING=7330.48 SQ.M. PHASE I: OTHER BUILDING=350.00 SQ.M. PHASE II: MAIN BUILDING=0.00 SQ.M. PHASE II: FUTURE BUILDING=450.00 SQ.M.)</td>
<td>8130.48 SQ.M.</td>
<td>39.91% OF TOTAL LAND AREA</td>
</tr>
<tr>
<td>4</td>
<td>PERMISSIBLE FAR</td>
<td>2.75 SQ.M.</td>
<td>AS PER NABADIGANTA LOCAL AUTHORITY</td>
</tr>
<tr>
<td>5</td>
<td>PERMISSIBLE BUILT UP AREA</td>
<td>56015.66 SQ.M.</td>
<td>AREA OF LAND X PERMISSIBLE FAR</td>
</tr>
<tr>
<td>6</td>
<td>CONSUMED FAR (PHASE I+PHASE II)</td>
<td>2.74 SQ.M.</td>
<td>PROPOSED BUILT UP AREA / AREA OF LAND</td>
</tr>
<tr>
<td>7</td>
<td>PROPOSED BUILT UP AREA (PHASE I: MAIN BUILDING=40986.79 SQ.M. PHASE I: OTHER BUILDING=350.00 SQ.M. PHASE II: MAIN BUILDING=11759.87 SQ.M. PHASE II: FUTURE BUILDING=2900.00 SQ.M.)</td>
<td>55996.66 SQ.M.</td>
<td>(A+B+C+D)</td>
</tr>
</tbody>
</table>