

SUBJECT: HVAC works of existing Test Research Laboratory Building, Construction of plant Room for HVAC works and Associated works at NIMR Campus, Sector 8, Dwarka, New Delhi

Sr. No.	Clarifications Sought by Bidders	Clarifications/Amendments, if any
1.	On Page No. SPEC Page E-32-R0 of Volume-IV, it is specified that 'The contractor is responsible to submit the drawings and details as required to the local authorities and obtain necessary approvals including sanction of load/enhancement of electrical load from SEB before energizing and commissioning'. Please confirm that the As Built drawings and details of existing installations shall be made available to the contractor for submission to the concerned authorities, as required by the authorities.	As built drawings are to be provided by the contractor after completion of the project and approval to be obtained from local authorities.
2.	On Page No. Specs-AC-Page-92 R2, approved Subcontractors is specified as Voltas/ETA/Blue Star/ Suvidha / Sterling & Wilson / Unique Engineers. The same may please be omitted and the qualified agencies having in-house competency of execution of HVAC works may be allowed to execute the HVAC works.	Item: Sub contractors on Specs-AC page-92R2 deleted.
3.	On Page No. Specs-AC-Page-92 R2, approved makes for Air Handling Units is given. It is requested to allow and include Mc Quay make Air Handling units also.	Tender conditions prevail.
4.	On Page No. ESTIMATE-EQUIPMENT-Page 1, Item no. 1.1 & 1.2 includes Autoclaves. Please confirm whether the Autoclaves shall be with In-Built Steam Generator or a separate steam boiler shall be considered for supply of steam to the Autoclaves. Also please confirm whether the Autoclaves are required with a PLC based programmable control panel for multiple cycle options. Also please provide the specifications and specify the approved makes for the Autoclaves.	Specifications enclosed at Annexure-I

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5.	On Page No. ESTIMATE-EQUIPMENT-Page 1, Item no. 2.1 & 2.2 includes Pass Box. Please provide the specifications for the Pass Box and specify the approved makes.	Specifications enclosed at Annexure-II
6.	As the scope of work includes some major equipments like lifts, DG Set, Autoclaves, Chillers etc. , which are long delivery items and will require site installation, testing and commissioning as well. Further, the scope of work also includes obtaining the statutory clearances and approvals from the concerned authorities; therefore the specified Completion Period of 5 months (Five months) is too short. It is therefore requested to kindly amend the Completion Period as 8 /9 months (Nine months).	Line 4 of NOTICE INVITING TENDER-to be read as: " Completion Period : 6 (six) Months including commissioning and handing over" Line 5 of Clause 1.2 of INSTRUCTIONS TO APPLICANTS-to be read as: Time of completion : 6 Months including commissioning and handing over"
7.	To provide sufficient time to prepare the bids, it is requested to kindly extend the submission date of the bid by two weeks / three weeks.	Amendment 2 Already issued with Last date of submission of tender extended to 15:00 hrs on 09.11.2012
8.	Free issued cement & steel shall be considered to arrive at final completed project cost.	Tender conditions prevail.
9.	Asked for "PROJECT UNDER EXECUTION OR AWARDED" AND then also asked for acknowledgement of " Certified that the above list of works is complete and no work has been left out and the information given is correct to my knowledge and belief"	(Annexure-IX, Volume I.) Under the table mention " Certified that the information given is correct to my knowledge and belief" instead of " Certified that above lists of works is complete and no work has been left out and that the information given is correct to my knowledge and belief."
10.	The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on a day work basis. The Contractor shall then be paid for such varied work under the terms set out in day work schedule which shall be the minimum wages applicable in the State of Jammu & Kashmir to the category of workers employed as on the day the work is carried out.	To be read as " Delhi "instead of " State of Jammu & Kashmir" wherever mentioned.

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11.	The Contractor shall provide security for his proper performance of the Contract to the Employer within 15 days after the receipt of the Letter of Acceptance. Please clarify. We request you to allow submission of PBG after completion period.	Performance Guarantee shall be submitted as per Tender Document.
12.	The payment terms are not clear: 10% advance @ 10% interest rate against submission of equivalent amount ABG 75% against material physically reached on site & against RA bills. 10% retention up to become 5% of contract value 5% of contract value as PBG If above understanding is correct, then payment against material should be 80% and not 75% as you mentioned. Please confirm.	Tender conditions prevail.
13.	Please clarify the tax structure to be considered while costing. Specify if taxation should be in WCT or otherwise. Also specify if you can issue C form	No Form C will be issued.
14.	We request your good-self to relook & reduce the LD rates or modify the term to 0.5% of the contract value per month. We will try our level best to complete the project in given time but unforeseen circumstances can't be predicted.	Not acceptable. Tendered Conditions prevails.
15.	Please clarify if Detailed work plan clearly bringing out how the Bidder proposes to carry out the work to achieve the quality and the time schedule is necessary at this stage of tendering.	To be submitted by the bidder along with technical offer.
16.	Please check and relook for bid validity period. Looking at current world economic activities the same cannot be assured over such long period of time. We request to freeze the bid validity period to 30 days.	Tender conditions prevail.
17.	Please clarify whether, water connection, electricity connection, work permission approvals/clearances from statutory and local civic authorities are to be arranged by the contractor	Yes, as specified in the Tender Document.
18.	Can star delta starter be considered in place of soft starter	Shall be as per Tender Document.

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19.	Dual speed motor for cooling tower mentioned in VOL-IV, not in BOQ	Dual Speed required as per Tender Document.
20.	No humidifier capacities mentioned in BOQ	Humidifier shall be included in AHUs as per specifications at page no. AC 15 R2, considering 100% Fresh Air System.
21.	Layout drawings not legible on A3 size. Please provide AUTOCAD versions.	Print may be taken on bigger size sheet.
22.	Civil specifications HSCC/Tech Specs HVAC Plant Rm NIMR Dwarka Page 23	Add Specification Sr. 7A and Sr. 7B for civil works enclosed at Annexure-III
23.	Electrical specifications after SPEC PAGE E34 R0	Add Specification Sr.13 for Lifts at Annexure-IV & Sr.14 for DG set at Annexure-V
24.	List of approved manufacturers SPEC PAGE E33 R0	Add "Sr. 13 LIFTS – OTIS, KONE, Scheindler, Mitsubishi, Johnson"
25.	List of approved manufacturers SPEC PAGE E33 R0	Add "Sr. 14 DIESEL ENGINE – Caterpillar, Kirloskar, Greave cotton, Cummins
26.	List of approved manufacturers SPEC PAGE E33 R0	Add "Sr. 15 ALTERNATOR – Kirloskar, Caterpillar, Crompton Greaves, Leroy Somer & controls (I) Ltd., Stamford
27.	Civil BOQ – Item 10.11	The item to be read as Item 10.11 enclosed at Annexure-VII
28.	Civil BOQ – Item 10.12	Line 32 of item 10.12 For "Provision of Busduct connection" read "Provision of Cable connection"
29.	Civil BOQ – PAGE C37	Add items 10.15, 10.16, 10.17, 10.18, 10.19, 10.20, 10.21, 10.22, 10.23 enclosed at Annexure-VI

GENERAL AMENDMENTS:

Sr. No.	Amendment / Clarification
1.	The Client / HSCC reserve the right to award the subject works in part or in a combination or in full. However, for Price comparison purpose all works shall be considered for determining the Lowest Bidder.
2.	Use of Downloaded Bid Document for submission is not allowed. The Bidder is required to purchase the Bid Document from HSCC office. Information given for use of downloaded Tender document mentioned in PQ (ANNEXURE-VIII) or elsewhere stands null and void.
3.	Amended ANNEXURE-VIII of PREQUALIFICATION (VOLUME I) attached herewith.

1. FULLY AUTOMATIC MICROPROCESSOR CONTROLLED HIGH PRESSURE & HIGH VACUUM STEAM RECTANGULAR STERILIZER

Construction :

- The Chamber shall be square / rectangular in shape constructed of heavy duty stainless steel 304 door and jacket of stainless steel 304 (316L or 316Ti - optional)
- The Pipes and fittings shall be of stainless steel and bronze & the valves shall be of ball type. Each sterilizer shall be mounted on a M.S sturdy stand. The outside paneling shall be made **of M.S Powder coated** to give elegant look. Shall have hinged panels on the side for easy serviceability. All other construction details shall be as per IS 3829 Part 1 199.

Design :

- Autoclave shall be designed as per international standard.
- Chamber of the autoclave shall be tested for hydraulic test pressure, performance as per BS & IS standards.
- Working pressure of autoclave shall be from 1.2 to 2.1 kg. cm² and vacuum upto 26" HG (with built in vacuum pump arrangement.
- Door gasket shall be of expansion type silicon and joint less.
- The heating system shall be provided with energy efficient and shall reduce running cost to great extent.
- Sterilization process shall be controlled by programmable logic controller with high accuracy for taking care of all user requirements.

Pulsating Deep Vacuum :

- Shall have high efficiency vacuum pump for mechanical air removal for excellent steam penetration even in fabric loads.
- Post sterilization vacuum drying treatment shall ensure the load is dry on unloading.

The chamber shall be designed and tested as per American Society of Mechanical Engineers standards.

Doors

- Shall have double door model. All doors shall have stainless steel contact parts and temperature resistant silicon rubber gasket.

Recording System (Optional)

- Shall have single point strip chart recorder for recording the process temperature, date and time.

Safety :

Following safety measures shall be incorporated during designing & manufacturing:

- Door safety to prevent starting of the process unless the door is closed and when the door is open while the chamber is pressurized.
- Insulated chamber to avoid scalding to the operator.
- Safety valves for over-pressure safety.
- Pressure vessels hydro-tested for maximum quality assurance.
- Provided with two locks one automatic and another manual. The automatic lock operates when pressure gauge reads 0.30-0.37kg/ cm² in the chamber

Salient Features :

Following salient features shall be incorporated during designing & manufacturing:

- Accurate in sterilization time and temperature.
- Door interlocks in case of double door sterilizer.
- Over heat protection.
- Excess pressure safety valve.
- Self Diagnosis fault message.
- Safety against electric overload.
- Visual and audio alarm for easy operation.
- Process online print for records.
- Assured sterilization followed by complete drying of load.

Steam Generator :

- A stainless steel electric boiler shall be provided under the shell with interconnecting steam pipes. The boiler shall be supplied with 6 KW immersion heaters mounted on stainless steel plate and electric controls would comprise of an air break contractor, automatic pressure controller, low water protection. The boiler shall also be additionally provided with one independent spring - loaded safety valve and a pressure gauge. The boiler shall also incorporate a gauge glass assembly with protector, water drain and water inlet valves are also to be provided.

Other Features :

Following features shall also be incorporated during designing & manufacturing:

- Two Nos. mechanical ejectors.
- Self Sterilizing vacuum drier.
- Safety valve spring loaded and vacuum breaker.
- Screen plug and Dial Thermometer for chamber's discharge line which shall be provided with steam trap and swing check valve.
- Manual single point operation to operate manually as per IS 3829 Part I.
- Door safety - when the chamber is under pressure self locking device automatically locks and unlocks when chamber pressure falls below 0.35 kg/cm².
- Built in steam generator made of S.S. 304 with Low water cut out, water level indicator, self locking gauge & glass valve.
- The equipment shall be provided with S.S. 304 railing and carriage with MS Trolley.
- Provided with settable, vacuum system, low water cut off system.

- Shall run on inbuilt electric Boiler. However, if required in future, the sterilizer can also be operated through Centralized Steam Supply available near to equipment @ 2.1 to 2.5 kg/cm².
- Working temperature 134° C.

Automatic Process Control :

- Microprocessor based programmable logic controller shall be used to control the Process. Manual operation shall also be provided to avoid inconvenience in case of automation failure.

Programs Provided :

Following Program Logics shall be available:

- Liquid cycle at 121° C
- Instrument Cycle 134° C
- Pre-Vacuum pulsating cycle
- Vacuum Leak Test.
- Bowie Test
- Flexible cycle from 105 to 134° C to suit user requirement.

Utilities & Environment Conditions:

- Supply Voltage 415 V, 3 Phase, 50Hz, for power refer chart
- Feed water: Soft water /DM Water/Good Water.
- Temperature range of +5° C to +45° C
- Maximum relative humidity of 80% for temperatures upto 31° C, decreasing linearly to 50% at 40° C.
- Main supply voltage fluctuation of + 5% of nominal.
- Provided with all piping connectors of SS:304

Approved manufacturers for Autoclaves: NAT STEEL, KLENZAIDS, YORCO OR equivalent

1. PASS BOX

Introduction:

Pass box is equipment used normally for transfer of material from & into the clean room without contaminating the clean room air & without opening room door. The two opposite doors are interlocked & only one door can be opened at a time. Fluorescent light is automatically put ON at the time of opening any one of the doors. The doors shall have glass window for viewing the material kept there in.

Principle of Working:

The Pass Box has two doors. One door opens in the Clean Room and other door opens in the other room. These doors are electrically interlocked so that any one door can be opened at a time. This avoids direct flow of air from the clean room to the other room or vice versa. This also obviates the need to open the Clean Room door frequently for transferring of material from & into the clean room. Thus, it helps in achieving the aim of material transfer without disturbing the cleanliness level of the clean room. High quality magnetic electric inter locks & sensors are used.

Construction:

Whole Cabinet shall be made of S.S. Sheet duly polished from inside & outside for longer life & durability.

Each hinged door shall have wide glass viewing windows, through which the material kept in the pass box can be seen / viewed. Fluorescent light shall be coupled with the interlocked doors so as to automatically switches ON when any door is opened and goes off when the door is closed.

UV light shall also be interlocked with doors. It is automatically switched on only when both doors are closed. Buzzer button is provided on both sides

Power Supply :

220V, Single Phase, 50 Cycles A.C.

Approved manufacturers for Pass Box: NAT STEEL, KLENZAIDS, YORCO OR equivalent

7A CHEMICAL RESISTANT EPOXY RESIN WALL COATING

MATERIAL

The system shall consist of 2 component solvent free, epoxy based, chemical resistant coating. The thickness of the coating shall be between 300 microns depending on the number of coats. The application of primer and coating is to be done as per the manufacturer's specifications.

- a. A coat of primer shall be applied over clean, dry surface:
- b. While the primer coat is tack-free, two topcoats of epoxy shall be applied:

APPLICATION/LAYING PROCEDURE

The surface should be properly cleaned and should be free from oil, grease, cement laitance and dust. The surface should be free from potholes, honeycombing, potholes & cavities. If defects are found, the surface should be prepared to a smooth finish.

The surface should be primed using epoxy primer. Allow the primer to dry overnight so that it is tack-free.

Top coat of epoxy should be applied in two coats to a thickness of 300 microns. The first coat should be allowed to become tack free before the second coat is applied.

The system should be air cured for a minimum period of 5 to 7 days to achieve the best results against loading & chemical resistance.

7B EPOXY BASED JOINTLESS ANTISTATIC FLOORING

The joint less flooring consists of 3 mm thick epoxy resin based antistatic flooring, self levelling with smooth finish, in required shade and of required conductor loading. Epoxy based flooring should be applied in several layers in order to insure permanent connection for the elimination of static electricity between the supporting base and the surface and should conform to IS: 9197. The entire job is to be undertaken by manufacturer's trained and skilled technicians to lay the epoxy-based floor as per IS: 4631.

The top layer of epoxy resin in 3 or more coats in the desired colour and shade is applied so as to achieve the required thickness, shade and finish.

The mechanical parametric properties to be achieved are as follows.

Resistance to compression	800 Kgf/Cm ²
Resistance to deflection	400 Kgf/Cm ²
Resistance to abrasion	0.35 g/h
Fire behavior	Class IV/1
Resistance to current leakage	1.10 Ohms

Measurements will be done for the finished and completed area to the nearest centimeter.

EPOXY FLOOR TOPPINGS

MATERIAL DESCRIPTION

The heavy-duty abrasion, chemical resistant & antistatic epoxy screed flooring shall be an epoxy Self leveling screed, which is laid to a thickness of 3mm. This shall be extremely monolithic, seamless, jointless, non slippery, scratch proof and is ideally suited for areas requiring Resistance to leakage of Current of 10⁴ to 10⁸ ohms.

- a. A coat of primer as mentioned below shall be applied over clean, dry concrete surface:
EPOXY PRIMER - Component A (Resin) (182gm)
EPOXY PRIMER - Component B (Hardener) (68gm)
- b. While the primer coat is still tacky, a 3 component, antistatic chemical resistant epoxy SCREED AS BASE COAT is to be applied with following materials @2.0kg/sqm
- Component A (Resin) (0.84kg)
- Component B (Hardener) (0.32kg)
- Component C (Graded Filler) (0.84kg)
- c. Over this a 2 component final top coat of antistatic SCREED AS is to be applied @3.5kg per sqm in two layers
Component A (Resin) (2.87kg)
Component B (Hardener) (0.63kg)

The system so devised should follow the antistatic specifications of ASTM D257 (Surface Resistivity) or BS 2050 (electrical Resistance) The static decay Test should be around 0.02sec. the manufacturer should have Test Reports from some prestigious institutions like Central Power Research Institute or ERTL.

PREPRATION PROCEDURE

The concrete/mortar substrate shall be prepared by mechanical means captive shot blasting / grinding etc as required complete to the satisfaction of engineer-in-charge.

APPLICATION LAYING PROCEDURE

The floor/coving/skirting substrate should be properly cleaned and must be free from oil, grease, cement laitance, dust and other surface contaminants. The moisture content of the concrete must be checked using thermo hygrometer and if found higher than 4% the substrate should be subjected to blow lamps, etc. to reduce the moisture contents.

Grooves of size 2mmX2mm at the edges of room along the perimeter and across the room are to be cut .

A copper wire of approx 3/20 gauges is to be laid in the groove in a slight tension manner with help of U nails. After lying of Copper wire the entire groove is to be filled with antistatic Epoxy putty comprising of Part A, Part B and Part C.

After fixing the wire and putty apply antistatic Primer @250gms per sqm with component A and B in ratio as mentioned above.

Allow the primer to dry and when it is tack free Mix component A & B & C of screed AS Basecoat and apply on the surface @ 2.0kg per sqm for approximately a thickness of 1mm.

After this application allow the Basecoat to dry for 24 hrs and then apply the top coat of self leveling SCREED AS on top of the Basecoat after mixing component A & B. The Application of Top coat has to be either in single layer or double layer @ 3.5kg per sqm to give overall thickness of the self leveling Antistatic screed as 3mm. After spreading of screed spread the material with notch trowel and spike the entire surface with specially designed Spike rollers to remove any air bubbles entrapped within the screed .

After the entire Self Leveling screed has been trowel and spiked allows it dry and cure. For soft Foot traffic movement curing of a minimum of 48hrs is recommended and for other regular use of the area a minimum of 7 days of curing is advisable.

13.00 LIFT INSTALLATION

13.01 The scope of work shall cover design, supply delivery, installation, testing and commissioning of car lifts. The scope of work shall also include the following item of civil works.

- a) Necessary scaffolding temporary barricade in the hoistway required during the erection of the elevators.
- b) Minor building work comprising of cutting holes and making good the car and counterweight rail brackets, hall buttons and indicators including laying of sills in position.
- c) Steel items such as machine beams, bearing plates buffer support channels, sill angles and fascia plates etc.
- d) Suitable trap doors with steel chequered plate covers.
- e) Providing and install a suitable vertical iron ladder for access to the pit.
- f) Any other item required for successful completion and commissioning of lifts. (including the hoisting beam in the machine room)

13.02 The work shall be done in accordance with regulations of any local code and following ISI codes which govern the requirements of installations.

IS: 1860-1980 code of practice for installation, operation and maintenance of Electric Passenger and Goods Lifts.

IS: 3534-1976 Outline dimensions of Electric Lifts.

IS: 4666-1980 Specifications for Electric passenger and Goods Elevators.

Indian Electricity Act 1910.

Indian Electricity Rules, 1956.

Delhi Lifts Rules, 1942.

13.03 SHOP DRAWINGS AND APPROVAL OF ELECTRICAL INSTALLATIONS :

The selected tenderer shall prepare a furnish shop drawings for approval by The Client, such shop drawings shall be based on the Architectural drawings and requirements laid down in specifications, local laws and regulations etc.

The detailed drawings shall be submitted within one month of placement of order. The successful tenderer shall obtain the approval of electrical Inspector and other local authorities as per requirements before submitting the drawings to Client/ Engineer. The contractor shall not proceed with in installation work till the drawings are approved by the Engineer-in-Charge. Expenses incurred such as license fee etc. towards obtaining the approval of Electrical Inspector, local authority shall be reimbursed to the contractor as per actual on production of documentary proof.

Approval of contractor's drawings shall not absolve the contractor of any of his obligations to meet the requirements of specification under this contract

Five sets of completion drawings operation manual, maintenance manual, spare parts details shall be submitted to the Client/ Engineer after completion of work.

13.04 GUARANTEE

The tenderer shall guarantee the equipment against all defects of materials and workmanship for a period of one year from the date of commissioning of the equipment as certified by the owner. Any defects arising during the guarantee period shall be rectified and replaced by the tenderer, at his own expense, to the satisfaction of the owner.

13.05 PERMITS, INSPECTION & LICENSE FEE

The contractor shall arrange all necessary local, provincial or national government permit and shall make arrangements for inspection and tests required thereby. Expenses to be borne by purchaser.

13.06 MAINTENANCE

After the completion of the installation and before handing over of each elevator by the elevator contractor, maintenance service for the equipment furnished shall be provided for a period of twelve (12) months. This service shall include regular examination of the installation by trained employees, and shall include all necessary adjustments, greasing oiling, cleaning supplies and genuine standard parts to keep the equipment in proper operation, except any parts made necessary by misuse, accident or neglect caused by other. Contractor shall provide 24 hours Emergency local call back service facility and shall furnish full details of such facilities available.

13.07 POWER SUPPLY

The apparatus shall be designed to operate on 415 + 5% Volts, 3 Phase, 4 wires, 50 Hz A.C. Supply for illumination signal equipment shall be 240 + 5% Volts, single phase 50Hz A.C..

13.08 ELECTRICAL WIRING

The necessary A.C. supply of 3 Phase, 415 Volts 50 HZ shall be made available in the main control switch unit to be provided by the contractor in the machine room. All the electrical works beyond the main supply switch shall be carried out by the contractor i.e. supply and installations of panels for drive motors, switches and control complete with wiring as per system requirement and approval of the Engineer.

The wiring shall be carried out strictly in accordance with Indian Electricity Rules and Indian code of Practice for Electrical Wiring Installation IS-732-1963 System Voltage not exceeding 650 V). For works not covered under any of the above wiring rules, the 13th edition of Electrical Engineers (Condense) shall apply. The cable and conduits to be used shall be of suitable size and grade conforming to relevant IS specification. Wiring for LT switchboard to the motor terminal shall be with heavy duty 1.1 KV grade PVC insulated PVC sheathed, FRLS aluminium cable. All the trailing cables used for control and safety device shall conform to

IS: 4289-1967, Specifications for lifts cables. The trailing cable circuits for controls, safety devices, lighting and signaling shall be separate and distinct.

Power wiring between controller and main board to various landings shall be drawn in suitable size heavy gauge conduit stove enameled/painted conforming to I.S specifications.

The Voltage and frequency of the supply shall be subjected to variations permissible under Indian Electricity Acts and Rules.

13.09 PARTICULAR SPECIFICATIONS

13.09.1	TYPE	:	Goods Lifts.
13.09.2	NO. OF ELEVATORS	:	As Per Bill of Quantities.
13.09.3	CAPACITY	:	As Per Bill of Quantities.
13.09.4	SPEED	:	As Per Bill of Quantities.
13.09.5	FLOORS SERVED/RISE	:	As Per Bill of Quantities.
13.09.6	STOP	:	As Per Bill of Quantities.
13.09.7	OPENINGS	:	(All Openings on same side) As Per Bill of Quantities.
13.09.8	OPERATION	:	Duplex/Simplex Collective as per BOQ.

13.09.9 CAR FRAME:

The car frame, which supports the car platform and enclosures, shall be made of structural steel and equipped with suitable guides and a car safety device mounted underneath the car platform. The hoist ropes shall include adjustable self/ aligning hinges.

The car shall be so mounted on the frame that vibration and noise transmitted to the passenger is minimized.

13.09.10 CAR SAFETY AND GOVERNER :

Suitable car safety to stop the car whenever excessive descending speed is attained shall be operated by a centrifugal speed governor connected to the governor through a continuous steel rope.

The governor shall be provided with self tensioning device to keep governor rope in proper tension even after rope stretch. Suitable means shall be supplied to cut off power from the motor and apply the brake on application of the safety.

13.09.11 COUNTER BALANCE :

A Suitable guided structural steel frame with appropriate filler weights shall be furnished to promote smooth and economic operation.

13.09.12 TERMINAL AND FINAL LIMITS :

Terminal limit switches shall be provided to slow down and stop the car automatically at the terminal landings within permissible over travel and final limit switches shall be provided to automatically cut off the power and apply the brake, should the car travel beyond the permissible over travel. They shall act independently of the operating devices and buffers.

13.09.13 TERMINAL BUFFERS :

Heavy duty spring buffers shall be installed as a means of stopping the car and counterweight at the extreme limits of travel. Buffers in the pit shall be mounted on steel channels which shall extend between both the car and counterweight rails.

13.09.14 CONTROLLER :

A Controller shall be provided to control starting stopping and speed of the elevator motor and also be automatically able to apply the brake if any of the safety devices operate or if power fails from any cause. In case of power failure and again restore of power the lift shall land to next floor and shall not go to basement/lowest level. Suitable software/hardware or rescue device shall be provided.

13.09.15 REVERSE PHASE RELAY:

A reverse phase relay shall be provided on the controller which is designed to protect the lift equipment against phase reversal and phase failure.

13.09.16 GUIDES :

Machined steel tee guides shall be furnished for the car and counterweight. The guide rails should be of steel solid and shall have tongued and grooved joints. Sliding clips shall be used for fastening the guides to allow building settlement without distorting the guide rails. To keep down the noise level and to reduce wear and tear of the sections, only Nylon Ribs shall be used in the guide shoes, after smoothening of the rails. The flanges shall be machined for the fish plate mounting such that rail alignment at joints almost remain constant.

13.09.17 FOUNDATIONS :

The machine shall be placed directly above the hoistway upon the machine room slab provided by the Owner.

13.09.18 ROPES :

The elevator shall be provided with traction steel ropes. Steel wire rope having a tensile strength of not less than 12.5 Ton/cm² of good flexibility shall be used for lift. The lift rope shall conform to IS: 14665- (Part-4 Sec-8):2001

13.09.19 MACHINE :

The machine shall be of the single wrap traction type and shall include a motor, electromechanical brake, steel worm, bronze gear, steel sheave shaft and Farrow-Molybdenum sheave all compactly mounted on a single base or bed plate. The worm shaft shall be provided with ball bearings to take the end thrust and roller bearings shall be furnished for the sheave shaft to ensure alignment and long bearing life. The driving sheave shall be grooved to ensure sufficient traction and minimize rope wear. It shall be provided for all bearings and the worm gear.

13.09.20 BRAKE :

The direct current brake shall be spring applied and electrically released and designed to provide smooth stop under variable loads. The brake should be capable of operation automatically by various safety devices, current failure, and by normal stopping of car. It should be possible to release the brake manually, such releases brake manually, such releases requiring the permanent application of manual force so as to move the lift car in short sties. For this purpose one set of brake release equipment shall be supplied.

13.09.21 MOTOR :

The motor shall be suited to the service proposed and arranged for adequate lubrication. The motor shall be class F insulation and one (1) hour rated squirrel cage induction type having high starting torque. It shall also be provided with Thermistors embedded in the stator windings for the highest degree of thermal motor protection.

13.09.22 CONTROL

The control shall be variable voltage variable frequency A.C. variable voltage, closed loop control system using solid state devices and electronic speed pattern generator to command the motor from a velocity transducer and load compensation circuits for a comfortable ride.

In Normal operation, the electromagnetic brake shall only be applied when the lift has come to a complete standstill. The brake shall only be meant for holding the lift in position at every landing, providing stopping without any jerking effect.

Each controller cabinet containing memory equipment shall be properly shielded from the pollution.

MICROPROCESSOR

The control shall employ a microprocessor working on a program such that precision leveling and highly efficient handling of passengers for least possible waiting and reduced travel time is ensured. The microprocessor system should be designed to accept programming with minimum downtime. It should be able

to monitor the state of input calls (such as car calls from COP and hall calls from hall fixtures) and output commands such as starting, decelerating and stopping the elevator. It should be able to generate floor location data, thereby, providing a reference position to establish the safety zones for door opening and closing, and also to initiate leveling slowdown.

13.09.23 SIMPLEX COLLECTIVE OPERATION

The operation shall be simplex collective with/without attendant for each elevator and shall consist of the following:-

IN THE CAR

There shall be furnished a flush type attractively finished mild steel panel which contains a series of luminous buttons numbered to correspond to the landings served, an emergency stop switch and an emergency call button connected to a bell which serves as an emergency signal.

AT HOISTWAY LANDINGS

There shall be provided an UP luminous push button and a DOWN luminous push button at each intermediate landing and a single button at the terminal landings.

The car shall not start unless the door is in the closed position and all hoistway doors are closed in the locked position.

If the car is idle and one or more car or landing buttons above the landing at which the car is standing are pressed, the car shall start in the UP direction and proceed to the highest landing for which any button is pressed and stops at intermediate landing for which a car button or up landing button is pressed sufficiently in advance of the car's arrival at such landings to permit these stops to be made. After each stop, the car shall proceed in the UP direction until it reaches the highest landing for which a call is registered. The car shall not stop on the UP trip at any landing in response to a DOWN call.

Similarly, if the car is idle and one or more car or landing buttons below the landing at which the car is standing are pressed, the car shall start in the DOWN direction, proceed to the lowest landing for which any button is pressed and stop at each intermediate landing for which a car button is pressed.

When the car is idle and a button for a landing above the car and a landing below the car are pressed, the car shall start towards the landing corresponding to the button pressed first. The call registered for the landing in the opposite direction from the car shall be answered after the car has responded to the farthest call in the direction established by the button pressed first.

A time relay shall hold the car for an adjustable interval of few seconds at the landings at which stops are made to enable passengers to enter or leave the car.

OPERATION WITH AN ATTENDANT

The regular car operating panel shall include buttons, switches, etc. for the collective-automatic control and shall also include.

A two-position key-operated switch marked to indicate ATT (attendant operation)

A buzzer: UP and DOWN direction light jewels and A non-stop button.

A car operating panel shall also include an UP and DOWN button.

When the key-switch is in the position of WITH ATTENDANT, the direction light and buzzer shall become operative and the UP and DOWN direction button in the regular car operating panel shall be made effective for the attendant operation.

When an attendant operation, the car and hoistway doors shall open automatically at each stop but the closing of the doors shall be subject to the UP or DOWN direction buttons. As a visual signal to the attendant, the UP and DOWN direction jewel shall illuminate upon registration of either car or landing calls to indicate the direction of the travel of the car. The attendant shall operate the elevator normally in the direction indicated by the direction jewel but, if desired, opposite direction travel may be realized by pressure of a car button for a landing in that direction from the car.

The pressure of a direction button shall cause the doors to close and the car to start in the direction desired, provided a call is registered for that direction. If pressure of the direction button is released before the car starts, the doors will re-open and car shall not travel. It shall so arrange the pressure on direction button can be released, once the car has started.

Continuous pressure of the nonstop button shall cause the car to by-pass all landing calls and respond only to registered car calls.

13. 09. 24 CAR ENCLOSURES :

The car enclosures shall be of sheet steel and shall be of an elegant design comprising of the following:

- a) Ceiling with light diffuser Perspex ceiling and fluorescent light.
- b) Concealed pressure fan with grille in ceiling. The lift shall have timer/sensor so that the fan is operation only when if lift is in operation.
- c) Ceiling steel painted white.
- d) Complete M.S spray painted car enclosure in plain finish
- b) M.S chequered plate floor.

13.09.25 CAR DOOR

The car entrance shall be provided with M.S sliding doors giving a clear minimum opening of 1000 mm wide by 2000 mm high.

13. 09. 26 HOISTWAY DOORS :

At each landing, horizontal sliding M.S powder coated opening door in plain finish giving a clear opening as required.

13. 09. 27 SIGNAL AND OPERATIVE FIXTURES :

The following signal and operative fixtures shall be provided for each lift in stainless steel face plates except in fireman's switch which shall have a glass face plate.

a) CAR OPERATING PANEL

There shall be two (2) No. panel in car located for easy operation when car is in either direction, with stainless steel face plate and shall comprise illuminated floor buttons, door open and emergency stop controls emergency call buttons, door open and emergency stop controls emergency call button, two position key operated switch, a Buzzer, UP and DOWN direction light panels, a non stop button, and an integral interphone.

b) HALL BUTTONS AND HALL POSITION INDICATOR

There shall be provided combined signal fixture (one riser) of compact design and of attractive hairline stainless steel face plate at the elevator entrance on each floor which for terminal landings shall have a single luminous push button and for intermediate landings shall have an UP luminous push button and a DOWN luminous push button. The jewels shall be of modular construction mounted on a stainless steel face plate. Whenever a button is pressed, the jewel shall light up to indicate registration of the call and shall remain enlightened till the car arrives.

c) CAR POSITION INDICATOR IN CAR

This shall be of compact design and of attractive hairline finish stainless steel face plate with easy to read digital display of the floors, indicating through which floor the elevator is passing or on which floor the elevator is stopped. This shall also incorporate illuminated arrows showing the direction of travel.

d) BATTERY OPERATED ALARM BELL AND EMERGENCY LIGHT

A solid state siren type alarm unit operated by 2 Nos. 9 volt rechargeable Nickel Cadmium batteries shall be provided which shall give a waxing and waning siren when alarm bell in the car is pressed momentarily.

An emergency light unit using a 9 volt dry battery power pack and incandescent lamp with stainless steel face plate shall be provided inside the car which shall operate automatically in the case of power failure.

e) OVERLOAD WARNING

Overload warning radars with audio-visual indication (visual indication shall show OVERLOADED) with stainless steel face plate shall be installed in the elevator car, so that when there is overload in the car the sign shall light up a flash indicating OVERLOADED and a buzzer shall operate during this period and the doors shall remain open until the overload is removed.

f) FIREMAN'S SWITCH

A toggle switch covered by a glass cover shall be provided on the ground floor for each elevator which shall permit a fireman to call the elevator to the ground floor by canceling all car and landing calls. The elevator shall then stop at the ground floor with the door open to permit the fireman to have exclusive use of the elevator without any interference from the landing calls.

g) INTERPHONE

Press and speak phone connected to security room.

13. 09. 28 ELECTRIC DOOR OPERATOR FOR CAR DOOR AND HOISTWAY DOOR:

An electric door operator for opening and closing the car door shall be provided. The opening of a car and hoistway doors shall be such that the doors shall start opening meant for so that by the time the elevator stops completely, the elevator and hoistway doors shall be fully open.

The equipment shall consist of a machine on the elevator car operating the car door when the car is stopping at a landing.

The car door and hoistway door shall be mechanically connected and shall move simultaneously in opening and closing.

The car and hoistway doors shall be power opened and closed and shall be checked in opening and closing with an oil cushioning mechanism built into the gear unit.

Each hoistway door shall be provided with an interlock which will prevent movement of the car away from the landing unit.

The doors are closed in the closed position as defined in the ISI codes.

An electric contact for the car door shall be provided which shall prevent car movement from the landing unless the door is in the closed position as defined in the ISI codes. The locking arrangement shall be so designed that the electrical circuit cannot be completed unless the doors are in the closed position and mechanical latching is effected.

Necessary switches shall be provided in the elevator machine room to control the operation of the doors.

The car and hoistway, doors shall open automatically as the car is stopping at a landing. The closing of the car and hoistway door must occur before the car can be started. Doors can be stopped and reversed during their closing motion.

13.09.29 DOOR HANGER AND TRACKS :

For the car and each landing door, sheave type two point suspension hangers complete with tracks shall be provided. Means shall be provided to prevent the door from jumping off the track and for vertical and lateral adjustment of doors.

Sheaves and rollers shall be of steel and shall include shielded ball bearing to retain grease lubrication. Adjustable ball bearings rollers shall be provided to take the upward thrust of the doors. Tracks shall be of suitable steel section with smooth surface. The locking of the two leaf parting type doors should be positive.

13.09.30 SAFETY SHOE :

A safety shoe (one on each door panel) shall extend to the full height of and project beyond the front edge of the car door.

Should this shoe touch a person or an object while the car door is closing, the car and hoistway doors shall return to the open position. The doors shall remain open until the expiration of a pre-determined interval and then close automatically.

13.09.31 LANDING ENTRANCE MATERIAL'S :

These shall consist of headers, extruded aluminium sills and strut angles.

13.09.32 WIRING :

Complete wiring in the equipment.

13.09.33 AUTOMATIC RESCUE DEVICE :

Automatic Rescue Device to be provided for all the lifts with battery backup so that it can land to the nearest level in case of power failure. Automatic Rescue Device shall have suitable battery backup so that it can operate minimum 7 times in a day provided the duration between usage is at least 30 minutes

14.0 DIESEL GENERATOR SETS

14.1 INTENT OF SPECIFICATION

14.1.1 This specification covers the design, manufacture, assembly, packing, dispatch, transportation supply, erection, testing, commissioning, performance and guarantee testing of **Diesel Gen-Sets with Acoustic Enclosure**, complete in all respects with all equipment, fitting and accessories for efficient and trouble free operation as specified here under.

14.2 SCOPE OF WORK:

14.2.1 Scope of Supply & Services:

General Scope of work shall include, supply, erection, testing and commissioning of the following:

- a) Diesel engine complete with all accessories, an Alternator directly coupled to the engine through flexible/rigid coupling complete with all accessories for starting, regulation and control, including base frame etc. interconnecting piping and accessories, power and control cable glands and lugs.
- b) Diesel Local/Remote control panel including cables between bidders local equipment and special cables if any.
- c) Equipment necessary for engine cooling system, radiators, pumps, valves, inter connecting pipes etc.
- d) Equipment necessary for fuel storing and distribution, day oil tank (990 Lt.), pipings, pumps, valves, level indicators etc.
- e) Flexible connections and residential type silencer of exhaust system, including thermal lagging.
- f) Batteries with iron battery stand and battery charging equipment, including their connections as necessary along with tools & accessories for battery maintenance.
- g) Anti Vibration Mountings etc.
- h) Preparing all related shop drawings for approval from client/consultant and statutory bodies.
- i) Obtaining approval of the installation of Diesel Generators by the Electrical Inspectorate and Pollution Control bodies and any other statutory bodies.
- j) Minor civil works like chasing, grouting etc. for execution of jobs.
- k) Carrying out performance and guarantee test at site available load but not more than the capacity of D.G. Set.

- l) Acoustic enclosure as per CPCB norms and type approved.

14.2.2 Specific Exclusions:

Following items of works are excluded from the scope of works under this specification:

- a) All civil works relating to DG foundation etc.
- b) All cables between contractors and owners equipment other than special cables external to the equipment.

14.3.2 The installation work shall conform to Indian Electricity act and Indian Electricity Rules as amended up to the date of installation.

The fuel oil installation shall meet all statutory requirements of Govt. of India as amended up to the date of installation. Any approval required from statutory authorities shall be obtained by the Contractor. Nothing in this specification shall be construed to relieve the contractor of these responsibilities.

14.3.3 Equipment conforming to any other National/International Standard which ensures equal or better quality may be accepted. In such case the bidder shall furnish copies of the standards in English along with his bid and shall clearly bring out the salient features of comparison with corresponding listed standards.

14.3.4 The equipment furnished under this specification has to operate in a tropical climate and shall be given tropical and fungicidal treatment as per relevant specification

14.3.5 Period of Operation/Duty Cycle:

The sets are intended to supply power only during an emergency for essential services and may be idle for long periods except for periodic routine tests once in a week. When there is a total failure of main power supply, the sets shall be required to operate continuously at full load for a period which at times may exceed even 24 hours.

14.4 ENGINE:

14.4.1 Type:

The diesel engine shall be of stationary type four stroke/two stroke with vertical in line or (V) type cylinder arrangement, Turbo-charged, cooled with radiators.

14.4.2 Rating:

- a) Prime power BHP rating of the engine shall be such that the DG set deliver the specified net electrical output while supplying power/driving all electrical and mechanical auxiliaries connected to alternator terminals and engine shaft at specified site conditions and ambient temperature of 50°C. The bidder shall submit the deration calculations if the engine is not designed for 50deg C. ambient temperature.
- b) It shall also be capable of satisfactorily driving the alternator at 10% over load at the rated speed for one hour in any period of 12 hours of continuous running.

The bidder shall have to furnish copy of deration chart from the original manual of the engine manufacturer and supporting calculations to arrive at diesel engine rating.

14.4.3 Speed and Vibration Levels:

- a) Speed shall be 1500 revolutions per minute. Speed governor/over speed protection shall be provided.

At due running conditions, speed shall be stabilized at plus or minus 2% nominal speed, regardless of load. At transient condition, engine speed shall vary not more than 10% plus or minus. Governor class shall be A1 (4% drop) for normal application unless otherwise specified.

- b) The engine vibration level shall not exceed 100 microns.

14.4.4 Lubrications:

- a) The engine shall have a closed cycle forced & splash lubricating system with positive oil pressure and a crank chamber for collection/storage of the lubricating oil during circulation.
- b) A lubricating oil filter shall be provided for operation under normal conditions for a period of 300 hours without the necessity of its replacement or cleaning.
- c) In case lubricating oil coolers are required it shall be supplied as an integral part of the Diesel Generator Set.
- d) Necessary temperature and pressure gauges and other instruments shall be supplied and fitted on the lubrication system.
- e) A lubricating oil level dipstick suitably graduated shall be provided and located in the accessible position.

14.4.5 Fuel System:

- a) The engine shall be capable of running on all types of diesel fuel oil normally available in India.
- b) The fuel consumption of the engine at full, three quarters and half of its rated power output shall be indicated by the Contractor in the bid.
- c) A fuel service tank of 990 litres capacity with each D.G. Set shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator marked in litres, filling inlet with removable screen, an outlet, a drain plug, an air vent and necessary piping. The fuel tank shall be painted with oil resistant paint. All pipe joints should be brazed/welded.

14.4.6 Air Intake System:

The diesel engine shall be provided with special dry type air filters having low resistance to air passage, high dust retaining efficiency and provision for easy cleaning. Filters shall be suitable for achieving satisfactory engine operation and ensuring the engine life under tropical humid conditions, with sulphur dioxide fumes, abrasive dust and coal particles of 5 to 100 microns present in the atmosphere. The minimum efficiency of filters shall be 90% down to 5 micron size.

14.4.7 Cooling:

The diesel engine should be water cooled with radiator heat exchanger system. The cooling system should include temperature gauge with high temp., alarm/trip corrosion resistor etc.

14.4.8 Engine Governor:

The governor shall be Electronic ISO-Chronous type to maintain zero speed rate or regulation and shall be AI type as per BS:5514 in order to take care of heavy motor starting. It shall have necessary characteristics to maintain the speed substantially constant even with sudden variation in load. However, a tripping shall be provided if speed exceeds maximum permissible limit. The governor shall be suitable for operation without external power supply.

14.4.9 Turbo Charger:

It shall be of a robust construction, suitable of being driven by engine exhaust having a common shaft for the turbine and blower. It shall draw air from filter of adequate capacity to suit the requirements of the engine.

14.4.10 Quietness of Operation:

- a) The engine shall be designed to achieve maximum quietness of operation.
- b) Efficient residential silencer shall be provided as per engine manufacturer's approved make only for the exhaust.
- c) Noise level of the set shall not exceed 115-120dbA at one meter distance of the engine.

14.4.11 Engine Starting:

- a) Engine starting shall be by electric starting motor complete with manual/automatic starting arrangement. The starter motor shall conform to IS:4722 and shall be of adequate power for its duty and be of inertia or pre-engaged type. The pinion shall positively disengage when the engine starts up or when the motor is de-energized. The engine cranking shall be only from the panel both for AMF & DG sets (Manual) and any engine starting devices etc. that are given as original fitment on the engine by engine manufacturers shall be either removed or padlocking arrangement given for this so that all normal start/stop operations could be done only from panel whether the set is AMF or manual.

The engine wiring shall be appropriately modified, ferruled to totally match with schematic drawings of the panel.

- b) Time for Run-up to Speed:
From the initial operation of the starting device, the engine shall start, run up to normal speed and be capable of accepting 60% of full load within a maximum time of 20 seconds, and full load within a further 20 second.

14.4.12 Starter Battery:

- a) The battery shall conform to the requirement of IS:1651. Starting battery each of 12 V, heavy duty high performance approved make/quality shall be provided to enable crank & start the engine even in cold/winter morning conditions. Type/voltage/AH capacity of same on 20 hour rated discharge period shall be indicated in the offer. The battery set shall be capable of performing at least (5) five normal starts without recharging.
- b) The battery shall be provided with good quality teakwood stand painted with acid proof black paint with min 3mm thick rubber mat below the batter.
- c) Batteries shall be of load container type only and not with PVC moulded sealed container so that each individual cells are available for individual monitoring during its life span. Each cell shall be provided with electrolyte filling cap with level floats for easy monitoring of electrolytic level.
- d) The battery shall be provided with 2 Nos. cables, minimum 1.5m long heavy duty rubber/PVC insulated cabling with brazed tinned lug at one end and with brazed tinned brass terminal lug at battery end - for connecting

batteries to cranking system - with 0.25 m long inter battery connecting cable.

- e) The lugs shall be clearly stamped (+) or (-) and positive cable also red sleeved for easy identification.
- f) The batteries Set shall be supplied fully filled and first charged ready to use.

14.4.13 Battery Charging System:

- a) Float rate charging and quick rate charging system shall be provided at the generator panel with appropriate bridge charger system, LC network, rate selector switch and generously rated charging transformer and silicon one rectifier bridge, so that the cranking battery system can be kept fully charged at all times from E.B. supply network with quick charging rate limited to 0.8 times rated discharge current with provision in control transformer and Si rectifier present to enable boost charging the battery at 2 times rated discharge current in case of emergencies. To this and in the mode selector switch boost charge position shall be present which however shall be kept disconnected at mode selector switch normally.
- b) DC ammeters to clearly indicate float charging current and quick/boost charging current shall be provided.
- c) Dropper resistor network on the load side of battery charger system shall be provided so that higher charger voltages in quick or boost conditions does not get impressed on the I/L and Contactor coils, which voltage shall remain well within +10% of rated voltage.
- d) Battery charging subsystem shall be designed for continuous operation at cubicle ambient of 50^oC corresponding to 45^oC ambient outside and should be designed to operate at 1.5 times rated maximum current corresponding to boost charge current which can reach in practice as high as 2.5 times or 3 times rated discharge current.
- e) Any charger dynamo and dynamo charging current network present on the set shall be made in operative so that both for AMF and manual application the cranking battery system is kept charged from the charger at the panels at all times during or shut down periods of the set.
- f) To the above and in case of manual DG sets, the input to charger subsystem viz., 240 V AC is foreseen to be provided from customer network from the portion that is normally supplied by manual DG Set during DG operation or being fed by E.B. System.

14.4.14 Engine Fitments:

The engine shall be provided with but not limited to following essential basic fitments:

Crank case breather	-	Dry type element.
Air Cleaner	-	Dry type mounted.
Corrosion resistor	-	to control acidity and impurities from
Lubricating Oil Cooler	-	coolant
Filters	-	Lub oil & fuel oil, paper element type.
Coolant Pump	-	Gear Driven.
Fuel Pumps	-	Priming & Transfer
Governor	-	Electronic Class A1.
Turbo Charger	-	Exhaust gas driven in case of turbo charged engines.
Flywheel with flywheel housing	-	SAE Type
Vibration dampers	-	One Set
Exhaust/Intake manifolds	-	
Oil Sump (crank case) with dip stick		
Engine Supports		
Residential type silencer in exhaust system		
Electrical starter 12 V or 24 V		
Safety controls & instruments		

14.4.15 Engine Instrumentation:

The following instruments mounted on instrument panel shall be essentially present as minimum:

- Engine speed tachometer with service hour counter
- Lub oil pressure gauge
- Coolant water temperature gauge

The instrument panel shall be mounted on engine using rubber dampers for vibration isolation.

The gauges shall have clear red marking to identify the limiting dangerous levels, 'Zone Markings' on the scale to indicate the normal healthy & abnormal operating zones for the parameters concerned.

The metering could be either normal electro-mechanical analogue type or electronic digital type, latter being preferred as manufacturers fitment only.

The engine control panel must be supplied by the engine manufacturer only.

14.5 ALTERNATOR:

14.5.1 The alternator shall have brushless type with rotating field and static excitation circuit controlled by field control unit suitably compounded for voltage and load current for a self excited self regulated system.

14.5.2 The alternator shall be in SP-DP enclosure, foot mounted with ball and roller bearings on end shields.

14.5.3 The alternator shall conform to IS:4722/BS:2613 and shall be suitable for tropical conditions.

14.5.4 The alternator shall comply with the following specifications:

Rating	-	As per BOQ. (Shall be capable of 10 % over loading at the rated speed for one hour of 12 hours continuous running).
Voltage	-	415 V
Speed	-	1500 RPM
Frequency	-	50 Hz.
P.F.	-	0.8 lag
Enclosure	-	IP:23
Insulation	-	H
Execution	-	Self excited, self regulated with brushless system and static voltage control unit suitably compounded for voltage and current to maintain terminal voltage constant at $\pm 5\%$ at all load for p.f. not less than 0.8. lag.
Terminal Box	-	As per BOQ.
Earthing Studs	-	2 Nos. in each DG

14.5.5 Neutral Point:

The winding of the alternator shall be star-connected.

14.5.6 Terminal Box and Connection:

The alternator output terminals shall be enclosed in a terminal box mounted in an accessible position on the alternator frame. As far as possible, connections between the exciter and alternator shall be contained within the machine frame and connections carrying A.C. and D.C. shall be segregated from each other. The terminal box shall be of sufficient size to conveniently terminate the size and number of the Owner's cables, which shall be intimated during detailed engineering. Suitable tinned copper pads shall be provided for power cable termination along with all necessary hardware and cable lugs. Glands and lugs shall be provided for control cables also. For single phase cables, gland plate shall be of non-magnetic material. Gland plate shall be removable type.

14.5.7 The generating set shall be so designed that it is capable of reaching its full voltage and frequency and shall be ready to take full load within 30 seconds of a remote starting impulse being received.

14.5.8 Acoustic Enclosure:

Thickness of Sheet – 14-G:

High Class sheet metal fabricated enclosure for reducing the noise level of DG Set and also acts as weather proof housing. Genset will be an integral part of acoustic enclosure and whole construction will be on multi-fold sheet channels and ISMC sections. Enclosure construction is fully bolted keeping in view the major service requirements all doors are provided with specially designed hinges and lockable handles, battery, fuel tank is housed inside the enclosure.

Acoustic Materials:

Rock wool in the form of slabs of 75 – 100 mm thickness and 48 KG/Metric cube density (Specification of Rock wool conforms to IS:8183).

Further to increase the life of Acoustic material resin coated fiber glass cloth is provided on exposed surface of Rock wool slabs and the panels are supported by perforated sheets.

Ventilation:

Acoustic enclosure is designed in such a way that there are no hot pockets around engine and it is provided with suitable designed engine radiator/or additional axial flow fan and does not allow the temperature to rise more than 7°C.

To achieve optimal output and minimum sound level from the DG Set, suitable openings with acoustic hoods are provide for increasing the inflow of air required for combustion and forced ventilation. Air intake system as per the recommendations and engine requirement are provided.

- Acoustic hoods with noise splitters provided to block and reduce the sound leakage.
- The sound control system designed to suppress the sound level to 75 db maximum at 1 meters distance in open environment.

Silencer:

Specially designed low noise silencer is provided. Silencer & engine exhaust outlet, connected with flexible SS below.

Vibration Isolation:

To avoid transfer of vibration from Genet to enclosure & surrounding specially designed vibration isolators are used.

14.6 AMF PANEL:**14.6.1 General:**

- a) The control panel shall be sheet steel enclosed and shall be dust and vermin proof providing a degree of protection of IP-42. Sheet steel used shall be cold rolled and at least 2.0mm thick and properly braced and stiffened.
- b) Control panel shall be provided with hidden hinged door(s) with pad locking arrangement and suitable brackets/channels shall be provided for floor mounting.
- c) All doors, removable covers and plates shall be casketed all around with neoprene gaskets. All accessible live connections shall be shrouded and it shall be possible to change individual switches, fuses, MCCBS without danger of contact with live metal.
- d) All live parts shall be provided with at least phase to phase and phase to earth clearances in air of 25mm and 20mm respectively.
- e) Adequate interior cabling space and suitable removable cable gland plate shall be provided. Necessary number of cable glands shall be supplied and fitted on to this gland plate. Cable glands shall be screwed on type and made of brass.
- f) Two number of earthing terminals shall be provided.
- g) All sheet steel work shall be degreased, pickled, phosphate and then applied with two coats of zinc chromate primer and powder coat finishing both inside and outside of shade 631 (gray).
- h) All meters are to be digital type.

14.6.2 AMF Control of Diesel Generating Sets:

- a) All DG Sets shall be controlled independently.
- b) Diesel Generator shall be capable of being stopped manually from remote as well as local. However, interlock shall be provided in the DG local

control panel to prevent shutting down operations as long as circuit breaker is closed.

c) Auto Operation:

When mains power is available, the healthiness of this power will be monitored through a mains voltage monitor. If voltages on the 3 phases are within limits, the monitor will send a closing signal to the mains breaker and mains power will be connected to the load.

If the voltage drops on any phase or on all phases, the monitor will sense this drop through a timer, and if this drop persists for more than a pre-adjusted period of time (say 1 to 20 seconds) a signal is sent to the engine starting circuit while at the same time opening the mains supply breaker and disconnecting load from mains as voltage is below acceptable limits.

The engine starting control monitor will send a signal to the D.C. battery supply for starting the engine through the starting solenoid. When the engine is healthy, it starts up in a few seconds and the generator develops voltage. The generator voltage monitor, monitors the voltage and when the voltage is developed, this give a signal to the generator breaker which closes and connects the diesel generator to the load. Simultaneously, it sends a signal to de-energize the engine starting circuit and the starter motor is disengaged. The engine protection circuits for high water temperature and low lubricating oil pressure are also energized.

d) Resumption of Supply:

If voltage from mains is resumed, the main voltage monitor will sense this voltage for healthiness, i.e. for maintained correct voltage for a period of time (adjustable up to three minutes) and then send a signal to stop the engine and to change over the breakers from generator to mains and normal supply is resumed to the load. The solenoid operation and closing and tripping of breakers should be done through control voltage 24 V.D.C.

e) Failure to Start:

A three attempt starting facility using two impulse timers and a summation timer for engine shall be provided and if voltage fails to develop within 30 seconds from receiving the first start impulse, the set shall lockout automatically and a visual and audible alarm shall be given in the control panel. The remote panel shall receive "DG Trouble Alarm".

14.6.3 The control panel shall have the following provisions for the control of each DG Set:

1. MCCB's & ACB's as per BOQ.
2. Master engine control which for OFF/AUTO/MANUAL/TEST with a facility for starting and stopping of the set.

3. Voltmeter 144 Sqmm with selector switches for alternator/Mains/Phases complete with protection.
4. Local/Remote selector switch to facilitate remote starting/stopping of the DG Set.
5. Frequency meter 144 Sqmm reed type.
6. Current transformers required for metering.
7. Ammeter 144 Sqmm with C.T. & selector switch, KWH Meter, KW 144 Sqmm.
8. Mains Supply, voltage monitor.
9. Engine control monitor.
10. Alternator voltage monitor.
11. D.C. Control relays, timers.
12. Engine protection system for low oil lubricating pressure and high water temperature.
13. Window type annunciator with static relays, alarm/hooter and accept, test, rest push buttons for all functions.
14. Engine hours run counter.
15. Control fuses.
16. Lifting Hooks.
17. Gland Plates.
18. Power/Control Contactors.
19. Earthing Studs.
20. Antivibration pads.
21. IDMT relays [CDG – 31]
22. Under Voltage Relays
23. Over Voltage Relays

14.6.4 Indication/Annunciation:

Pilot indicating lamps/shall be provided for the following:

1. Charger - ON/OFF
2. Earth Fault
3. Set shutdown due to `Engine high water temp.`
4. Set shutdown due to `Low oil pressure`
5. Set shut down due to `Lock of fuel`
6. Over speed trip

Indicating lamp shall be of the panel mounting filament type with series resistors.

14.6.5 The DG Sets would normally be controlled from remote for which following provisions are being made on the remote control panel. The necessary control devices/contacts for these external connections shall be wired out to the DG control panel terminal blocks.

1. Starting and stopping of the DG Set
2. DG running indication
3. Watt hour meter, Wattmeter, Voltmeter, Ammeter and Frequency meter.

14.7 ENGINE SAFEGUARDS:

Safeguards shall be provided and arranged when necessary to stop the engine automatically by the following:

- a) Energising a solenoid coupled to the stop lever on the fuel injection pump rack.
- b) De-energising the "fuel on" solenoid
- c) Energising the "fuel - cut off" solenoid.

The operation of the safeguard shall at the same time give individual warning of the failure by illuminating an appropriate local visual indicator and remote alarm at generator panel.

The contactors, relays and other devices necessary for signal and control, for above purposes shall be provided at Generator panel.

At the set at a easily accessible place an "EMERGENCY STOP" mushroom head stay put type P.B shall provided to stop the set in emergency mode.

The safe guard to "STOP THE SET" shall stop the set irrespective of mode selection of the set viz Auto, Manual or test for following cases, with simultaneous isolation of alternator ckt.

- a) Emergency stop P.B's operation
- b) Over speed.
- c) Low lube oil pressure.
- d) Earth fault

14.8 TESTS:

14.8.1 The alternator of each type and rating shall be type tested for the following tests as per IS:4722, IEEE 115 & BS:5000. Test certificates to be provided for routine and type tests from the manufacturers.

14.9 ERECTION, TESTING, COMMISSIONING AND PERFORMANCE & GUARAANTEE TESTS/PROCEDURE AT SITE:

The entire work of erection, testing and commissioning of equipment supplied under this package shall be carried out by contractor and performance and guarantee tests to be conducted at site are also included under the scope of this specification. For this purpose the contractor shall depute suitable qualified technical supervisor to site on advance intimation to the Owner along with all special testing equipment required for testing and performance and guarantee tests. The supervisor(s) shall be responsible for the installation, testing, commissioning checks and performance & guarantee tests mentioned in relevant clauses of this volume and the checks recommend by the contractor.

The contractor shall ensure that the equipment supplied by him is installed in a neat workman like manner such that they are leveled, properly aligned and well oriented. The tolerances shall be established in Contractors drawings and/or as stipulated by the Owner.

All special tools and tackles and spares required for erection, testing and commissioning of equipment shall be supplied by the contractor.

Erection, testing and commissioning manuals and procedures shall be supplied, prior to dispatch of the equipment.

The contractor shall ensure that the drawings, instruction and recommendations are correctly followed while handling, setting, testing and commissioning the equipment.

14.9.1 Commissioning Check Tests/Performance and Guarantee Test:

In addition to the checks and test recommended by the manufacturer, the contractor shall supervise the following acceptance tests to be carried out on each test at site.

i. Load Test:

The DG Set shall be given load test at site for a period of at least 6 hours depending upon the actual power factor of the load and set shall be subjected to the maximum achievable load without exceeding the engine or alternator capacity.

This full load test is to be followed immediately by a 10% overload run for one hour. The performance of the engine, alternator shall be satisfactory at the end of this overload run.

During the load test half hourly records of the following shall be taken:

- a) Ambient temperature
- b) Cooling water temp.
- c) Lubricating oil pressure.
- d) Speed
- e) Voltage, wattage and current output.
- f) Oil tank level

ii. Speed and Governing:

The speed of the engine shall be verified to ensure that it conforms to the requirement of BS:5514.

iii. Check of Fuel Consumption:

A check of the fuel consumption shall be made through out the test run of full load and overload.

iv. Noise Level:

The equivalent 'A' weighted sound level measured at a distance of 1 meter horizontally from the base of any equipment furnished and installed under these specifications expressed in decibels to a reference of 0.0002 microbar, shall not exceed the limit given as per CPCB norms. 75 dbA average at 1 mtr. distance from acoustic enclosure.

ANNEXURE - VI

Project: HVAC works of existing Test Research Laboratory Building, Construction of plant

BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7

- 10.15 Providing and installation of fully insulated wooden fire rated shutter of 120min. fire rating conforming to BS: 476 part 22 and IS:3614 Part II as per the prototype tested and certified by CBRI Roorkee, of 55mm thickness, comprising of 75mm x 49mm hardwood internal timber frame work, with infill of 96 kg/m³, ceramic fiber blankets, coated with VIPER FR or equivalent intumescent coating on both sides for insulation. The coated insulation shall be sandwiched between 12mm thick, Non combustible Boards (Calcium Silicate) on both sides (edge to edge on internal Hardwood frame) and clad with 3mm thick commercial ply of approved quality & 1mm thick laminate of approved brand and manufacture on both sides, with 55mm x 14mm 2nd class teak wood lipping all round the shutter.

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BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7

The shutter is suitable for mounted on the door frame, as per the item given below.. Both frame and shutter shall be fitted with fire & smoke intumescent seal of Viper or equivalent make of size 20 x 4mm on all the three sides except bottom. The pasting of the ply/veneer/laminate should be done using automatic machine and should be free from any nails or perforations. The board shall be Resistant to vermin, mould growth, minor impact, abrasion and short term water attack. The shutter shall be fixed with the frame with the help of SS 304 grade ball bearing hinges of size 100x76x2mm with necessary screws and making cut out for vision panel. Provisions/reinforcement for fixing all fixtures shall be built in on the door prior to the supply.

Single/Double Shutter

5 sqm

Project: HVAC works of existing Test Research Laboratory Building, Construction of plant

BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7
10.16	<p>Providing and fixing door frames as per BS: 476 part 22, IS:3614 Part II as per the prototype certified by CBRI Roorkee made out of 2nd class Teak Wood (Ivory Coast)frame of section 140x65mm for fire resistant doors of 120 minutes fire rating, with heat activated intumescent fire seal strips of size 20 x 4 mm(for smoke sealing) provided in grooves on all three sides of the frame with one coat of approved brand of fire retardant primer including two coats of fire retardant paint FR 881or equivalent un thinned on cleared hard wood surface of door frames (@3.5 sq.m. per litre per coat) including preperation of base surface as per recommendations of manufacturer to make the surface fire retardant, including fixing the frame with 8 nos. 100 mm long, 10 mm dia metal dash fastners complete as per directions of the Engineer in charge NOTE:- cost of fire seal strips, dash fastners are included in the item. Nothing extra shall be paid if size of any component of material exceeds the limit mentioned in the item.</p>	10	Metre			
10.17	<p>Providing and fixing UL listed door Co-ordinator (of Becker Fire Solutions or approved equivalent Make) for coordination of double leaf doors, of approved brand and manufacture with minimum one year warantee.</p>	2	Each			

Project: HVAC works of existing Test Research Laboratory Building, Construction of plant

BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7
10.18	Providing & fixing of Fire-stop Fire sealing System mortar type of approved make for sealing of floors, wall openings for the purpose of compartmentation. The FPSS consists of 225mm thick slab casted with vermuclite based cementitious compound as per manufacturer specifications including the cost of centering and shuttering required . The FPSS system must provide min. two hour fire rating as per IS 12458-1989 having CERTIFICATION from CBRI, Roorkee or any other approved equivalent Govt. laboratory, for 2 hr. Fire rating.					
		5	sqm			
10.19	Providing and fixing 6 mm thick pyroswiss extra or equivalent fire rated clear toughened glass of approved make, of 120 minutes fire rating to be fixed in vision panel including cost of fire ceramic tape and moulding/beading etc all complete					
		0.5	sqm			
10.20	Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in - charge.					
		5	Cum			
10.21	Demolishing R.C.C. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer - in- charge.					
		5	Cum			

Project: HVAC works of existing Test Research Laboratory Building, Construction of plant
BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7
10.22	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge.		5 Cum			
10.23	Extra for providing power operated doors in place of manual operated doors for 500 kg lifts mentioned at item 10.11.		2 Set			

Project: HVAC works of existing Test Research Laboratory Building, Construction of plant

BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7

LIFT

10.11 Design, supply, installation, testing and commissioning of 500 Kg goods lift, serving different floors in the lift shaft including lift well pressurization. The lift should be as per detailed specification / drawing enclosed as required and as under :

Speed : 0.5 MPS

Travel: B+G

Stops & opening: 2 stops 2 opening

Controller: A.C. variable voltage & variable frequency

Automatic rescue device complete with dry maintenance free batteries as required.

Operation: Microprocessor based single automatic push button/ simplex selective collective/ with / without attendant.

415 V, 3 phase, 50 Hz, 4 wire system

The lift well size is 1900mm x 1900 mm. The clear entrance should be minimum 1000 mm either through manual side opening/ vertical biparting doors

Project: HVAC works of existing Test Research Laboratory Building, Construction of plant
BOQ for Civil Work

Item No	Description Of Item	Total Qty	Unit	Rate in Figures(Rs)	Rate in Words(in Rs)	Amount in Figures (in Rs)
1	2	3	4	5	6	7

Type of doors: a) Car : Manual operated, side opening/ vertical biparting doors spray painting of approved shade MS doors. (b) Landing doors: MS spray painted.

A hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car.

Toe guard, IR curtain on full height, two phase fireman's drive control/ switch etc to be provided in the lift.

Goods lift as mentioned above

2 Set

CERTIFICATE

We certify that the amendments of tender documents submitted by us along with our bid for (tender no.)_____ (name of work)_____

_____ are downloaded from HSCC website (www.hsccltd.com) is same in content and form (verbatim).

We also undertake that any deviation, if detected at any stage, would entitle HSCC/NIMR to reject our bid/tender/offer and take suitable penal action against us. In any such an eventuality, the decision of HSCC/NIMR shall final and the same would be legally binding on us.

Signature & seal of the Tenderer