SECTION - V

SECTION V

TECHNICAL SPECIFICATIONS GREEN BUILDING – IGBC COMPLIANCE, ENVIRONMENT HEALTH AND SAFETY POLICY

A. TECHNICAL SPECIFICATIONS GREEN BUILDING – IGBC COMPLIANCE

1. INTRODUCTION

INDIAN GREEN BUILDING COUNCIL (IGBC)

India is witnessing tremendous growth in infrastructure and construction development.
The construction industry in India is one of the largest economic activities and is growing at an average rate of 9.5% as compared to the global average of 5%. As the sector is growing rapidly, preserving the environment poses a host of challenges. To enable the construction industry environmentally sensitive, CII Sohrabji Godrej Green Business Centre has established the Indian Green Building Council (IGBC). IGBC, is a consensus driven not-for-profit Council, represents the building industry, consisting of more than 1,923 committed members. The Council encourages, builders, developers, owners, architects and Project architect/EIC to design & construct green buildings, thereby enhancing the economic and environmental performance of buildings.

The Green Building Movement in India has been spearheaded by IGBC since 2001, by creating awareness amongst the stakeholders. Thus far, the Council has been instrumental in enabling 2.23 Billion sq.ft of green buildings in the country. The Council's activities have enabled a market transformation with regard to green building materials and technologies. IGBC continuously works to provide tools that facilitate the adoption of green building practices in India. The development of IGBC Green New Buildings rating system® is another important step in this direction.

In order to obtain minimum Gold rating of IGBC on the basis of IGBC Green New Building Criteria is attached to the tender.

Note: Bidders are advised to go through the gold ratings requirement in the attachment in order to make themselves familiar with the IGBC guidelines before making the bids. The party in order to obtain IGBC rating shall work under the guidance of Project Architect / EIC. The statutory payment will be in the scope of NHIDCL however the party shall deploy experience manpower in order to obtain the ratings.

The green concepts and techniques in the building sector can help address national issues like water efficiency, energy efficiency, reduction in fossil fuel use for commuting,

handling of consumer waste and conserving natural resources. Most importantly, these concepts can enhance occupant health, productivity and well-being.

Against this background, the Indian Green Building Council (IGBC) has launched 'IGBC Green New Buildings rating system® to address the national priorities. This rating programme is a tool which enables the designer to apply green concepts and reduce environmental impacts that are measurable. The rating programme covers methodologies to cover diverse climatic zones and changing lifestyles.

IGBC has set up the Green New Buildings Core Committee under the leadership of Ar. Raghavendran, to develop the rating programme. This committee comprised of key stakeholders, including architects, builders, consultants, developers, owners, institutions, manufacturers and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system, both in its content and process.

2. Benefits of Green New Buildings

Green New buildings can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption right from day one of occupancy. The energy savings could range from 20 - 30 % and water savings around 30 - 50%. The intangible benefits of green new buildings include enhanced air quality, excellent daylighting, health & well-being of the occupants, safety benefits and conservation of scarce national resources.

3. National Priorities Addressed in the Rating System

The IGBC Green New Buildings rating system addresses the most important national priorities which include water conservation, handling waste, energy efficiency, reduced use of fossil fuels, lesser dependence on usage of virgin materials and health & well-being of occupants. The rating system requires the application of National standards and codes such as the NBC, ECBC, MoEF guidelines, CPCB guidelines, and several others. The overarching objective is to be better than the national standards so as to create new benchmarks.

❖ Water Conservation:

Most of the Asian countries are water stressed and in countries like India, the water table has reduced drastically over the last decade. IGBC Green New Buildings rating

system encourages use of water in a self-sustainable manner through reduce, recycle and reuse strategies. By adopting this rating programme, green new buildings can save potable water to an extent of 30 - 50%.

- **Handling of Consumer Waste:**

  Handling of waste in buildings is extremely difficult as most of the waste generated is not segregated at source and has a high probability of going to landfills. This continues to be a challenge to the municipalities which needs to be addressed. The rating system intends to address this by encouraging buildings to segregate the building waste.

- **Energy Efficiency:**

  The building sector is a large consumer of electrical energy. Through IGBC Green New Buildings rating system, buildings can reduce energy consumption through energy efficient
  - building envelope, lighting, air conditioning systems, etc., The energy savings that can be realised by adopting this rating programme can be to the tune of 20 - 30%.

- **Reduced Use of Fossil Fuels:**

  Fossil fuel is a slowly depleting resource, the world over. The use of fossil fuel for transportation has been a major source of pollution. The rating system encourages the use of alternate fuel vehicles for transportation.

- **Reduced Dependency on Virgin Materials:**

  The rating system encourages projects to use recycled & reused material and discourages the use of virgin materials, thereby, addressing environmental impacts associated with extraction and processing of scare natural resources.

- **Health and Well-being of Occupants:**

  Health and well-being of occupants are the most important aspect of IGBC Green New Buildings rating system. The rating system ensures adequate ventilation, daylight and occupant well-being facilities which are essential in a building. The rating system also recognises measures to minimise indoor air pollutants.

4. IGBC Green New Buildings Rating System®

IGBC has set up the Green New Buildings Core Committee to develop the rating programme. This committee comprised of key stakeholders, including architects,

builders, consultants, developers, owners, institutions, manufacturers and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system, both in its content and process.

a. Features

IGBC Green New Buildings rating system® is a voluntary and consensus-based programme. The rating system has been developed based on materials and technologies that are presently available. The objective of IGBC Green New Buildings rating system is to facilitate a holistic approach to create environment friendly buildings, through architectural design, water efficiency, effective handling of waste, energy efficiency, sustainable buildings, and focus on occupant comfort & well-being.

The rating system evaluates certain mandatory requirements & credit points using a prescriptive approach and others on a performance-based approach. The rating system is evolved so as to be comprehensive and at the same time user-friendly. The programme is fundamentally designed to address national priorities and quality of life for occupants.

Some of the unique aspects addressed in this rating system are as follows:

- Recognition for architectural excellence through integrated design approach.
- Recognition for passive architectural features.
- Structural design optimization with regard to steel and cement. This is a developmental credit. Projects are encouraged to attempt this credit, so as to help IGBC in developing baselines for future use.
- Water use reduction for construction. This is also a developmental credit.
- Based on the feedback from green building proponents, use of certified green products will be encouraged. IGBC has launched a new initiative to certify green products to transform markets. Products would be evaluated right from extraction to disposal.
- Handholding from IGBC Counsellors will now be available for the projects.
- A site visit and audit are proposed before award of the rating.
- Projects are encouraged to report energy and water consumption data on an annual basis, to facilitate research in this area.

b. Scope

IGBC Green New Buildings rating system® is designed primarily for new buildings, both for air-conditioned and non-air-conditioned buildings. New Buildings include (but are not limited to) offices, IT parks, banks, shopping malls, hotels, hospitals, airports, stadiums, convention centres, educational institutions (colleges, universities), libraries, museums, etc., Building types such as residential, factory buildings, schools, integrated townships will be covered under other IGBC rating programmes.

IGBC Green New Buildings rating system is broadly classified into two types:

1) **Owner-occupied buildings** are those wherein 51% or more of the building's built-up area is occupied by the owner.
2) **Tenant-occupied buildings** are those wherein 51% or more of the building's built-up area is occupied by the tenants.

Based on the scope of work, projects can choose any of the above options.

c. The Future of IGBC Green New Buildings Rating System

Many new green building materials, equipment and technologies are being introduced in the market. With continuous up-gradation and introduction of new green technologies and products, it is important that the rating programme also keeps pace with current standards and technologies.

Therefore, the rating programme will undergo periodic revisions to incorporate the latest advancement and changes. It is important to note that project teams applying for IGBC Green New Buildings rating system® should register their projects with the latest version of the rating system. During the course of implementation, projects have an option to transit to the latest version of the rating system.

IGBC will highlight new developments on its website (www.igbc.in).

5. Overview and Process

IGBC Green New Buildings rating system® addresses green features under the following categories:

- ❖ Sustainable Architecture and Design
- ❖ Site Selection and Planning
- ❖ Water Conservation
- ❖ Energy Efficiency

- Building Materials and Resources
- Indoor Environmental Quality
- Innovation and Development

The guidelines detailed under each mandatory requirement & credit enables the design and construction of new buildings of all sizes and types (as defined in scope). Different levels of green building certification are awarded based on the total credits earned. However, every green new building should meet certain mandatory requirements, which are non-negotiable.

The various levels of rating awarded are as below:

Certification Level	Recognition
Certified	Good Practices
Silver	Best Practices
Gold	Outstanding Performance
Platinum	National Excellence
Super Platinum	Global Leadership

a) When to use IGBC Green New Buildings Rating System®

IGBC Green New Buildings rating system® is designed primarily for New Buildings (owner-occupied and tenant-occupied).

The project team can evaluate all the possible points to apply under the rating system using a suitable checklist (Owner-occupied buildings and Tenant-occupied buildings). The project can apply for IGBC Green New Buildings rating system® certification, if the project can meet all mandatory requirements and achieve the minimum required points.

b) Registration

Organisations interested in registering their projects under IGBC Green New Buildings rating system Certification are advised to first register on IGBC website (www.igbc.in) under 'IGBC Green New Buildings Rating System' tab. The website includes information on registration fee for IGBC member companies as well as non-members.

Registration is the first step which helps establish initial contact with IGBC and provides access to the required documents, templates, important communications and along with other necessary information.

IGBC website provides all important details on IGBC Green New Buildings rating system® registration & certification - process, schedule and fee.

c) Certification

To achieve the IGBC Green New Buildings rating, the project must satisfy all the mandatory requirements and the minimum number of credit points.

The project team is expected to provide supporting documents at preliminary and final stage of submission, for all the mandatory requirements and the credits attempted.

The project needs to submit the following:

1. General information about project, including
    a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
    b. General drawings (in PDF format only):
        i. Master/ Site plan
        ii. Parking plans
        iii. Floor plans
        iv. Elevations
        v. Sections
    c. Photographs / Rendered images
2. Filled-in templates
3. Narratives and supporting documentation such as drawings, calculations (in excel sheets), declarations / contract documents, purchase invoices, manufacturer cut-sheets / letters/ material test reports, etc., for each mandatory requirement and credit.

The project documentation is submitted in two phases - Preliminary submittal and Final submittal:

- Preliminary phase involves submission of all documents, which shall include the mandatory requirements and the minimum number of credits. After the preliminary

submission, review is done by third party assessors and review comments would be provided within 30 days.

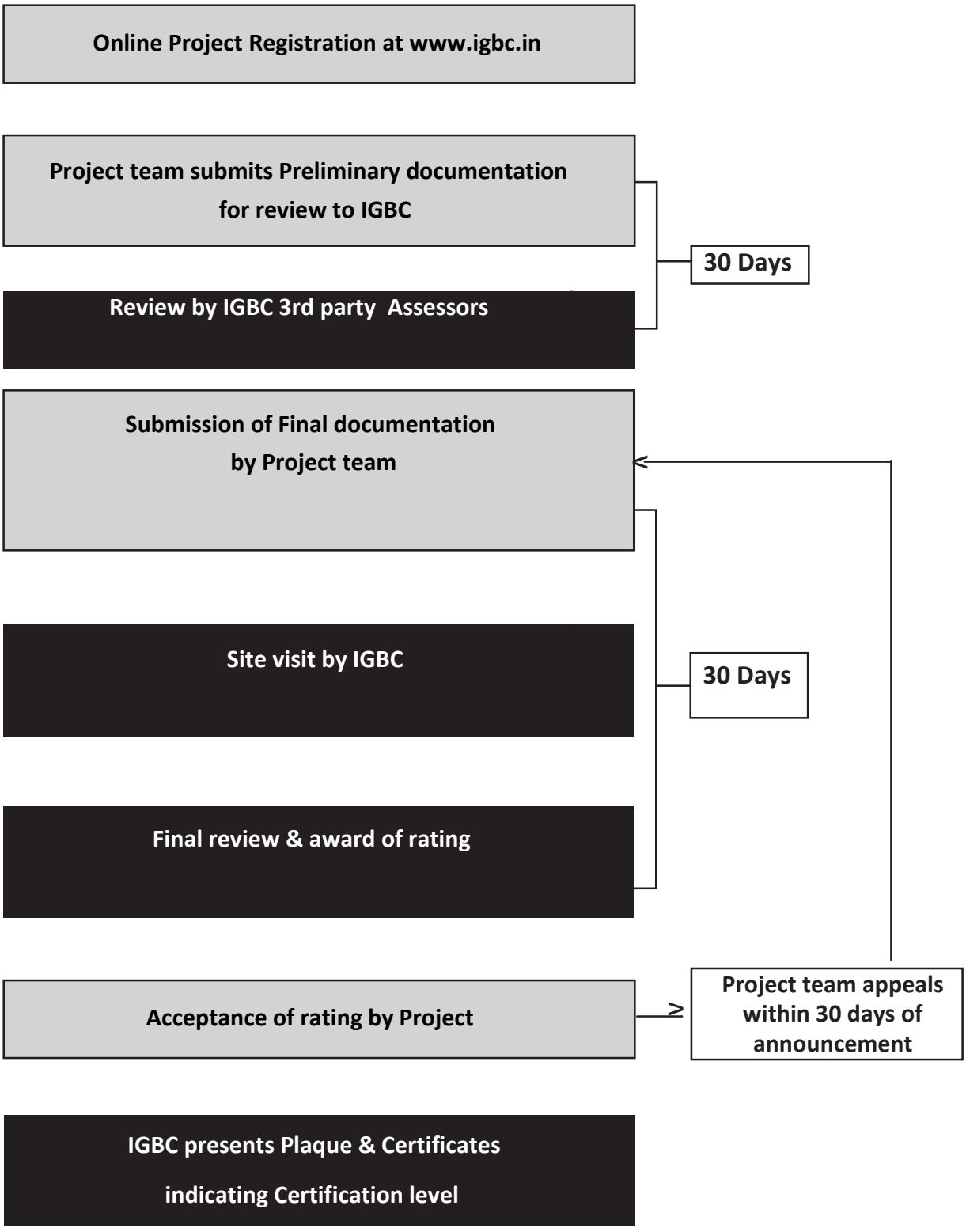
- The next phase involves submission of clarifications to preliminary review queries and final submittal. This review will also be provided within 30 days, after which the rating is awarded.

It is important to note that the mandatory requirements and credits earned at the preliminary review are only considered as expected. These mandatory requirements and credits are not awarded until the final documents are submitted, along with additional documents showing implementation of design features. If there are changes in any 'expected credits' after preliminary review, these changes need to be documented and resubmitted during the final review.

The threshold criteria for certification levels are as under:

Certification Level	**Owner-occupied Buildings**	**Tenant-occupied Buildings**	**Recognition**
Certified	50 – 59	50 – 59	Good Practices
Silver	60 – 69	60 – 69	Best Practices
Gold	70 – 79	70 – 79	Outstanding Performance
Platinum	80 – 89	80 – 89	National Excellence
Super Platinum	90 - 100	90 - 100	Global Leadership

IGBC will recognise Green New Buildings that achieve one of the rating levels with a formal letter of certification and a mountable plaque.


Online Project Registration at www.igbc.in
Project team submits Preliminary documentation for review to IGBC
Review by IGBC 3rd party Assessors
30 Days
Submission of Final documentation by Project team
Site visit by IGBC
Final review & award of rating
30 Days
Acceptance of rating by Project
Project team appeals within 30 days of announcement
IGBC presents Plaque & Certificates indicating Certification level

d) Precertification

Projects (Tenant - occupied Buildings) by developers can register for Precertification. This is an option provided for projects aspiring to get precertified at the design stage. Precertification also gives the developer a unique advantage to market the project to potential buyers.

The documentation submitted for precertification must detail the project design features which will be implemented. The rating awarded under precertification is based on the project's intention to conform to the requirements of IGBC Green New Buildings rating system®. It is important to note that the precertification rating awarded need not necessarily correspond to the final rating.

Pre-certified projects are required to provide the status of the project to IGBC, in relation to the rating, once in every six months until the award of the final rating.

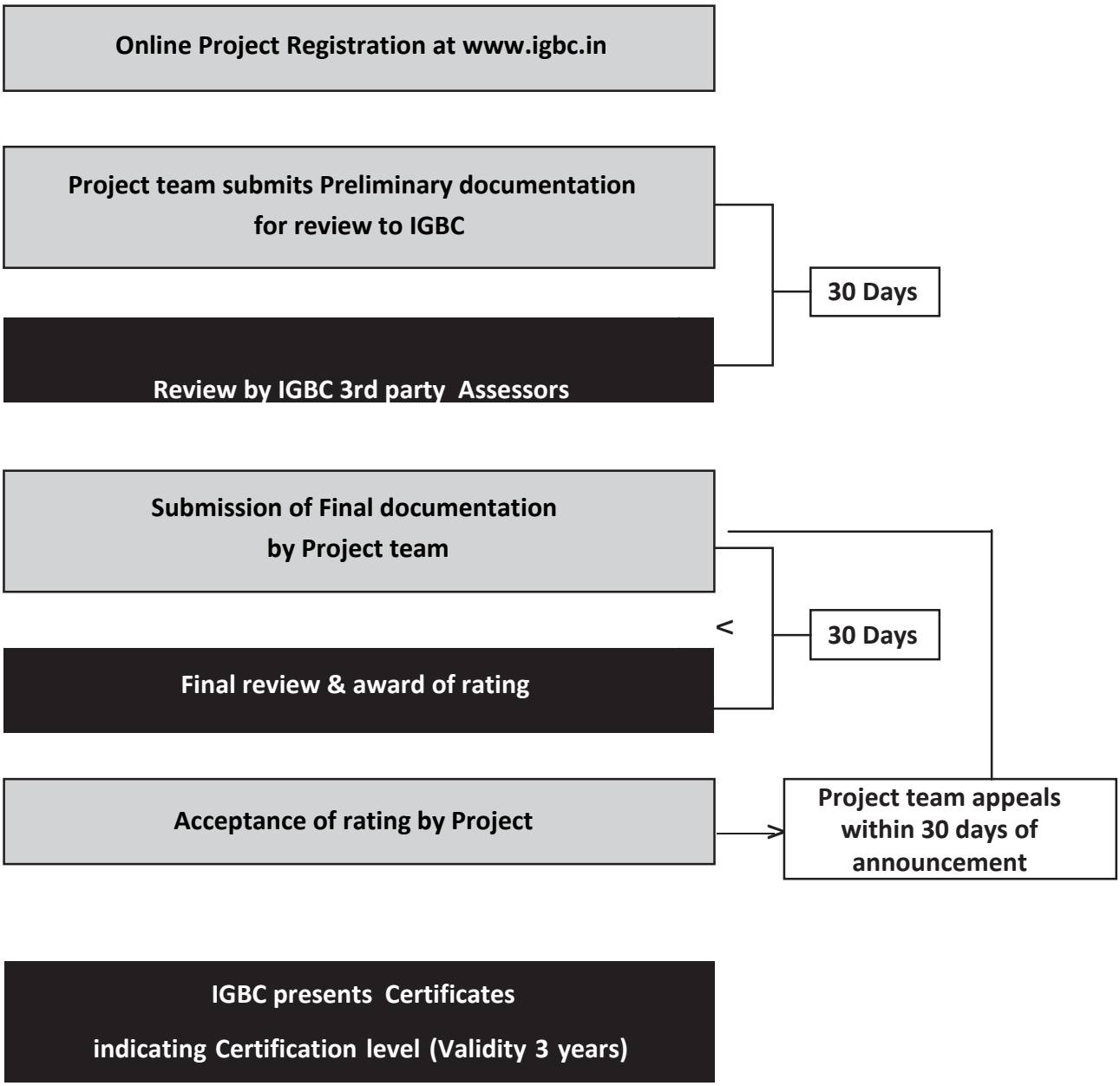
Those projects which seek precertification need to submit the following documentation:

1. General information about project, including
   a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
   b. General drawings (in PDF format only):
      1. Master/ Site plan
      2. Parking plans
      3. Floor plans
      4. Elevations
      5. Sections
   c. Photographs/ Rendered views
2. Filled-in templates
3. Narratives and supporting documentation such as conceptual drawings, estimate / tentative calculations (in excel sheets), declarations from the owner, etc., for each of the mandatory requirement and credit

IGBC would take 30 days to review the first set of precertification documents. On receiving the clarifications posed in the first review, IGBC would take another 30 days to award the precertification.

A certificate and a letter are provided to projects on precertification.

Precertification Process



The Precertification is valid for 3 years from the date of award, after which projects are Projects by developers can register for Precertification. This is an option provided for projects required to apply for the full certification (or) submit construction progress reports once in six months to get an extension certificate for Precertification rating.

Note :

- Projects (Owner-occupid Buildings) applying for MoEF clearance can apply for Provisional Certification. The Provisional Certification process will be same as Precertification process.

e) Credit Interpretation Ruling (CIR)

In some instances, there is a possibility that the design team may encounter certain challenges in applying or interpreting a mandatory requirement or a credit. It can also happen in cases where the project can opt to achieve the same intent through a different compliance route.

To address this, IGBC uses the process of Credit Interpretation Ruling (CIR) to ensure that interpretations are consistent and applicable to other projects as well.

The following are the steps to be followed in case the project team encounters any difficulty:

- ❖ Refer the Abridged Reference Guide for description of the credit intent and compliance options.
- ❖ Review the intent of the mandatory requirement / credit and self-evaluate whether the project satisfies the intent.
- ❖ Review the Credit Interpretation Ruling web page for previous CIRs on the relevant mandatory requirement or credit. All projects registered under IGBC Green New Buildings rating system will have access to this page.
- ❖ If a similar CIR has not been addressed or does not answer the question sufficiently, submit a credit interpretation request. Only registered projects are eligible to post credit interpretation request. Two CIRs are answered without levying any fee, and for any CIR beyond the first two CIRs, a fee is levied.

f) Appeal

In rare cases, mandatory requirements / credits get denied due to misinterpretation of the intent. On receipt of the final review and if the project team feels that sufficient grounds exist to appeal a credit denied in the final review, the project has an option to appeal to IGBC for reassessment of denying

mandatory requirements / credits. The documentation of the mandatory requirements / credits seeking appeal may be resubmitted to IGBC along with necessary fees. IGBC will take 30 days to review such documentation. If an appeal is pursued, please note that a different review team will be assessing the appeal documentation. The following documentation should be submitted:

1. General information about project, including
    a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
    b. General drawings (in PDF format only):
        i. Master/ Site plan
        ii. Parking plans
        iii. Floor plans
        iv. Elevations
        v. Sections
    c. Photographs / Rendered views
2. Filled-in templates for respective mandatory requirement / credit.
3. Resubmittal and appeal submittal documentation for only those mandatory requirements / credits that the project is appealing for. Also, include a narrative for each appealed mandatory requirement / credit to describe how the documents address the reviewers comments and concerns.

g) Fee

Registration, Precertification / Provisional Certification, Certification and CIR fee details are available on the IGBC website (www.igbc.in) or can be obtained from IGBC (igbc@cii.in).

h) Updates and Addenda

As the rating system continues to improve and evolve, updates, addenda and errata to the abridged reference guide will be made available through IGBC website. The additions thereof will be suitably incorporated in the next version of the rating system.

IGBC Green New Buildings Rating System Checklist		Points Available	
		Owner-occupied Buildings	Tenant-occupied Buildings
Modules		**100**	**100**
Sustainable Architecture and Design		**5**	**5**
SA Credit 1	Integrated Design Approach	1	1
SA Credit 2	Site Preservation	2	2
SA Credit 3	Passive Architecture	2	2
Site Selection and Planning		**14**	**14**
SSP Mandatory Requirement 1	Local Building Regulations	Required	Required
SSP Mandatory Requirement 2	Soil Erosion Control	Required	Required
SSP Credit 1	Basic Amenities	1	1
SSP Credit 2	Proximity to Public Transport	1	1
SSP Credit 3	Low-emitting Vehicles	1	1
SSP Credit 4	Natural Topography or Vegetation	2	2
SSP Credit 5	Preservation or Transplantation of Trees	1	1
SSP Credit 6	Heat Island Reduction, Non-roof	2	2
SSP Credit 7	Heat Island Reduction, Roof	2	2
SSP Credit 8	Outdoor Light Pollution Reduction	1	1
SSP Credit 9	Universal Design	1	1
SSP Credit 10	Basic Facilities for Construction Workforce	1	1
SSP Credit 11	Green Building Guidelines	1	1
Water Conservation		**18**	**19**
WC Mandatory Requirement 1	Rainwater Harvesting, Roof & Non-roof	Required	Required
WC Mandatory Requirement 2	Water Efficient Plumbing Fixtures	Required	Required
WC Credit 1	Landscape Design	2	2
WC Credit 2	Management of Irrigation Systems	1	1
WC Credit 3	Rainwater Harvesting, Roof & Non-roof	4	4
WC Credit 4	Water Efficient Plumbing Fixtures	5	5
WC Credit 5	Wastewater Treatment and Reuse	5	5
WC Credit 6	Water Metering	1	2

Modules		Points Available	
		Owner-occupied Buildings	Tenant-occupied Buildings
Energy Efficiency		**28**	**28**
EE Mandatory Requirement 1	Ozone Depleting Substances	Required	Required
EE Mandatory Requirement 2	Minimum Energy Efficiency	Required	Required
EE Mandatory Requirement 3	Commissioning Plan for Building Equipment & Systems	Required	Required
EE Credit 1	Eco-friendly Refrigerants	1	1
EE Credit 2	Enhanced Energy Efficiency	15	15
EE Credit 3	On-site Renewable Energy	6	6
EE Credit 4	Off-site Renewable Energy	2	2
EE Credit 5	Commissioning, Post-installation of Equipment & Systems	2	2
EE Credit 6	Energy Metering and Management	2	2
Building Materials and Resources		**16**	**16**
BMR Mandatory Requirement 1	Segregation of Waste, Post-occupancy	Required	Required
BMR Credit 1	Sustainable Building Materials	8	8
BMR Credit 2	Organic Waste Management, Post-occupancy	2	2
BMR Credit 3	Handling of Waste Materials, During Construction	1	1
BMR Credit 4	Use of Certified Green Building Materials, Products & Equipment	5	5
Indoor Environmental Quality		**12**	**11**
IEQ Mandatory Requirement 1	Minimum Fresh Air Ventilation	Required	Required
IEQ Mandatory Requirement 2	Tobacco Smoke Control	Required	Required
IEQ Credit 1	CO_2 Monitoring	1	1
IEQ Credit 2	Daylighting	2	2
IEQ Credit 3	Outdoor Views	1	1

Modules		Points Available	
		Owner-occupied Buildings	Tenant-occupied Buildings
IEQ Credit 4	Minimize Indoor and Outdoor Pollutants	1	1
IEQ Credit 5	Low-emitting Materials	3	3
IEQ Credit 6	Occupant Well-being Facilities	1	-
IEQ Credit 7	Indoor Air Quality Testing, After Construction and Before Occupancy	2	2
IEQ Credit 8	Indoor Air Quality Management, During Construction	1	1
Innovation and Development		**7**	**7**
ID Credit 1	Innovation in Design Process	4	4
ID Credit 2	Optimization in Structural Design	1	1
ID Credit 3	Waste Water Reuse, During Construction	1	1
ID Credit 4	IGBC Accredited Professional	1	1

The threshold criteria for certification levels are as under:

Certification Level	Owner-occupied Buildings	Tenant-occupied Buildings	Recognition
Certified	50 - 59	50 - 59	Good Practices
Silver	60 - 69	60 - 69	Best Practices
Gold	70 - 79	70 - 79	Outstanding Performance
Platinum	80 - 89	80 - 89	National Excellence
Super Platinum	90 - 100	90 - 100	Global Leadership

B. TECHNICAL SPECIFICATIONS ENVIRONMENT HEALTH AND SAFETY POLICY

1.0 SCOPE:

This specification established the Environment, Health and Safety (EHS) management requirement to be complied with by the Contractors during construction.

Requirements stipulated in this specification shall supplement the requirements of EHS Management given in relevant Act (s) / legislations. General Terms and Conditions of Contract (GTC), Special terms and Conditions of Contract (STC) and Job Specifications. Where different documents stipulate different requirements, the most stringent shall be adopted.

2.0 REFERENCES

This document should be read in conjunction with following:

- General Terms and Conditions of Contract (GTC)
- Special Terms and Conditions of Contract (STC)
- Job Specifications

3.0 REQUIREMENTS OF ENVIRONMENT, HEALTH & SAFETY (EHS) MANAGEMENT SYSTEM TO BE COMPLIED BY BIDDERS

3.1 MANAGEMENT RESPONSIBILITY

3.1.1 The Contractor should h a v e a documented EHS policy to cover commitment of their organization to ensure health, safety and environment aspects in their line of operations.

3.1.2 The EHS management system of the Contractor shall cover the EHS requirements including but not limited to what is specified under Para 1.0 and para 2.0 above.

3.1.3 Contractor shall be fully responsible for planning and implementing EHS requirements. Contractor as a minimum requirement shall designate / deploy the following to co-ordinate the above:

No. of workers deployed

Up to 250 - Designate one safety supervisor

Above 250 & up to 500 - Deploy one qualified and experienced Safety Engineer / officer

Above 500	- One additional safety (for every 500 or less) engineer/officer as above.

Contractor shall indemnify & hold harmless Project Architect/EIC & either representatives free from any and all liabilities arising out of non - fulfillments of EHS requirements.

3.1.4 The Contractor shall ensure that the Environment, Health & Safety (EHS)requirements are clearly understood & faithfully implemented at all levels at site.

3.1.5 The Contractor shall promote and develop consciousness for Safety, Health and Environment among all personnel working for the Contractor. Regular awareness, program site meetings shall be arranged on EHS activities to cover hazards involved in various operations during construction.

3.1.6 Arrange suitable first aid measures such as First Aid Box, trained personnel to give First Aid, Stand by Ambulance or Vehicle and install fire protection measures such as: adequate number of steel buckets with sand and adequate fire extinguishers to the satisfaction of Project Architect/EIC.

3.1.7 The Contractor shall evolve a comprehensive planned and documented system for implementation and monitoring of the EHS requirements. This shall be submitted to CMPDIL/ Owner for approval. The monitoring for implementation shall be done by regular inspections and compliance to the observations thereof. The Contractor shall get similar EHS requirements implemented at his sub- contractor(s) work site/office. However, compliance of EHS requirements shall be the sole responsibility of the Contractor. Any review / approval by Project

Architect/EIC shall not absolve contractor of his responsibility / liability in relation to all EHS requirements.

3.1.8 Non-Conformance on EHS by Contractor (including his Sub-contractors) as brought out during review/audit by Project Architect/EIC representatives shall be resolved forthwith by Contractor. Compliance report shall be provided to Project Architect/EIC.

3.1.9 The Contractor shall ensure participation of his Resident Engineer / Site-in-Charge in the Safety Committee / EHS Committees meetings arranged by Project Architect/EIC. The compliance of any observations shall be arranged urgently. He shall assist Project Architect/EIC to achieve the targets set by them on EHS during the project implementation.

3.1.10 The Contractor shall adhere consistently to all provisions of EHS requirements. In case of non-compliance or continuous failure in implementation of any of EHS provisions; Project Architect/EIC may impose stoppage of work without any Cost & Time implication to Owner and/or impose a suitable penalty for non-compliance with a notice of suitable period, **up to a cumulative limit of 1.0% (one percent) of Contract Value with a maximum limit of Rs. 10 lakhs**. This penalty shall be in addition to all other penalties specified elsewh ere in the contract. The decision of imposing stoppage work, its extent & monitory penalty shall rest with Project Architect/EIC & binding on the Contractor.

3.1.11 All fatal accidents and other personnel accidents shall be investigated by a team of Contractor's senior personnel for root cause & recommend corrective and preventive actions. Findings shall be documented and suitable actions taken to avoid recurrences shall be communicated to Project Architect/EIC. Project Architect/EIC shall have the liberty to independently investigate such occurrences and Contractor shall extend

all necessary help and co-operation in this regard.

3.2 HOUSE KEEPING

3.2.1 Contractor shall ensure that a high degree of housekeeping is maintained and shall ensure inter alia the followings wherever applicable:

a. All surplus earth and debris are removed/disposed off from the working areas to identified location(s).

b. Unused/Surplus Cables, Steel items and steel scrap lying scattered at different places within the working areas are removed to identified location(s).

c. All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).

d. Roads shall be kept clear and materials like: pipes, steel, sand boulders, concrete, chips and bricks etc. shall not be allowed on the roads to obstruct free movement of men & machineries.

e. Fabricated steel structural, pipes & piping materials shall be stacked properly for erection.

f. Water logging on roads shall not be allowed.

g. No parking of trucks / trolleys, cranes and trailers etc. shall b e allowed on roads which may obstruct the traffic movement.

h. Utmost care shall be taken to ensure over all cleanliness and proper up keep of the working areas.

i. Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the premises.

j Only properly designed steel scaffolding materials to be used for working at heights more than 3.0M. Double scaffolding using wooden ballis maybe allowed for working at height less than 3.0M

3.3 ENVIRONMENT, HEALTH AND SAFETY

3.3.1 The Contractor shall provide safe means of access to any working place including provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen, and, Project Architect/EIC. Contractor shall ensure deployment of appropriate equipment and appliances for adequate safety and health of the workmen and protection of surrounding areas.

3.3.2 The Contractor shall ensure that all their staff and workers including their sub- contractor(s) shall wear Safety Helmet and Safety shoes. Contractor shall also ensure use of safety belt, protective goggles, gloves etc. by the personnel as per job requirements. All these gadgets shall conform to relevant IS specifications or equivalent.

3.3.3 Contractor shall ensure that a proper Safety Net System shall be used at appropriate locations. The safety net shall be located not more than 30 feet (9.0 metres) below the working surface at site to arrest or to reduce the consequences of a possible fall of persons working at different heights.

3.3.4 Contractor shall ensure that flash back arrester shall be used while using Gas Cylinders at site. Cylinders shall be mounted ontrolleys.

3.3.5 The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health for driving of vehicles, handling and erection of materials and equipment's. All lifting equipment's shall be tested certified for its capacity before use.

Adequate and suitable lighting at every work place and approach there to, shall be provided by the Contractor before starting the actual operations at night.

3.3.6 Hazardous and/or toxic materials such as solvent coating, or thinners shall be stored in appropriate containers.

3.3.7 All hazardous materials shall be labelled with the name of the materials, the hazards associated with its use and necessary precautions to be taken.

3.3.8 Contractor shall ensure that during the performance of the work, all hazards to be health of personnel, have been identified, assessed and eliminated.

3.3.9 Chemical spills shall be contained & cleaned up immediately to prevent further contamination.

3.3.10 All personnel exposed to physical agents such as ionizing radiation, ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with the type of exposure involved.

3.3.11 Where contact or exposure of hazardous materials could exceed limits or could otherwise have harmful affects, appropriate personal protective equipment's such as gloves, goggles, aprons, c hemical resistant clothing and respirator shall be used.

- A Crèche where 10 or more female workers are having children below the age of 6 years.
- Reasonable Canteen facilities are made available at appropriate location depending upon site conditions.

3.3.13 Suitable facilities for toilet, drinking water, proper lighting shall be provided at site and labour camps, commensurate with applicable Laws / Legislation.

3.3.14 Contractor shall ensure storage and utilization methodology of materials that are not detrimental to the environment. Where required Contractor shall ensure that only the environment friendly materials are selected.

3.3.15 All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulations relating to the hazardous materials substances and wastes. Contractor shall not dump, release or otherwise discharge or dispose off any such materials without the express authorization of Project Architect/EIC.

4.0 DETAILS OF EHS MANAGEMENT SYSTEM BY CONTRACTOR

4.1 On Award of Contract

The Contractor shall prior to start of work submit his Safety Health and Environment Manual or procedure and EHS Plans for approval by Project Architect/EIC. The Contractor shall participate in the pre-start meeting with Project Architect/EIC to finalize EHS Plans including the following:

- Job procedure to be followed by Contractor for activities covering. Handling of equipment, Scaffolding, Electric Installation, describing the risks involved, actions to be taken and methodology for monitoring each activity.
- Project Architect/EIC review / audit requirement.
- Organization structure along with responsibility and authority records / reports etc. on EHS activities.

4.2 During job execution

4.2.1 Implement approved Environment, Health & Safety management procedure including but not limited to as brought out under para 3.0. Contractor shall also ensure to:

- arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc., as applicable.

- arrange all HSE permits before start of activities (as applicable) like hot work, confined space, work at heights, storage of chemical / explosive materials and its use and implement all precautions mentioned therein.
- submit timely the completed checklist on EHS activities, Monthly EHS report, accident reports, investigation reports etc. as per Project Architect/EIC requirements. Compliance of instructions on EHS shall be done by Contractor and informed urgently to Project Architect/EIC.
- ensure that Resident Engineer / Site-in-Charge of the Contractor shall attend all the Safety Committee / EHS meetings arranged by Project Architect/EIC. Only in case of his absence from site that a second senior most person shall be nominated by him in advance and communicated to Project Architect/EIC.
- display at site office and work locations caution boards, list of hospitals, emergency services available.
- provide posters, banners for safe working to promote safety consciousness.
- carryout audits /inspection at subcontractor works as per approved EHS document and submit the reports for Project Architect/EIC review.
- assist in EHS audits by Project Architect/EIC, and submit compliance report.
- generate & submit HSE records / report as per EHS Plan.
- appraise Project Architect/EIC on EHS activity

SECTION VI

SECTION VI

TECHNICAL SPECIFICATIONS

A. TECHNICAL SPECIFICATION OF CIVIL WORKS:

1.0 GENERAL:

1.1 The work shall in general conform to the **Latest CPWD Specifications** (corrected up to the last date of submission/uploading of bid) as mentioned in General Conditions of Contract (GCC). Work under this Contract shall consist of furnishing all labour, materials, equipment, tools & plants and appliances necessary and required.

1.2 The Contractor shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other Contractor(s) or by the Engineer-in-
Charge and shall as far as possible arrange his work and shall place and dispose of the materials being used or removed, so as not to interfere with the operations of other Contractor simultaneously working or he shall arrange his work with that of the others in an acceptable and coordinated manner and shall perform it in proper sequence to the complete satisfaction of others.

1.3 Regarding testing of civil & electrical & other materials, the testing of materials shall be conducted in Govt. Laboratory/ Govt. Engineering Colleges/ IITs/ NITs or from the laboratory approved by Engineer-in-charge. The charges of testing of materials in approved laboratory shall be borne by the Contractor.

1.4 No payment shall be made for any damage caused by rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The Contractor shall be fully responsible for any damage to the govt. property and work for which the payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The Contractor shall be fully responsible for safety and security of his material, T&P, Machinery brought to the site by him.

1.5 The Contractor shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 Constructional practices and safety-2016, National Building code of India, Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site to render and direct first-aid to causalities. A telephone may be provided to first-aid assistant with telephone

numbers of the hospitals displayed. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities.

1.6 Contractor should spray curing water on concrete structure and shall not allow free flow of water. Concrete structures should be kept covered with thick cloth/gunny bags and water should be sprayed on them. Contractor shall do water ponding on all sunken slabs using cement and sand mortar.

1.7 **Approved Makes**:
Specification/brands names of materials to be used as per the scope of work are listed in the bid documents. The efforts should be made by the Contractor to use indigenous products. The Contractor should also consider the availability of spares parts/ components for maintenance purposes while proposing any brand/ manufacturer. The materials of any other brand/manufacturer may be proposed for use by the Contractor in case the brands specified below are not available in the market and/or Contractor intends to use some other brand better than the brands mentioned in this list. The alternate brand can be used only after the approval of Engineer-in-Charge. The list of approved makes is appended to this document.

1.8 **Method Statement:**
The Contractor shall submit a 'Methods statement' for each important activity for the approval of the Engineer-in-charge soon after the award of work to him. The 'Methods statement' is a statement by which the construction procedures for any activity of construction is formulated and stated in chronological order. The 'Methods statement', should have a description of the item with elaborate procedures in steps to implement the same, the specifications of the materials involved, their testing and acceptance criteria, equipment to be used, Precautions to be taken, etc.

1.9 The work shall be carried out in accordance with the Design Basis Report, Architectural drawings and structural drawings (proof checked/vetted by the Contractor) and approved by the Engineer-in-Charge. The Technical Specifications are to be read with and in general conforming to the Latest CPWD Specifications.

1.10 The Contractor shall procure the required materials in advance so that there is sufficient time to testing of the materials and clearance of the same before use in the work. The Contractor shall provide at his own cost suitable weighing and measuring arrangements at site for checking the weight / dimensions as may be necessary for execution of work.

2.0 **For Detailed Specification of DSR items of Civil works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD specification 2009 VOLUME I AND VOLUME II** (corrected up to the last date of submission/uploading of bid)

3.0 GLASS REINFORCEMENT CONCRETE (GRC) WALL CLADDING TILES.

3.1 MATERIAL:

3.1.1 GRC Wall cladding tiles is a highly refined architectural precast concrete building stone made by a special process to simulate natural stone. Because of its versatility of form, color and texture, GRC Wall cladding tiles offers a superior, yet cost effective, ornamentation medium.

3.1.2 The thickness of the tiles should range between 12 to 18 mm (depending on the texture of the tile), allowing variance of ±2 mm in accordance with IS: 1237-1980.

3.1.3 The composition of tiles should be '43' Grade White Portland cement, reinforced with Alkali Resistant Glass Fiber and the pigmentation should be done with exterior grade synthetic inorganic iron oxide pigments manufactured by 'BAYFERROX (Germany)' or equivalent.

3.1.4 The pigmentation should be homogeneous and in accordance with British Standards BS EN 12878:1999. The other additives should be fine washed graded quartz, super plasticizers and integrated water proofing agents and others.

3.1.5 The tiles should be produced with high vibration technology and should have compressive strength equivalent to M-40 Grade@ 28 days. The top surface of the tiles should be sealed with acrylic lacquer resulting in surface water absorption of tiles, less than 1% and water absorption by 24 hrs. immersion method, less than 8%.

3.1.6 Stone shall be of the type as specified in the item. It shall be hard, sound durable and tough free from cracks, decay and weathering and defects like cavities cracks, flaws, holes, veins, patches of soft or loose materials etc. Thickness of stone shall be as specified.

3.1.7 Before starting with the installation procedure, Contractor first need to calculate the area where he wants to clad. Contractor can instruct to the labour to calculate by simply measuring its length and breadth and then multiplying it. This would help him get an estimated amount of material for the cladding.

3.2 SUBMITTAL :

3.2.1 Product Data: Manufacturer's (as per approved make) standard specifications, and descriptive literature for main products and any accessory items, including:

1. Spec-Data product information sheets. (GRC Wall cladding tiles GRC Wall Cladding Tiles, Pattern: Unibrick country Brick, Size: 7.5" x 2.25) or as per Project Architect.

2. Color charts - Copper Red, or approved by Project Architect.
3. Building code evaluation reports.
4. Blank warranty forms.

3.2.2 Samples: Color boards prepared with actual stone veneer style specified or selected for this Project; show joints, color variations, and textures expected in finished installation.

3.3 SCAFFOLDING

As specified in 7.4.11. of **CPWD Specification 2009 Volume I** (corrected up to the last date of submission/uploading of bid).

3.4 SURFACE PREPARATION:

This is the most crucial part the whole procedure as it would ensure the bonding that the adhesive/ mortar will have the wall because if the bond between the adhesive/ mortar and wall is not intact than the cladding can plunge off the wall. So, the procedure for surface preparation is as follows-

3.4.1 Plastered wall to be rough finished for mechanical ponding, wet cladding can be initiated directly on wall.

3.4.2 If your wall is painted remove the layer using grinders than cut grooves into wall using an angle grinder, horizontally as well as vertically to create keys, for mechanical bonding.

3.5 INSTRUCTION

3.5.1 Ensure that the surface is not friable and that all laitance, dust is removed. Do not wet the surface before cladding commences.

3.5.2 Mortar mix must be applied to the surface to a minimum bed thickness of 10mm or as per manufacturer instruction.

3.5.3 Spread only enough mortar/adhesive for each individual piece. Should a thin film (skin) appear on the surface of the adhesive, re-agitate with trowel before bedded.

3.5.4 Press the dry Natural stone cladding firmly into wet mortar with a twisting action. Product must be bedded with the aid of a Rubber mallet.

3.5.5 Lift and replace random cladding to ensure that 100% contact is being achieved between the cladding and mortar (no voids behind cladding).

3.5.6 Back buttering of Natural stone cladding is recommended where the back of the cladding product surface is irregular or when cladding in awkward locations.

3.6 INSTALLATION PROCEDURE

The tiles should be applied on a rough plaster of cement mortar 1:3 (1 cement: 3 coarse sand) and the fixing of tiles should be done by 'GRC Wall cladding tiles' tile adhesive or equivalent as per manufacturer's laying instruction.

4.0 UPVC WINDOWS AND VENTILATORS:

4.1 GENERAL:

All type of UPVC Door and Window are as per SOQ. Detailed specification of UPVC Door and Window for size and material can be as per manufacturer (in approved make) approved by Engineer -in-charge /Project Architect.

4.2 MATERIAL: As specified in 9.18.0 of **CPWD Specification 2009 Volume I** (corrected up to the last date of submission/uploading of bid).

4.3 TEST: As specified in 9.19.4 of **CPWD Specification 2009 Volume I** (corrected up to the last date of submission/uploading of bid).

4.4 SPECIFICATION FOR TYPES AND SIZES OF UPVC WINDOWS AND VENTILATORS TO BE INSTALLED AS PER SOQ ITEM:

4.4.1 UPVC (un-plasticized polyvinyl chloride) sliding windows size 2400w x 2070h (53.48 sq. Ft.) 41201-03000, Slider Screen-: Track + Screen, Super Screen Sash type, White Handle Colour, Grooved SL Alumi Rail, Patio sliding Handle, SS 430 (CS) Espag. Type, White Bead Colour all complete as per drawing.

4.4.2 UPVC (un-plasticized polyvinyl chloride) sliding windows size 1200w x 2070h (26.74 sq. ft) complete in all respect with specification of SY05 Combination System, Combination System, 6.0mm+12mm air gap +6mm thick toughened glass, White colour,I-60 Slider Series Coupling 180 - 40107-01400, Full Reinforcement, Channel Reinf of type, 1.5mm Rein thick frame , 2.0mm Reinf thick Sash, White Frame colour , Window O/F: 41101-11000,Slider O/F : 41201-01000, White Sash Colour, Slider Sash : 41201-03000, Slider Screen-: Track + Screen, Super Screen Sas type, White Handle Colour,: Grooved SL Alumi Rail, Patio sliding Handle,SS430 (CS) Espag. Type, White Bead Colour all complete as per drawing.

4.4.3 UPVC (un-plasticized polyvinyl chloride) sliding windows size 600w x 2070h (13.37 sq. ft) complete in all respect with specification of SY05 Combination System, Combination System, 6.0mm+12mm air gap +6mm thick toughened glass, White colour,I-60 Slider Series Coupling 180 - 40107-01400, Full Reinforcement, Channel Reinf of type, 1.5mm Rein thick frame , 1.5mm Reinf thick Sash, White Frame colour ,

Window O/F: 41101-11000, White Sash Colour, Cement T- Sash : 41101-13000, ,White Handle Colour, Casement Handle - Espag, SH Friction hinge type, SS Friction Hinge,SS430 (CS) Espag. Type, White Bead Colour all complete as per drawing.

4.4.4 UPVC (un-plasticized polyvinyl chloride) sliding windows size 900w x 2070h (20.05 sq. ft) complete in all respect with specification of SY05 Combination System, Combination System, 6.0mm+12mm air gap +6mm thick toughened glass, White colour, Coupling 180 - 40107-01400, Full Reinforcement, Channel Reinf of type, 1.5mm Rein thick frame , 1.5mm Reinf thick Sash, White Frame colour , Window O/F: 41101-11000, White Sash Colour, Cement T- Sash : 41101-13000, ,White Handle Colour, Casement Handle - Espag, SH Friction hinge type, SS Friction Hinge,SS430 (CS) Espag. Type, White Bead Colour all complete as per drawing.

4.4.5 UPVC (un-plasticized polyvinyl chloride) sliding windows size 750w x 2070h (16.71sqft) complete in all respect with specification of SY05 Combination System, Combination System, 6.0mm+12mm air gap +6mm thick toughened glass, White colour, I-60 Slider Series ,Coupling 180 - 40107-01400, Full Reinforcement, Channel Reinf of type, 1.5mm Rein thick frame , 2.0mm Reinf thick Sash, White Frame colour , Window O/F: 41101-11000, Slider O/F -41201-01000,White Sash Colour, Slide Sash : 41201-03000, Slider Track + Screen, Super Screen Sas Type, White Handle Colour, Grooved shape SL Alumi rail, Patio Sliding handle,SS430 (CS) Espag. Type, White Bead Colour all complete as per drawing.

4.4.6 Providing and fixing UPVC (un-plasticized polyvinyl chloride) ventilator size 900w x 900h (8.72sqft) complete in all respect with specification of SY01 Combination System, Combination System, 6.0mm+12mm air gap +6mm thick toughened glass, White colour, I-60 Int. Glz. Sys, Tilt/Turn F, White colour, Full Reinforcement, Channel Reinf of type, 1.5mm Rein thick frame, White frame colour, Window O/F - 41101-11000, White Bead Colour all complete as per drawing.

4.4.7 UPVC (un-plasticized polyvinyl chloride) ventilator size 600w x 600h (3.88sqft) complete in all respect with specification of SY01 Combination System, Combination System, 6.0mm+12mm air gap +6mm thick toughened glass, White colour, I-60 Int. Glz. Sys, Tilt/Turn F, White colour, Full Reinforcement, Channel Reinf of type, 1.5mm Rein thick frame, White frame colour, Window O/F -41101-11000, White Bead Colour all complete as per drawing.

4.5 FIXING:

Fixing of window and ventilators shall be done as per manufacturer's fixing instruction. All corner joints shall be homogeneously fusion heat welded in accordance with the instructions of the profile Systems supplier. The resulting joints shall be finished by the grooving/knifing method. Solvent welded joints shall not be allowed.

4.6 MEASUREMENT:

The Measurement shall be done by simply counting the number of UPVC window and ventilators as per Manufacturer criteria or contract.

4.7 RATE:

The rate includes the cost of the materials and labour involved in all the operations described above. The cost of anchor bolts or screws for joining the frame is included in the rate. Any other hardware, which may be required, shall be inclusive.

4.6 GLAZING:

All glazing shall be internally beaded. The windows shall be constructed in such a manner that the glazing or deglazing can take place without the removal of the sash or frame.

5.0 FULLY AUTOMATIC SLIDING DOOR

5.1 GENERAL:

Automatic Sliding glass door operator 4150 mm, compliant with future European standards and produced according to the guidelines for power-operated windows, doors and gates, BGR 232, the UVV and the VDE regulations.

5.2 TESTING:

TÜV design tested, tested according to the low voltage guidelines, fulfils DIN 18650 standards, for framed glass door application with 12mm toughed glass for 2 Nos sliding door panels and 2 Nos fixed panels, both sliding Operator & Frame Finish should be Silver Anodized E6/C0, with operator dimensions (H x D) : 100 x 180 mm and of length as required to suit the opening size given below.

5.3 SPECIFICATION/FEATURES:

The track profile should be separate from the main profile for enabling reduction in vibration insulation. Microprocessor-controlled control unit, Self-learning, with adjustable parameters for opening and closing speed, hold-open time and opening and closing force, reversing when obstruction is encountered, Class of protection IP 20. Activators- 6 Safe Combinations Radars with Motion & Presence Detection (02 Nos), Light barrier comprising of receiver and transmitter - 01 Pair, with Electro-mechanical locking, Program Switch with Key. Max Panel Weight Carrying Capacity of 2 X 100 Kgs. tem shall have constant power supply 230V+ 5%, 50Hz, AC. The requirement in total is as mentioned, wall connecting profiles be used on top of over panel and on all sides to fixed panels only. The above work should complete in all respect as per approved drawings and to the satisfaction of Architect /Engineer-in-Charge.

5.4 INSTALLATION:

The installation for automatic sliding door opener has a lot of procedures, and each process should be carefully done under the supervision of Engineer-in-charge, Company which deal with this type of work or Project Architect. For electrical supply he may contact to Contractor as it is under Contractor scope.

5.5 PRECAUTION:

After the installation is completed, close the door, check the door moving leaf active area without obstructions, sensor area without active person. Then switch the power. When the first time the power on, the door will slowly movement to record the door route.

5.4 MEASUREMENT AND RATE:

The rate includes the cost of the materials and labour involved in all the operations described above. The cost of anchor bolts or screws for joining the frame is included in the rate. Any other hardware, which may be required, shall be inclusive.

6.0 GLASS DOOR

6.1 GENERAL:

6.1.1 Glass Door (Single Leaf) size of 2100 mm x 1050mm of 10mm toughened glass with Slim line 45mm frames clip in profiles all around the door with complete assembly.

6.1.2 DP45 Door Profile frame of size 45X50mm with seals with Junior Office Hinges (3nos) & Studio Gala Locks (1no) & Studio Gala lever handles in aluminum silver (EV1) finish , Euro profile cylinder and TS 89 Door closer with slide channel (as per EN 1154) and saddle plate for fixing on the Glass door and necessary seals to be provided all around the door frames.

6.1.3 The slim line profiles shall be suitable for Glass thickness of 10mm.

6.1.4 The Profile shall be matt natural anodized, the Profile Manufacturer to supply all the necessary clips, seals and fixing accessories for the system. All Profiles to be with 2 mm Gauge thickness Excluding 20 Micron of Anodizing.

6.2 PRECAUTION BEFORE INSTALLATION:

6.2.1 All installation materials used have been checked for compatibility.

6.2.2 Correct orientation of system has been identified. Inswing or Outswing.

6.2.3 Sill condition is understood and necessary weep system is in place where standard Doors sill is not being applied.

6.2.4 Frame has been sealed and joined at all points indicated in instructions

6.2.5 Opening checked for correct dimensions.

6.2.6 Frame is installed at correct depth within the opening

6.2.7 Frame has been installed square, level and plumb

6.2.8 Plastic shims were utilized under sill when required

6.2.9 Jambs were shimmed to prevent rolling

6.2.10 Shims were applied between head track and header. Only as recommended in instructions
6.2.11 Installation holes prepared correctly
6.2.12 Sealant was applied to sill installation holes prior to inserting screws & top of screw heads once applied
6.2.13 Correct fastener placement has been followed as directed by manufacturer
6.2.14 Proper operation and adjustment has been achieved

Frame has been checked for level, square and plumb. All horizontal and vertical adjustments have been made so that proper reveals are present and product is operating as designed. Weep holes have been checked and free of obstruction and debris. All trash has been discarded. All hardware has been installed correctly and checked for proper operation. Product has been closed and locked and recommended to not be used as thoroughfare by other trades. Product is protected from damage. Final inspection of weather proofing and operation has been performed. Job has been turned over to contractor or Site engineer with approval.

6.3 INSTALLATION: Product was installed as directed by the Manufacturer approved by the Engineer-in-charge.

7.0 FULL HEIGHT GLASS PARTITION/ FULL HEIGHT PARTITION/ LOW HEIGHT PARTITION

7.1 GENERAL:

Furnish and install glass partitions. Provide all labor, materials, tools, equipment, and services for glass partitions in accordance with provisions of contract documents.

7.1 FULL HEIGHT GLASS PARTITON:

Glass partition of 10 mm Toughened Glass using slim line System-45 Frames clip in profile to a height of maximum 3m or as per drawing. The Fixed glass to be fixed using BP45 Profiles at Top & Bottom & fixed frame cleat. The profile size to be 45x25MM to be fixed on to the floor/ ceiling as per the architect design. H Junction profile to be used at all Glass to Glass vertical joints, 90 Deg L Junction Profiles and T Junction profiles necessary as per design. In case of Glass overall panel MP45 & BP45 Over panel Profile to be used. The clip in profiles shall be suitable for Glass thickness of 10 mm. The Profile shall be matt natural anodized, the Profile Manufacturer to supply all the necessary clips, seals and fixing accessories for the system.

All Profiles to be with 2 mm Gauge thickness Excluding 20 Micron of Anodizing.

7.2 FULL HEIGHT PARTITION

7.2.1 GENERAL:
69 mm thick of approved make drywall partition system/approved equivalent, which include "Approved make Steel" G.I framework (180GSM Galvanizing; 345 Mpa Yield Strength), comprising of 51mm Floor and Ceiling track profile, 0.5 mm thick, having

two equal flanges of 32mm, fixed to the floor and ceiling, in plumb with each other, with sleeves and screws at 610 mm; Vertical G.I studs of size 51mm, 0.5mm thick, having one flange of 42mm and another flange of 44mm and two equal lips of 5mm insert fixed into the track profiles at 610 mm centers.

9 mm Heavy Duty Fibre Cement board (Confirming to IS 14862; Type - B) are screw fixed to the either side of the framework with 25mm drywall screws, respectively, at 300 mm centers. Rate shall be inclusive of Glass wool of 48kg/m3 density and 50mm thickness that has to be placed in between the cavity of frame.

7.2.2 JOINTING AND FINISHING:
Finally edges of the board are to be jointed and finished so as to have a flush look which includes filling and finishing with Everest compound of standard. make with Self-adhesive Fiber glass mesh tape. The rate shall be inclusive of providing & finishing 2 coats of top paint and labour for cutouts for light fixtures grills, diffusers etc.

7.3 LOW HEIGHT PARTITION

7.3.1 GENERAL:
69 mm thick X1350 mm height , approved make drywall partition system/ approved equivalent, which include "Approved make Steel" G.I framework (180GSM Galvanizing; 345 Mpa Yield Strength), comprising of 51 mm Floor and Ceiling track profile, 0.5mm thick, having two equal flanges of 32 mm, fixed to the floor and ceiling, in plumb with each other, with sleeves and screws at 610 mm; Vertical G.I studs of size 51 mm, 0.5 mm thick, having one flange of 42mm and another flange of 44mm and two equal lips of 5mm insert fixed into the track profiles at 610 mm centers.

9 mm approved make Heavy Duty Fibre Cement board (Confirming to IS 14862; Type - B) are screw fixed to the either side of the framework with 25mm drywall screws, respectively, at 300 mm centers. Rate shall be inclusive of Glass wool of 48kg/m3 density and 50mm thickness that has to be placed in between the cavity of frame.

7.3.2 JOINTING AND FINISHING:
Finally edges of the board are to be jointed and finished so as to have a flush look which includes filling and finishing with Everest compound of std. make with Self-adhesive Fiber glass mesh tape. The rate shall be inclusive of 2 coats of top paint and labour for cutouts for electrical, telephone, computer conduits etc.

7.4 INSTRUCTION:

7.4.1 Product was tested, installed as directed by the Manufacturer approved by the Engineer-in-charge.

7.4.2 The product shall be gone through quality assurance. Glass shall be clear tempered per ASTM C1048-97b.

7.4.3 Proper storage of partitions before installation and continued protection during and after installation will be the responsibility of the Contractor.

7.4.4 The submitting manufacturer guarantees the proposed substituted product complies with the product specified and as detailed on the drawings.

7.4.5 The complete installation of the glass wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved drawings and manufacturer's standard printed specifications, instructions, and recommendations.

7.4.6 Cleaning: All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.

7.4.7 Warranty: Track, carriers, and horizontal rails shall be guaranteed for one year against defects in material and workmanship. The glass is not included in this warranty.

7.4.8 Cartoning and other installation debris shall be removed to on-site waste collection area, provided by others.

7.4.9 Tolerance: ±10 mm in height and width.

7.4.10 Specification of partition, installation process all depends on manufacturer's as per approved make.

8.0 LAMINATE WALL PANEL

8.1 GENERAL

8.1.1 Pre-manufactured panel system including mounting hardware and specified accessories.
8.1.2 Submittal of Product Data: Manufacturer's Safety Data Sheets (MSDS) on each product to be used, including:

a) Preparation instructions and recommendations.
b) Storage and handling requirements and recommendations.
c) Installation methods.

8.1.3 Manufacturer's Drawings: Manufacturer's drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with adjacent work.
8.1.4 Selection Samples: For each finish product specified, one complete set of color samples representing manufacturer's standard range of available colors and patterns.
8.1.5 Quality assurance: Firm experienced in successful production of wall systems similar to that indicated for the Project, with sufficient production capacity to produce required units without causing delay in the work.

8.1.6 Installer Qualifications: Demonstrate successful experience in installing architectural woodwork similar in type and quality to those required for this project.
8.1.7 Provide prefinished decorative laminates where shown on the drawings, as specified herein, and as needed for a complete and proper installation.

8.2 PREPARATION

8.2.1 Panels must be acclimated to ambient temperature and humidity conditions in accordance with manufacturer's specifications prior to installation.
8.2.2 Clean surfaces thoroughly prior to installation.
8.2.3 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

8.3 MATERIAL

8.3.1 1MM THK LAMINATE FINISH (selected as per approved make):
1 mm thk selected laminate of approved colour & approved make, glued with approved phenol formaldehyde based adhesive or approved equivalent overlaying on substrate without any gap/air bubbles pressed uniformly to line level and plumb, item complete with all edge lipping with water based PU TW lipping mounted flush to surface as per detailed drawings and Architects recommendations: all accessories, fixing implements , men material and lift upto 6 Mtr. Finished complete with all necessary masking with avg. min 10mm wide masking tape before applying polish to edge lipping and getting mock up approved by Engineer in charge/ Architect. Item to include protecting finished item by avg. 20 microns thk polythene sheet till handover of facility complete.

8.3.2 UNICOLOUR LAMINATE (selected as per approved make):
unicolor decorative laminate with homogeneous same color of decorative surface and core layers as per 438:3 -2005, FSC & Green Guard. Item to be completed in all respects as per drawings and instructions from Project in charge.

8.3.3 1-(B)) MR+ (MAR RESISTANT) TUFF GLOSS LAMINATES (selected as per approved make):
(Mar Resistant) Tuff Gloss Laminates 1mm thickness, conforming to IS 2046:1995, 3to 4 times more resistant than normal Gloss Laminate, gloss meter reading is over 110 at 60-degree angle reading as per ASTM D6037-96. Item to be completed in all respects as per drawings and instructions from Project in charge.

8.4 INSTALLATION

8.4.1 Install in accordance with manufacturer's instructions.

8.4.2 The laminate sheet shall be fixed using approved quality adhesive recommended by the manufacturer and applied strictly in accordance to their instruction/specifications.

8.4.3 The adhesive shall be applied in a thin layer and while still tacky, it shall be spread evenly with steel in both directions to Project.

8.4.4 Assume full contact with the adhesive / Fevicol / SR. A constant and even pressure is applied for not less than 24 hours to ensure good bonding of the surface to the board. The laminate surface shall be cleaned as recommended by the manufacturer of all stains/ adhesive marks etc.

8.5 PROTECTION

1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.

9.0 MDF EXTERIOR GRADE PLAIN PARTICLE BOARD

9.1 GENERAL:

MDF is the short term for medium density fibre board. Alum, wax, resin or other additive introduced to the agglomerate for MDF prior to forming, primarily to increase water resistance. Any suitable type of synthetic resin adhesive may be used for the purpose of bonding to comply with physical and mechanical requirements.

9.2 TESTING OF SAMPLES

9.2.1 Preparation and Conditioning of Test Specimens: All the test specimens shall be prepared and conditioned before testing in accordance with the procedure given in IS 2380 (Part 1).

9.3 QUALITY ASSURANCE

MDF shall conform to the requirement of quality and performance as specified in standard of manufacturer.

9.4 MATERIAL:

MDF Exterior grade plain particle board of approved makes: Plain Exterior Grade MDF Boards of 9.75mm thickness, Exterior grade wood base (Grade-I), Melamine Bonded, Stamped IS 12406. All accessories, screws, fixing implements, labors, material and all lifts. Item to be completed in all respects as per drawings and instructions from Engineer in charge.

10.0 PLYWOOD

10.1 MATERIAL:

Partition skinning with avg 12 mm thk BWP Grade Plyboard IS 710 BWP grade on over Al. skeletal frame/wooden frame , as approved by Architect. Plywood shall be 12mm thick, non-decorative, factory made as per IS:710 and should be ISI marked and be made of non-coniferous timber red hard wood with moisture contents not more than 12% and dimension as given in IS code. The panel comprising of plywood should

be 9 ply construction and cross bend and panel core shall be glued by hot pressed with Quadra process, while the thickness of face veneer (Okume/Gurjan) shall not be less than 0.5mm. all core shall fully confirm to the requirement specified in the IS code. All timber used should be well seasoned and chemically treated. Adhesive used shall be phenol formaldehyde synthetic resin BWP type specified in IS:848-1974. All dimensions shall be finished dimension and manufacturers test certificate for test specified in IS:710 shall be rendered." Item shall be complete in all respect.

11.0 FALSE CEILING

11.1 GI METAL LAY IN BLACK GROOVE CEILING :

Providing & Fixing of GI Metal Suspended Ceiling System - Approved make In Perf. With fleece 600x600x0.5mm (MICROLOOK) EDGE TILES in global white colour to be laid on Black Groove 15mm wide T - section flanges color white having rotary stitching on the Main Runner, 1200 mm & 600 mm Cross Tees with web height of 38mm. The tiles should have Humidity Resistance (RH) of 100%, with Light Reflection of 62%, NRC 0.7.

INSTALLATION: To comprise main runner spaced at 1200mm centers securely fixed to the structural soffit at 1200mm maximum center. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall. Flush fitting 1200mm long cross tees to be interlocked between main runners at 600mm center to form 1200 x 600 mm module. Cut cross tees longer than 600mm require independent support. 600 x 600mm module to be formed by fitting 600mm long flush fitting cross tees centrally between the 1200 mm cross tees. Perimeter trim to be wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centers.

SUSPENSION SYSTEM accessories supplied by Hilti consisting of HLC Sleeve Anchor Fasteners of thread size 6.5mm x 25/5 with Soffit Cleat made of Galvanized steel of size 27 x 37 x 25 x 1.6mm and Level Clip in dimensions of 85x30x0.8mm with 4.00 mm GI wire.

11.2 BAFFLE CLOSED

Providing & fixing Vertical Linear Baffle Ceiling made out of Aluminum Extrusion in Aluminum alloy grade 6063. The baffle blade shall be in size of 100x 25 x 3600mm in Wood grain finish – Pradoo & Cabrueava. The baffle blade shall be suspended using Slotted U-profile at on-center spacing in multiples of 25mm. Longer lengths of Baffle to be connected by Baffle Joiner and the ends to be fixed with End caps.

INSTALLATION OF U-GRID :

The U profile to be suspended at every 1200mm on-center using 6mm threaded rod from the structural soffit using U-profile hanger. U-profile splice to be used to join more than one U profiles of length 3.75M. 1st U-Grid Channel must be no more than 400mm from the perimeter.

INSTALLATION OF BAFFLES :

Locate the slot for Baffle Hangers in slot of Baffle section at 1200mm centers. Hangers are inserted into the slot, then rotated 90° and fixed into position by tightening the grub screw. Baffle to be lifted into position and hangers engage over lip of U-Grid Channel. Each Hanger to be secured into position by inserting the Locking Clip.
Baffles blades to be connected at ends with Baffle Joiner, which are inserted into the top and bottom slots of the Baffle closed profile for alignment only. The bottom Joiner to be located first and fastened on one side only. The top Joiner to be fitted then and secured with grub screws on one side. Then the two Baffle sections shall be joined and the top Joiner is screw fastened on the 2nd Baffle profile.
End Caps to be located by pushing the End Cap tongues into Baffle slots.

11.3 CELLIO OPEN CELL 100MM X 100MM 'LAY-IN' ALUMINIUM CEILING WITH 15mm GRID

Providing and fixing in true horizontal level Cello Open cell Aluminum lay-in ceiling tiles with border panels forming flush-tegular edge of size 600mmx600mmx38mm having Fire Performance CLASS 0/Class 1 (BS 476). The tile of 'Global white' color with cell size 100mm X 100mm shall be laid on white painted Suprafine XL15mm profile grid system comprising Main runners (3000mm), 1200mm and 600mm cross tees with 15mm white flanges and 38mm web height.

The grid should be of "Approved" make with 15mm wide T - section flanges color white having rotary stitching on all T sections i.e. the Main Runner with C3 coupling, 1200 mm & 600 mm Cross Tees with Hardened XL2 Clip having a web height of 38 mm and a load carrying capacity of 14 Kgs/M. The T Sections have a Galvanizing of 90 grams per M2 with pull out strength of 100 Kgs. Suspension system is to be of Approved make.

INSTALLATION: To comprise main runner spaced at 1200mm centers securely fixed to the structural soffit by approved hangers at 1200mm maximum centre & not more than 150mm from spliced joints. The last hanger at the end of each main runner should not be greater than 600mm from the adjacent wall. 1200mm long cross tees to be interlocked between main runners at 600mm centre to form 1200 x 600 mm module. Cut cross tees longer than 600mm require independent support. 600 x 600mm module to be formed by fitting 600mm long cross tees centrally between the 1200 mm cross tees. Installation to be carried out by Trained Installation team & Installation should be carried out as per recommended procedure. Perimeter trim to be wall angles, secured to walls at 450 mm maximum centers.

SUSPENSION SYSTEM accessories manufactured and supplied by Industries consisting of M6 Anchor Fasteners with Vertical Hangers made of Galvanized steel of size 26 x 26 x 25 x 1.2mm with a Galvanized Thickness of 80gsm, A pre Straightened Hanger wire of dia – 2.65 mm of 1.8 m length., thickness of 80gsm and a tensile

strength of 344- 413 MPa, along with Adjustable hook clips of 0.8mm thick, galvanized spring steel for 2.68 mm. The adjustable clip also consists of a 3.5 mm aquiline wire to be used with the main runner.

11.4 SOUNDSCAPE BLADE 400X1200X40MM

Providing and Fixing Approved SoundScapes – Blades which are 40 mm thick, pre-formed fiberglass blades with sizes of 200X1200mm, 200mmX1600mm, 400X1200mm, 400X1600mm,400X1800mm, 500mm X 1200mm and 500X1600mm with Dura brite finish on all sides and edges, Acoustical performance of 0.65 NRC in standard White color with Light reflectance 87%, or in the color specified by the Architect (Light Ivory, Pale Green, Pastel blue, Traffic Grey, Pale Brown) and Fire Performance Class B – s1, d0 as per En 13501-1.

INSTALLATION WITH U-PROFILE HANGER:
The U-profile of size 20mmX30mmX3750mm to be suspended based on the on-centre distance between the factory fitted spiral hooks on the blades. The on-centre distance between the factory fitted spiral anchors is length of the blade – 600mm. U profile to be suspended using 6mm threaded rod from the structural soffit no further than 450mm from each wall. U- Profile splice to be used to join longer lengths more than 3.75M.

U- Profile hanger kit comprising of Blade hanger and snap hooks to be used to suspend the Blades to the U –profile. Blade hanger to be locked on the U-profile using the Locking clips on the square slots with on center spacing in multiples of 50mm. Snap hooks to be fixed on the blade hanger. Soundscapes Blades to be installed on the snap hook by inserting the factory fitted spiral hooks into the snap hooks on both sides.

Blade connector kit comprising of bottom connector and top connector to be used to join two blades side by side.

Installation to be according to the instructions provided by manufacturer.

11.5 SOUNDSCAPE SHAPES - ACOUSTICAL CLOUDS (INDIVIDUAL SUSPENSION)

Providing and Fixing Approved Soundscape - Acoustical clouds which are 30 mm thick, flat glass fibre panels with Humidity Resistance RH 90% & Recycled Content of minimum 30%, come in various shape options like Square and in standard Traffic White colour with LR 90% or in the color specified by the Architect / Engineer in charge (Ivory / Pale Green / Pastel Blue / Traffic Grey / Pale Brown). or in the color specified by the Architect / Engineer in charge (Ivory / Pale Green / Pastel Blue / Traffic Grey / Pale Brown) . The size and sound absorption details are as below: Square 1200x1200mm 2.48. The back of each panel to have embedded square frame bracket system of 610x610mm in which provisions are already made for integration of

installation system for suspension of individual or grouped panels.

INSTALLATION:
The panels to be suspended individually using the Soundscape Deck hanging kit. Each kit to consist of gripper structure anchors, aircraft cables and bottom end cable adjusters. Each panel to be suspended using the aircraft cables which are suspended from the soffit using the gripper structure anchors and its other end passing through the bottom end cable adjuster which are screwed in the 4 corners of the frame bracket system. The height & level of the panels can be adjusted using the bottom end cable adjusters.

11.6 G. I LAY-IN PLAIN

Providing & Fixing of GI Metal Suspended Ceiling System GI Lay In Plain Fleece 600x600x0.5mm (regular) EDGE TILES in global white colour to be laid on 24mm normal Grid 24 mm wide T - section flanges color white having rotary stitching on the Main Runner, 1200 mm & 600 mm Cross Tees with web height of 32mm. The tiles should have Humidity Resistance (RH) of 100%, with Light Reflection of 62%.

INSTALLATION: To comprise main runner spaced at 1200 mm centers securely fixed to the structural soffit at 1200mm maximum center. The First/Last suspension system at the end of each main runner should not be greater than 450 mm from the adjacent wall. Flush fitting 1200mm long cross tees to be interlocked between main runners at 600mm center to form 1200 x 600 mm module. Cut cross tees longer than 600 mm require independent support. 600 x 600mm module to be formed by fitting 600mm long flush fitting cross tees centrally between the 1200 mm cross tees. Perimeter trim to be wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centers.

SUSPENSION SYSTEM accessories supplied by Approved make consisting of HLC Sleeve Anchor Fasteners of thread size 6.5mm x 25/5 with Soffit Cleat made of Galvanized steel of size 27 x 37 x 25 x 1.6mm and Level Clip in dimensions of 85x30x0.8mm with 4.00 mm GI wire.

11.7 WOODWORKS GRILLE WITH DOWEL MADE OF NATURAL BAMBOO WITH 24 MM PRELUDE 43 BLACK SYSTEM

Providing & fixing of woodworks grille with dowel made of natural bamboo with 24mm prelude 43 black exposed grid. The Woodworks (WW) Grille panel of nominal size 57x300x2400mm comprising 6 blades of 57x16x2376mm with on center spacing of 50mm fixed thru dowel of dia-12mm x 300mm with on center spacing of 300mm and additional end dowels at 150mm from both the edges. Ledger of 6.5x24x2400mm to be used for covering face of wall angle. WW Grille should comply with ASTM-E84: Class A and have Relative Humidity of RH70. The panels are UV coated to Natural or Carbonized shades. Optional: Open edges may be covered using “Edge Caps” of 66x19x2400mm and “Blade Junction” of 66x38x2400mm to be used along the

connection of two WW Grille Panels.
The grid should be of "Approved" make Prelude 43 with 24mm wide T - section flanges Black powder coating having rotary stitching on all T sections i.e. the Main Runner, 1200 mm & 600 mm Cross Tees with a web height of 43mm for the main runner & the Cross Tees and with a load carrying capacity of 20 Kgs/M2. Black dowel clips of spring steel to be used for fixing panel to suspension system.

INSTALLATION: To comprise main runner spaced at 1200 mm centers securely fixed to the structural soffit using Approved suspension system (specifications below) at 1200mm maximum center. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall. Flush fitting 1200 mm long cross tees to be interlocked between main runners at 600mm center to form 1200 x 600 mm module. Cut cross tees longer than 600 mm require independent support. 600 x 600mm module to be formed by fitting 600 mm long flush fitting cross tees centrally between
the 1200 mm cross tees. Perimeter trim to be wall angles of size 19x19x3000mm, secured to walls at 450 mm maximum centers.

11.8 PORTLAND MAPLE CEILING APPROVED EQUIVALENT WOODWORKS 600X600X18MM MICROLOOK EDGE TILES IN RG3003 (RG3) PERFORATION WITH 15mm SUPRAFINE 43 EXPOSED GRID" SYSTEM:

Providing & Fixing of Wooden finished Suspended Ceiling System with Woodworks Microlook edge tiles with 15mm Suprafine 43 exposed grid. The Tile in RG3003 (RG3) perforations having hole diameter as 3mm and open area as 3% with approved laminate finish with 0.7mm matching PVC edge banding and having an NRC of 0.42, Humidity Resistance (RH) of 70% in module size of 600mm x 600mm x 18mm and density of 725 Kgs/M3. The tile shall be laid on Superfine 43 with 15 mm wide T - section flanges colour white having rotary stitching on all T sections i.e. the Main Runner, 1200 mm & 600 mm Cross Tees with a web height of 38mm and a load carrying capacity of 15.5 Kgs/M2 & pull out strength of minimum 100 Kgs. The T Sections have a Galvanizing of 90 grams per M2 and need to be installed with Suspension system of Approved make.

INSTALLATION: To comprise main runner spaced at 1200mm centers securely fixed to the structural soffit using suspension system (specifications below) at 1200mm maximum center. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall. Flush fitting 1200mm long cross tees to be interlocked between main runners at 600mm centre to form 1200 x 600 mm module. Cut cross tees longer than 600mm require independent support. 600 x 600mm module to be formed by fitting 600mm long flush fitting cross tees centrally between the 1200 mm cross tees. Perimeter trim to be approved brand wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centers. approved brand SUSPENSION SYSTEM accessories manufactured and supplied by approved brand World Industries consisting of M6 Anchor Fasteners with hanger hole, pre-Straightened Hanger wire of dia – 2.5 mm of 1.80 m length having a tensile strength of

344-413 MPa and a minimum pull strength of 110 kgs. (Adjustable hook clips of 0.7mm thick, galvanized spring steel can also be used for installation purpose as an additional accessory. The adjustable clip also consists of a 4 mm aquiline wire to be used with the main runner).

11.9 PLAIN PORTLAND MAPLE CEILING APPROVED EQUIVALENT CAT NO. RG 10077 WOODWORKS 600X600X18MM MICROLOOK EDGE TILES IN PLAIN WITH 15MM SUPRAFINE 43 EXPOSED GRID SYSTEM:

Providing & Fixing of Wooden finished Suspended Ceiling System with
Woodworks Micro look edge tiles with 15mm Suprafine 43 exposed grid. The Tile in Plain with approved laminate finish with 0.7mm matching PVC edge banding, would have Humidity Resistance (RH) of 70% in module size of 600x600x18mm and density of 725 Kgs/M3. The tile shall be laid on approved brand Suprafine 43 with 15 mm wide T - section flanges colour white having rotary stitching on all T sections i.e. the Main Runner, 1200 mm & 600 mm Cross Tees with a web height of 38mm and a load carrying capacity of 15.5 Kgs/M2 & pull out strength of minimum 100 Kgs.. The T Sections have a Galvanizing of 90 grams per M2 and need to be installed with Suspension system of Approved make.

INSTALLATION: To comprise main runner spaced at 1200mm centers securely fixed to the structural soffit using suspension system (specifications below) at 1200mm maximum center. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall. Flush fitting 1200mm long cross tees to be interlocked between main runners at 600mm center to form 1200 x 600 mm module. Cut cross tees longer than 600mm require independent support. 600 x 600mm module to be formed by fitting 600mm long flush fitting cross tees centrally between the 1200 mm cross tees. Perimeter trim to be wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centers.

SUSPENSION SYSTEM accessories manufactured and supplied by Industries consisting of M6 Anchor Fasteners with hanger hole, pre-Straightened Hanger wire of dia – 2.5 mm of 1.80 m length having a tensile strength of 344-413 MPa and a minimum pull strength of 110 kgs. (Adjustable hook clips of 0.7mm thick, galvanized spring steel can also be used for installation purpose as an additional accessory. The adjustable clip also consists of a 4 mm aquiline wire to be used with the main runner).

12.0 ARTIFICIAL GREEN WALL (VERTICAL WALL GARDEN)

12.1 GENERAL:
Providing testing and commissioning of Artificial boxwood matt is a matt prepared with synthetic PVC leaves made to look like actual plant for vertical applications both in indoors & outdoors. The main reason for usage of this matt is maintenance-Artificial matt stands up to heavy use and requires no irrigation and trimming and no sunlight but only requires periodic cleaning if used in interiors.

Since major cities across globe are turning into concrete jungles with very less space for greenery, so artificial green matt in different leave patterns which almost look real is best solution to create a soothing green effect without any maintenance.
For exterior applications UV matt are recommended for long life
Application is done using rubber adhesive or by simply hanging matt on walls with screws giving a long-lasting installation.

Further artificial flowers or bushes to be added in matt to give more natural look as per requirement. TechArtz Global is major importer of this material from Germany & China to India. The Rate shall be inclusive of providing and fixing SS Fastener of 10mmdia. and 100mm Long (IS code) duly Fixed the ply to Wall.

13.0 FLOORING

13.1 TEXTURE LAMINATE WOODEN FLOORING:
Providing and laying of 8mm thick AC5 grade textured laminated wooden flooring (as/ EN 13329), including 100mm high skirting with 0.2mm thick direct laminate on top of specially developed substrate core of planks size 1288mm x196mm having smart lock tongue and grove construction with edges dully impregnated to secure long lasting joints secure together confirm to EN 13329. the approved décor planks to be placed on a 0.2 mm thick alkali resistant polyethylene foam (density 3920-935kg/m3) with a 1.5mm thick extruded polyethylene foam (density 30-32 kg/m3) on top to secure the floating floor to resist any moisture movement from the sub floor on top to secure the floating installation. the skirting is to be secured with the help of matching wall based ,60mm high, with t-profile &reducer/ beading. the installation at site has to be done by company trained and approved installers. all complete as per instructions from engineer-in-charge. (the item includes skirting &all necessary profiles, beading etc. complete in all respect).

13.2 VINYL FLOORING
Sports flooring of Vinyl flooring Polaris consists of following specifications for Badminton court, General performance sports flooring, shock absorption, vertical deformation, vertical ball behavior, resistance of rolling load, resistance to wear ,specular gloss having overall thickness 6.5mm weight 4200 g/sqm sheet size 1.5m width & 10m length shall all be conforming to BS EN 14904.

14.0 PAINTING/FINISHING WORK

14.1 LUSTRE PAINT

Providing and applying on all exposed surfaces of beams, ceiling & walls etc. 3 coats of Lustre paint of approved make and shade as per manufacturer specification with a brush or roller after levelling the surface to a smooth finish with the help of putties etc. & having base coats of approved primer before applying three coats of paint. Rate to include additional coat of paints in any required to get smooth and uniform finish. Rate to include scrapping & sand papering for wall, beam & ceiling surfaces. Rate

quoted by the contractor shall include necessary cleaning, preparation of surface, centering, scaffolding, cleaning of paint stains, curing etc. complete. Rate Shall include application at all heights, wastage and provision of suitable platform with railing all around the scaffolding. Only pipe scaffolding is permitted. Scaffolding is mandatory for any height above 1.2 m from floor level. (included in structural glazing item) actual area shall be measured.

14.2 SPECIAL EFFECT PAINT(TEXTURE)

Providing & Applying smooth stone wall finishing system manufactured by spectrum/ UltraTech, comprises of a 2 component system 25kg dry material and 5ltr binder made up of pure / specially selected quartz, mineral aggregates inorganic pigment, the material contain pure acrylic co polymer in emulsion including anti cracking, ant rusting, antifoaming, bactericides, U.V resistant and broad spectrum fungicides, to be sprayed to the surface by mean of customized spray gun of 3 HP, with the applied thickness of coating being between 1.5mm to 2.0 mm , as per applied on a cured ,dry , smooth, level plaster without keying as per the shades/ combination approved, by the approved applicator, of manufacturer , all complete inclusive of primer on the base.

14.3 CONCRETE PROTECTIVE PAINT (TILE GUARD CLEAR)

Providing and application of concrete protective paint, including initial coat of priming coat by spray or brush by diluting with water in ratio as specified by manufacturer, followed by two neat coats of finishing without any dilution. Application shall be as recommended by Manufacturer. Dry Film thickness of one priming coat and two finishing coats shall be 225-250 microns. The datasheet of the concrete protective paint shall be submitted and approved by architect beginning of work. Concrete protective paint of approved make on all ceilings/ RCC extension of approved shade including supply of all materials tools as per direction of engineer in charge. Rate quoted by the contractor shall include necessary centering, provision of suitable platform with railing all around the scaffolding, cleaning of paint stains, curing etc. complete. Flash point IS101/1987 Part 1, Sec 6: NA. Drying time: Surface dry time 30 minutes.

14.4 WALLPAPER

Providing and applying select approved Wall paper of approved make and shade on all surfaces & at all heights including scaffolding, preparing the surface by brushing and brooming down, etc. complete. The dry/wet cleaning of floors etc. after wall paper is to be carried out. Item to include getting mock-up for approved by Architect/Engineer in charge, all approved gluing as per detailed specifications and approval, all accessories, men material and all lifts, protecting finished surface with min. 20 microns thk polythene sheet till facility handover, finished cleaned complete. Item to be completed in all respects as per drawings & instructions from Project- in-charge.

14.5 ARTWORKS ON WALLS

Providing & installation work in special area panel size 6.0 x 2.4 m made out of modular acrylic sheet panel of 1.2x 2.4 each of 12mm thick of approved color and make to shape as per approved design pattern with computerized numerically controlled (CNC)-router cutting machine upto the min size of 10-25 mm width. Basic price of acrylic sheet with cutting of 600 /sq. ft. Item inclusive of single unit sample & all softcopies of artworks approval by architect all installation. & cleaning men & material & all fixing implements complete with all lift up to 20 mts including protecting exhibits from damage till handover with all necessary approved protective aids. The art work will be sourced from reputed professionals depending upon the quality of the work within the basic rate as per approval from EIC/Architect.

15.0 ROLLER BLINDS:

15.1 Providing & fixing of Roller Blinds Approved make Non-Blackout, Blind Shade, Color Decided as per site Color matching to be decided by site engineer-in-charge.

16.0 SHELTER GUARD

16.1 Providing and applying two coats of WPM 310, single component tough UV stable acrylic based highly elastomeric waterproof facade membrane, ensure that the coating is applied evenly at the recommended coverage rates. (3.2 Sqm per ltr per coat). apply the first coat of WPM310 over dried coat of primer and allow it to dry. apply the second coat of WPM310 in opposite direction to the first coat. Time gap of minimum 4 hours between the first and second coat should be maintained strictly. including grinding all sharp edges of the substrate to make them flush with the surface, cleaning the substrate to make them free from all contaminants, treating the cracks and construction joints, etc. and complete as per manufacturer's specification. Membrane must confirm specific gravity: approx. 1.3 g/cm3; characteristics of cured membrane- water vapour transmission (ASTM E96) at 1.0 mm: 21.9 g/sqm/24hrs; tensile strength: AS 1145 - after 28 days dry: 2.1 Mpa, after 14 days UV exposure: 3.0 Mpa, after 2500 Hrs QVA: 5.9 Mpa; Elongation at break AS 1145 - after 28 days dry: 460%, after 14 days UV exposure: 315%, after 2500 Hrs QUV: 180%. Application temperature: 10 Deg C to 35 Deg C; Service temperature: 0 to 60 Deg C; VOC content: 100g/L.

B. TECHNICAL SPECIFICATION OF PUBLIC HEALTH WORKS:

1.0 For Detailed Specification of DSR items of Public health works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD specification 2009 VOLUME I AND VOLUME II (corrected up to the

last date of submission/uploading of bid) i.e. in Sub-head No. 17, 18, 19, 23.

2.0 For Nonscheduled item mentioned in SOQ shall be installed as per manufacturer's direction approved by the Engineer-in-charge.

3.0 Specification/brands names of fixtures to be used as per the scope of work are listed in the bid documents. The efforts should be made by the Contractor to use indigenous products. The Contractor should also consider the availability of spares parts/ components for maintenance purposes while proposing any brand/ manufacturer. The materials of any other brand/manufacturer may be proposed for use by the Contractor in case the brands specified below are not available in the market and/or Contractor intends to use some other brand better than the brands mentioned in this list. The alternate brand can be used only after the approval of Engineer-in-Charge. The list of approved makes is appended to this document.

C. TECHNICAL SPECIFICATION OF ELECTRICAL WORKS:

1.0 INTERNAL ELECTRICAL WORKS

For Detailed Specification of DSR items of Internal Electrical works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD General specification for electrical works Part 1 (Internal) 2013 (corrected up to the last date of submission/uploading of bid).

2.0 EXTERNAL ELECTRICAL WORKS

For Detailed Specification of D.G. Set of Electrical works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD General specification for electrical works Part VII (D.G SET) 2013. (corrected up to the last date of submission/uploading of bid).

For Detailed Specification of Substation of Electrical works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD General specification for electrical works Part IV (SUBSTATION) 2013. (corrected up to the last date of submission/uploading of bid).

2.1 DG SET (SOUND PROOF DG SETS OF 125 KVA)

"Supply ,installation ,testing and commissioning of 125 KVA water cooled silent DG set comprising of water cooled Diesel Engine developing 156 BHP @ 1500 RPM & 125 KVA alternator rated at three Phase , 415 Volts , 50 Hz: 0.8 P.F. @ 1500 RPM Both

mounted , and aligned on a common MS base Frame Complete with MS Fuel tank , Standard AMF Control Panel , Residential Exhaust Silencer , AVM Pads fitted on base frame , 1 nos. 12 Volts DC Battery ,Battery Leads , 1st fill of lube oil all housed in sound proof Acoustic Enclosure as per specification attached as per satisfaction of engineer in-charge.

Note: The Agency Will provide first filling of full tank Diesel with supply of DG set"

2.2 DG AMF PANEL

Supply, installation, testing and commissioning of DG, cubical type, totally enclosed, free standing type, dust, damp and vermin proof made up of 14/16 SWG CRCA sheet, complete with busbars, M.V. Danger notice plate, inter connections with suitable capacities aluminum leads / solid aluminum strips / rods ,power coats painted and having incoming and outgoing switchgear as mentioned below and complete as required.

1. All relays to operate at 240 V single phase, 50HZ, AC supply through UPS

2. Panel should be suitable for manual and automatic operation (AMF) and shall be complete as required.

One no.250 A auto change over switch for changeover state electricity board power and DG set power including by pass facility as approved by the engineer – in-charge.

1 no. MCCB as per following details specifications

250 AMP. 415 V, 4 pole MCCB with Microprocessor realest and variable current settings 0.8 to 1.0) with earth fault release

"ON" LED indicating Lamp and 2A control SP MCB

Extended rotary operating mechanism

Digital energy meter with one set of suitable CTs, CT sorting link

Digital Ampere Meter of suitable range with suitable set of CTs and ASS

Digital Volt meter with VSS and HRC fuse

Digital multi-function meter to show, KWH, KVAH, P.P and frequency meter one set of suitable CTs, CT shorting links.

2.3 PROTECTION AND AMF COMPONENTS FOR ABOVE MENTION DG SET

Over voltage relay

Under voltage relay

Battery charger (with trickle and boost charging).

Digital voltmeter and ammeter.

8 window Alarm annuciator with separate hooter , accept ,reset and push button

Hooter

Engine cranking relay

Main supply voltage monitor, alternator voltmeter monitor and engine starting relays

Auxiliary relays, Timer, Push button and control fuse

Phase sequence relays

2.4 ENCLOSURE:

Fabrication, PVC sleeving, Control/power wiring and necessary electrical / mechanical interlocking etc. any other item required for proper functioning of the system complete as required

Providing and fixing oil tank of suitable capacity complete with suitable M.S Fabricated ,M.S stand oil level indicator gauge tank and stand duly painted complete with float switches etc. including its connections to the fuel tank of the DG set complete as required

The silencer should be minimum 20'-0" long nothing extra shall be paid

125KVA DG set with AMF panel mentioned as above Model No: 6BTAA5.9G13

2.5 EARTHING OF DG SET:

Earthing with G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meter long etc. with charcoal/ coke and salt as required.(2No for DG body earthing)

Earthing with copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meter long etc. with charcoal/ coke and salt as required.(2No. For DG Neutral earthing)

Providing and fixing 25 mm X 5 mm copper strip on surface or in recess for connections etc. as required.

Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.

Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.

Providing & laying in position cement concrete 1:3:6 (1Cement:2Coarse sand: 6 graded stone aggregate 20mm nominal size) in foundation of DG sets etc including form work etc as required. (1No DG set+1No CSS 2X6x5X.6Mtr)

2.6 400KVA, 11KV SUB-STN

Providing and fixing of FIRE EXTINGUISHER ABC Powder type (stored pressure)as per is :15683 complete with all accessories as per manufactures specification.ISI Mark complete in all respect. 4 kg capacity.

Providing and fixing of FIRE EXTINGUISHER CO2 type as per is: 15683 complete with all accessories as per manufactures specification.ISI Mark complete in all respect. 4.5 kg capacity

2.7 PCC POLES

Supply and erection of pre-stressed cement concrete pole of suitable length with a given planting depth confirming to IS1678-1978 below ground level in excavated pit of suitable dimensions complete in all respect as per satisfaction of engineer in charge.

PCC pole overall length 11metre planting depth 1.83 meter, top dimensions 152.4mmx 203.2mm bottom dimensions 152.4mmx368.3mm load capacity 363Kg and wt 1146Kg.

ACSR- Supply and sagging of al conductor steel reinforced (ACSR) on pole including binding with insulators.

2.8 GO SWITCH 200A & POLE ACCESSORIES

Supply & erection of 11KV 400-800A GO switch confirming to ISI specifications. The item includes supply and erection of operating pipe and handle arrangement of MS flat 50mmX6mm and channels 75mmx40mm sheet. The GO switch is to be fitted with locking arrangement so as it locks upward on “ON" position and locks downward in "OFF" position. The entire GO switch assembly/unit should be properly earthed and the job is to be completed as approved by engineer-in-charge.

ACSR DOG conductor (100sq mm) Size (6/4.5Al+1/4.5GI)

Supply and Erection of MS angle iron size 50mm x 50mmx 6mm thick with cutting, bending and necessary holes as desired by Engineer-in-charge at site.

Supply and erection of MS channel iron size 100mmx50mmx6mm thick with cutting, bending and necessary holes as desired by engineer in charge

Supply and erection of MS flat size 50mmx5mm thick with cutting, bending and necessary holes as desired by engineer in charge

2.9 XLPE INSULATED HT ARMOURED CABLES

Supply & laying of Circular Aluminum conductor, conductor screened with extruded semiconducting compound, XLPE insulated, insulation screened with extruded semiconducting combination in combination with copper tape (0.3KA for 1sec.) cores laid up, FRLS PVC inner sheathed, galvanized steel strip armored and overall FRLS PVC sheathed cable confirming to IS:7098/II/85 working voltage 11KV(UE) grade to be laid 1 m below ground level including excavation, sand

cushioning, covering with sand & bricks and back filling the trench etc., of the required size:-

Circular Aluminum conductor, conductor screened with extruded semiconducting compound, XLPE insulated, insulation screened with extruded semiconducting combination in combination with copper tape (0.3KA for 1sec.) cores laid up, FRLS PVC inner sheathed, galvanized steel strip armored and overall FRLS PVC sheathed cable confirming to IS:7098/II/85 working voltage 11KV(UE) grade 70sq.mm (Three Core)

2.10 EARTHING OF SUB- STATION.

Earthing with G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meter long etc. with charcoal/ coke and salt as required.(2No for Transformer body earthing)

Earthing with copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meter long etc. with charcoal/ coke and salt as required.(Neutral Earthing)

Providing and fixing 25 mm X 5 mm copper strip on surface or in recess for connections etc. as required.

Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.

Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.

Supply and making outdoor cable termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for 3X70Sq mm XLPE A conductor cable of 11 KV grade as required.

Supply & Erection of galvanized D iron clamps complete with shakle insulator (100mmx110mm) GI bolts, Nuts and washers, coach screws etc as required.

Supply & erection of shackle insulators (Medium). The item includes supply and erection of nuts and bolts and other accessories whatsoever required at site for fixing it to the structure pole. .The job is to be completed as approved by engineer in charge.

Supply & erection of galvanized stay sets for 11KV over head lines complete with 19/20mm dia 1.8mtr long GI stay rod, anchor plate of size 45cmx45cmx7.7mm thick, thimbles, stay clamps, turn buckle) 20mmx600mm), 7/4,00 mm dia GI Stay wire and 11 KV strain insulator etc in cement concrete 1:3:6 (1 cement: 3 Coarse sand : 6 graded stone aggregate 40mm nominal size) foundation including excavation and backfilling as required.

Supply & erection of 11KV pin insulators with GI pin confirming to ISI specifications. The item includes supply and erection of nuts and bolts and other accessories whatsoever required at site for fixing it to the structure pole. .The job is to be completed as approved by engineer in charge.

Supply & erection of 11KV Disc insulators with GI pin confirming to ISI specifications. The item includes supply and erection of nuts and bolts and other accessories whatsoever required at site for fixing it to the structure pole. .The job is to be completed as approved by engineer in charge.

Supply & erection of 11KV Lightning Arrestors suitable for 3 wire, 11KV overhead lines with rated voltage 9KV(rms) with nominal discharge current rating 5KA and complete with galvanized clamping arrangement G.I. bolts nuts washers etc etc as required confirming to ISI specifications. .A separate earth to be provided to lightning arrestor complete as approved by engineer in charge.

2.11 500 KVA Package Sub-Station

2.11.1 HT Switchgear

HT 11kV Compact switchgear (Type DV) consisting of One No. direct cable compartment and one No. fixed manual vacuum Circuit Breaker in SF6 stainless steel enclosure with series trip, self powered microprocessor based Over current & Earth Fault (IDMTL + Inst.) relay protection .Interconnection between HT and Transformer shall be using 1C x 3 x 95.sq.mm Al. unarmored XLPE (E) Cable.

2.11.2 Transformer

400/500 KVA,11KV/433V,DYn11, ONAN OIL/DRY TYPE, hermetically sealed transformer with corrugated wall design & top bushings for HT & LT with off load tap switch of rating+5 to -5% @2.5% on HT side of transformer.(Make:

2.11.3 LT PANEL

LT Indoor panel 433V with Aluminum Busbars, Fabrication using 1.5/2 MM CRCA sheet steel , Ingress protection IP4X , complete with internal wiring.

2.11.4 INCOMER cum OUTGOING

400A, 250A & 200A (1No. Each) 433V, 4P, 50Hz, 36KA,Fixed Manual MCCB with thermal base release as incomer cum outgoing.

2.11.5 Outdoor Enclosure

Outdoor type enclosure having modular construction of Galvanized Sheet Steel. The Enclosure shall have IP54 degree of protection for HT & LT switchgear compartment & IP23 degree of protection for Transformer compartment. The enclosure exterior shall be painted with polyurethane paint (color Light Gray & D.A.Gray). Each compartment will be provided with the door and pad locking arrangement. The

Compartment illumination lamp with door operated switch shall be provided for each compartment

2.11.6 Interconnection & Earthing

Interconnection between HT switchgear & Transformer using 1Cx3x95Sq.mm XLPE Single core cable & Interconnection between Transformer & LT switchgear using Busbars. Internal earthing connections by GI strips.

2.11.7 HT Panel/Transformer/LT Panel must be of same make.

Package Sub-Station is outdoor plinth mounted type. Civil work for package substation is not in our scope. The Foundation details will be furnished.

Package Sub-station will be complete with the internal interconnections & earthing. Accessories required for the external connections of HT & LT cables like termination kits, lugs, glands etc & extending of earth bar to earth pits is not included in our scope.

D. TECHNICAL SPECIFICATION OF FIRE FIGHTING WORKS:

1.0 SPECIFICATIONS FOR FIRE HYDRANT & SPRINKLER SYSTEM.

1. General.

1.1. Work under this subhead is time-bound and has t be completed within the time limit set in the tender. Work shall be executed in accordance with an agreed schedule which shall be submitted by the tenderers along with offer and agreed to by owners.

1.2 Scope of work.

The scope of work in this subhead shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely do all work relating to the supply, installation, testing & commissioning of Fire Fighting System as described herein after and shown on the drawings. The scope of work in general shall include the following.

i) Fire Fighting Pumps & Accessories and related electrical works.
ii) External & Internal Fire Hydrant System.
iii) Sprinkler system in entire building.
iv) Hand Appliances.

Without restricting to the generality of the foregoing, the work shall include the following: A Hydrant System covering the entire complex and consisting of the following:

(v) Three number of Pump – One number Main electric end suction pump of 2280 LPM at 60 M head, one number a Diesel Standby split casing Pump for Hydrant System of 2280 LPM at 60 M head and Jockey Pump for System pressurization of 180 LPM at 60 M. head.

(vi) Other piping system ancillaries such as Suction and Delivery Headers, Air Vessel, Pressure Gauges, Pressure Switches, Pump Panel etc. as required.

(vii) External Hydrant Ring Main of 150mm dia with single headed Yard Hydrants, RRL Hoses, Branch Pipes etc. all housed in a Hose Box.

(viii) Internal Hydrant system where required with single headed landing valves on each floor accompanied by 1 number swinging type Hose Reel, 2 numbers RRL Hoses, 1 number of Branch Pipe etc. all housed in the niche. Bidder shall provide front frame with shutter for niche.

(ix) Sprinkler system for entire building.

(x) Hand appliance as per Bill of Quantities.

(xi) To obtain the approval of the relevant drawings before actual installation at site and to get the complete installation inspected and passed by the concerned authorities, as may be necessary as per local bye-laws. (any fee payable to the local bodies.

1.3 Contractor's Experience.

1.3.1 Contractors shall engaged specialist agency only for this work of Fire Fighting systems.

1.3.2 The selected specialist agency must have sufficient experience in the execution of turnkey projects as specified.

1.3.3 Contractor must submit with the tender a list of similar jobs carried out by him as required along with the name of works, name and address of clients, year of execution, capacity of plant and value of work.

1.4 Technical Information.

1.4.1 Contractor shall submit along with the tender copies of detailed specifications, cuts, leaflets and other technical literature of equipment and accessories offered by him.

1.4.2. Contractor's attention is specially invited to the special conditions and other clauses in the agreement which required the contractor to: -

a. Submit detailed shop drawings.
b. Use material of specific makes and brands
c. Obtain all approvals from Fire Fighting authorities.
d. Execute the entire work on a turn-key basis so as to provide a totally operating plant.

1.5 Exclusions.

1.5.1. Work under the contract does not include the following work.

1.5.2 Electrical cable up to incoming motor control centre.

1.6. **Site Accessibility**.

1.6.1 The equipments are to be located in pump house located within the Service block.

1.6.2 The equipment must be carried from the goods receiving station to the site in an extremely careful manner to prevent damage to the equipment building or existing services.

1.6.3 Contractor must visit the site and familiarize himself with above problems to ensure that the equipment offered by him are of dimensions that they can be carried and planed in position without any difficulty.

1.7 Approvals.

The contractor shall prepare all submission drawings and obtain all approvals of fire fighting works from fire fighting authorizes.

1.8 **System Description**.

1.8.1 The Hydrant System shall comprise of AC motor driven pump set, standby diesel pump set, jockey pump set for pressurization and fire booster pump with all required accessories including valves, special fittings, instrumentation, control panels and any other components required to

complete the system in all respects.

1.8.2 The Hydrant System shall be semi automatic in action and shall be laid covering the entire area externally and all the floors internally with independent piping system for Sprinkler System, a separate piping system shall be installed.

1.8.3 The Hydrant System shall be kept pressurized at all times. The proposed Hockey Pump shall take care of the leakages the system, pipe lines and valve glands.

1.8.4 The pressure in the hydrant pipe work shall be kept constant at 6 Kg/cm^2. In the event of fire when any of the hydrant valve in the network is opened, the resultant fall in header pressure shall start the AC motor driven fire pump through pressure switches automatically. There shall be one Diesel Engine Driven pump as standby for both hydrant system. In case of failure of electricity or failure of Electric Pump to start on demand, the standby Diesel Pump shall automatically take over.

1.8.5 However, shutting down of the pump set shall be manual except for the Jockey Pump which shall start and stop automatically through pressure switches. In addition to auto start arrangements, the main pump shall also have an over-riding manual starting facility by push bottom arrangement.

1.8.6 The ping for the hydrant system in the yard shall be laid in soil 1 Metre deep or in rectangular trench. The pipe laid in soil shall be protected as specified.

1.8.7 The yard hydrants shall be placed at a regular spacing of 45m centre to centre. The following accessories are proposed near each yard hydrant.

i) One no. gunmetal single headed hydrant vales.
ii) Two nos. RRL Hoses of size 63mm dia x15m long.
iii) One nos. gunmetal Branch pipe.

Gun metal hydrant valve, RRL hose and gunmetal branch pipe will be accommodated in a aluminium hose box mounted on brick pedestals.

1.8.8. The Internal Hydrant System (Wet Risers) shall be provided at points as indicated on the drawing on each floor.

1.8.9. The hydrant point shall be directly tapped from the Riser pipes, and shall be furnished with required accessories such as –

i) One no. gunmetal single headed hydrant valves.
ii) Two nos. RRL Hoses of size 63mm dia x 15m long.

iii) One no. first aid Dunlop hose reel full swinging type 20mm dia x 30m long.
iv) One nos, gunmetal Branch pipe.

The hydrant risers shall be terminated with air release vale at the highest points to release the trapped air in the pipe work. At each tapping from the Riser a Orifice Plate shall be located in the lower floors to reduce the pressure.
An overhead tank 20000 litres capacity will be connected to the fire hydrant system.

1.8.10 Sprinkler system shall be distributed entire building so as to cover 12-12 sq.m area with one sprinkler

Sprinkler risers shall be provided with instantaneous control valve with alarm gang.

An overhead tank of 20000 litres capacity with makeup line will be connected to sprinkler riser at basement (overhead tank is excluded from scope of work)

A suitable drainage arrangement with bye-ass valve shall be provided to facilitate maintenance f sprinkler pipe work.

1.8.11 To compensate for slight losses of pressure in the system and to provide an air cushion for counteracting pressure surges/water hammer in the underground pipe work Air Vessels shall be furnished in the pump room ear fire pumps. The air vessel shall be normally partly full of water and the remaining being filled with air which shall be under compression when the system is in normal operation.

1.8.12 The entire Wet Riser and external Hydrant Ring Main System shall be fed from the water supply (Static Water Tank) and pump room to be provided by the others.

1.9 GENERAL SPECIFICATIONS.

1.9.1 Pipes and Fittings.

Pipes for Wet Riser system shall be of GI pipe (Heavy Duty).Pipes upto 150mm dia shall be GI and conform to IS-1239. Pipes with dia 200mm and above (6mm thick) shall be MS and form to IS-3589. All pipes shall be I.S.I. marked. Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

1.9.2 Jointing

Joint for black steel pipes and fittings shall e metal-to-metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.
Joints between C.I. or black steel pipes, valves and other apparatus, pumps etc. shall be made with C.I. or M.S. flanges with appropriate number of bolts. Flanged joints shall be made with 3mm thick insertion rubber gasket.

Note : Joints for pipes and fittings upto 50mm diameter shall be threaded joints using Teflon Tape or equivalent bonding tape on the threads. Joints for pipe and fittings above 50mm diameter shall be welded joints.

1.9.3 Pipe Protection.

a) All pipes in underground masonry trenches/service tunnels, above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

b) Pipes in wall chases shall be protected from corrosion by 2 coats of bituminous paints.

c) Protection of Underground pipes.
The underground steel pipes shall be protected by coating and wrapping.
The coating and wrapping shall be done, in general as per IS:10221-1982.
It specified in Bill of Quantities, the proprietary pipe production system shall be provided as per the Manufacturers recommendation. The proprietary system shall be of approved make.

1.9.4 Installation of Pipes.

All pipes shall be adequately supported from ceiling or walls by structural clamps fabricated from M.S. structural e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of primer and two coats of black enamel paint. The contractor shall provide inserts at the time of slab casting or provide suitable anchor fasteners.

The pipe supports or hangers shall be designed to withstand combined weight of pipe, pipes fittings, fluid in pipe and insulation. Pipe supports shall be of steel and coated with rust preventing paint and finished with two coats enamel paint. The maximum spacing for pipes supports shall be as below :

Pipe (MM)	Spacing (MTR)	Size of support
Up to 25	2.0	6 mm
32 to 65	2.4	8 mm
75 to 125	2.7	10 mm
150 & above	3.0	12 mm

Pipes supports shall be spaced at maximum interval of 1.5 mtrs. on either side of heavy fittings and valves. Wherever piping passes through walls, pipes sleeves of diameter larger than that of piping shall be provided. Pipe sleeves shall be of steel or cast iron pipe.

The underground piping shall be supported with cement concrete blocks of suitable size and strength provided at an interval of 2.5 metres. The pipes shall be laid at 1 metre Depth (top of the pipe) and trench excavated for sufficient width. The rate of pipes shall include the scope of excavation / refilling the trench. 1:2:4 concrete thrust blocks are also to be provided at turning of pipe. The cost of installation includes concrete pedestals etc. as required and to be included in the item rate.

1.9.5 **Orifice Flanges**.

Contractor shall provide orifice flanges fabricated from 6mm thick stainless steel plates on the branch lines feeding different zones/floors so as to allow required flor of water at a pressure of 3.5 kg/sq.cm. for each hydrants and 2 bar at 1800 LPM at installation valve for sprinkler system. The contractor shall design the orifices to ensure the required pressure.

1.9.6 Air Vessel and Air Release Valve.

Air vessel on top of wet riser piping shall be fabricated of at least 8mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 250mm dia and 1m high. This shall be complete with necessary flange connection to the wet riser piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and galvanized to be IS:4736 – 1968. This shall be tested for twice the working pressure.

1.9.7 **Valves & Other Accessories**.

1.9.7.1 General

Each valve body shall be marked with cast or stamped lettering giving the following information's:

a) The manufacturer's name or trade mark.
b) The size of the valve
c) The guaranteed working pressure.

Isolating valves on the water supply lines shall be full bore ball valve type for pipe diameters upto 50mm. For 65mm dia and above these shall be butterfly valves.

1.9.8. **Full Way Ball Valve**.

The valves shall be of full bore type and of quality approved by the Project Architect / EIC. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

1.9.9 Butterfly Valves.

Butterfly valves shall be of centric disc construction with single piece body of Cast Iron with disc of aluminium bronze with nitrile seat. Shaft shall be stainless steel with Teflon bearing butterfly valve shall conform to PN 1.6 rating and shall be provided with suitable matching flanges compatible with PIN 1.6 rating of valves.

1.9.10 Non-Return Valves.

Non-return valves are to be IS:778-1984 manufactured from gun-metal or dezincification resistant brass.

1.9.11 Drain Valve.

Drain Valves are to be provided at all low points in the system for draining the water. These shall be 40mm dia full way ball valve fixed on 40mm dia black steel pipe.

1.9.12 Pressure Switches.

Pressure switches shall be differential type for operation of all pumps and for the various duties and settings required. Pressure switches shall be for heavy duty operation and of approved make. All pressure switches shall be factory calibrated.

1.10 External Fire Hydrants.

Yard Hydrant valves shall be single headed as per IS:5290. The valve shall be complete with hand wheel, quick coupling connection spring loaded

type and gun metal blank cap. The Yard Hydrant shall be laid on 150mm dia Hydrant Ring Main, branched off to 80mm dia and Stand Post of 80mm dia.

1.11 **Internal Landing Valves**.

The internal landing valves shall be double-headed made of gun metal and conforming to IS:5290. It shall be complete with hand-wheel, quick coupling connection spring loaded type and blank cap.

1.12 **Hose pipes, Branch Pipes and Nozzles**.

Hose Pipe : Hose pipe shall be rubber lines woven jacketed and 63mm in diameter. They shall conform to type-2 (Reinforced rubber lined) of IS:639-1979. The hose shall be sufficiently flexible and capable of being rolled.

Each run of hose pipe shall be complete with necessary coupling at the ends to match with the landing valve or with another run hose pipe or with Branch pipe. The couplings shall be of instantaneous spring lock type.

Branch Pipe : Branch pipe shall be of gunmetal 63mm dia and be complete with male instantaneous spring lock type coupling for connection to the hose pipe. The branch pipe shall be externally threaded to receive the nozzle.

Nozzle : The nozzle shall be of copper or gunmetal, 20mm in internal diameter. The screw threads at the inlet connection shall match with the threading on the branch pipe, the inlet end shall have a hexagonal head to facilitate screwing of the nozzle on to the branch pipe with nozzle spanner.

End couplings, branch pipes, and nozzles shall conform to IS:903-1985, two hoses of 15 mtr. Lengths with couplings shall be provided with each external (yard) hydrant. One nozzle and one branch pipe with coupling shall be provided with each yard hydrant.

1.13 **External Fire Hose Cabinet**.

The external fire hose cabinet to accommodate the hose pipes, branch pipe nozzle and the hydrant outlets shall be fabricated from 1.5m sheet steel. This shall be lockable and provided with centre opening glazed doors.

The support for hose cabinet shall be of brick work up to a height of 0.5m above ground level. The depth of footing for this support shall be minimum 50cm below ground level, resting on levelling course of minimum 10cm of PCC (1:5:6). The brick work shall be plastered in cement mortar (1:6). The hose cabinet shall be painted red and stove enamelled.

1.14 Internal Fire Hose Cabinet.

Each internal fire hydrant valve shall be housed in a nitch of size indicated on drawings. Each internal fire hose Cabinet shall hold double headed hydrant,4 Hoses and 2 Branch pipes and 1 no. Dunlop hose reel mounted on a drum.

A) The cabinet shutters & frames shall be fabricated from boxed steel sections and MS pate 2mm thick.

B) The front glass of shutters shall be 5.0mm thick clear glass and shall be held by means of rubber. Locking arrangement shall also be made with one number of mortice lock of approved make. A separate Key Box of 16mm thick MS sheet with glass facing shall be provided.

C) The Shutter shall be given a powder coat finish in post office red colour.

1.15 Hose Reel.

The hose reel shall be directly tapped from the riser through a 25mm dia pipe, the drum and the reel being firmly held against the wall by use of dash fasteners. The Hose Reel shall be swinging type (180 degrees) and the entire Drum, Reel etc. shall be as per IS:884. The rubber tubing shall be of approved quality and the nozzle shall be 6mm dia shut off type.

1.16 **Brigade inlet Connections**.

One set of 4 ways collecting head Fire Brigade connection shall be provided at the location indicated in the drawing.

The inlet to the riser shall be with 150mm dia sluice valve and non-return valve. The scope shall include providing necessary reducers, tees bends and special fittings as required. Necessary enclosure mad of 2mm thick sheet metal with support shall be provided, as in the case of hose cabinets.

1.17 **AUXILIARY PUMPING EQUIPMENT**.

1.17.1 Scope.

This section covers the details or requirements of the auxiliary equipment necessary for the operation of the fire pumps and the wet-riser system.

1.17.2 Drive

The pump shall be directly driven from the electric motor. Flexible coupling and coupling guard shall be provided.

1.17.3 Capacity.

The discharge and head of the jockey pump shall be as mentioned in Bill of Quantities.

Jockey pump shall be Horizontal /Vertical mono-block / coupled type. The pump casing shall be of cast iron and parts like impeller, sleeve, wearing ring etc. shall be of non- corrosive metal like bronze, brass or gunmetal. The shaft shall be of stainless steel.
Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of the dust or water. The pump casing shall be designed to withstand 1.5 time the working pressure.

1.17.4 Motor.

The motor shall be squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz, system. The motor shall be totally enclosed fan cooled type confirming to protection clause IP 21 of IS 4691. The class of insulation shall be B, synchronous speed shall be 3000 RPM/1500 RPM. The motor shall conform IS 325-1978 and rated for continuous duty.

1.17.5 Motor Starter.

The motor starter shall be automatic star delta type with overload trip, but without under voltage / no volt trip. Starter shall conform to IS 1822-1967.

1.18 MAIN ELECTRIC FIRE PUMP.

1.18.1 Scope

This section covers the details of requirements of the motor, starter and pump for the electrically operated firm pump.

1.18.2 General.

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 Hz A/C system,. Both the motor and the pump shall be assembled on a common base plate of fabricated MS channel type or cast iron type.

1.18.3 Drive

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided.

1.18.4 Fire Pump (Electrical)

The fire pump shall be horizontal end suction centrifugal type. It shall have a capacity to deliver 2280 LPM as specified, developing adequate head so as to ensure a minimum pressure of 3 kg. per sq.cm at the highest and the farthest outlet. The delivery pressure at pump outlet shall be not less than 6 kg. per sq.cm. in any case.

The pump shall be capable of giving a discharge of not less that 150 percent of the rated discharge, at a head of not less than 65 percent of the rated head. The shut off head shall be within 120 percent of rate head.

The pump casing shall be of cast iron to grade FG 200 to IS:210 and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze / brass / gunmetal. This shaft shall be of stainless steel.

Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

The pump shall be provided with a plat indicating the suction lift delivery head, discharge speed and number of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

1.18.5 Motor

The motor shall be squirrel cage A/C induction type suitable for operation on 415 volts 3 phase 50 Hz system. The motor shall be totally enclosed fan cooled type conforming to protection clause IP 21 vide IS-4691.The class of insulation shall be B. The motor shall be rated to continuous duty as per relevant IS and shall have a horsepower rating necessary to drive the pump at 150 percent of its rated discharge.

1.18.6 Motor Starter.

The motor starter shall be automatic star Delta type conforming to IS:1822-1967. The starter shall not incorporate under voltage or overload trip or single-phase preventor. The starter assembly shall be suitably integrated in the power control panel for the wet riser system.

Each pump shall be provided with vibration isolating pads of appropriate size.

1.19 DIESEL FIRE PUMP.

1.19.1 Scope

This section covers the details or requirements of the stand by fire pump operated by a diesel engine.

1.19.2 General

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on wet battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common bed place, fabricated with mild steel channel.

1.19.3 Drive

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided. The speed shall be 1500/1800 RPM.

1.19.4 Fire Pump (Diesel)

The fire pump shall be horizontal split casing centrifugal type. It shall have the capacity to deliver 2280 LPM as specified. Developing adequate head so as to ensure a minimum pressure of 3 kg. per sq.cm. at the highest and the farthest outlet. The delivery pressure at the pump outlet shall be not less than 7 kg per sq.cm. in any case. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head. The shaft shall be of stainless steel. The pump shall be provided with mechanical seal. The pump casing shall be designed to withstand 1.5 times the working pressure.

Bearing of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

1.19.5 Diesel Engine

Engine Rating :-

The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater plugs etc.) The engine shall be multi cylinder /vertical, 4-stroke cycle, water-cooled, diesel engine, developing suitable HP

at the operating speed specified to drive the fire pump, Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and after correction for altitude, ambient, temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum UP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of the rated head. The engine shall be capable for continuous non-stop operation for 8 hours. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run.
The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform ton B.S. 649/IS 160/IS 10002, all amended up to date.

1.19.6 Cooling System.

The engine cooling system shall be radiator water cooled system. The radiator assembly shall be mounted on the common base plate. The radiator fan shall be driven by the engine as its auxiliary with a multiple fan belt. When half the belt brake remaining belts must be capable of driving the fan. Cooling water shall be circulated by means of an auxiliary pump of suitable capacity driven by the engine in a closed circuit.

1.19.7 Fuel System.

The fuel shall be gravity fed from the engine fuel tank to the engine driven pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself suitably wall mounted on brackets. The fuel filter shall be suitably located to permit easy servicing.

The engine fuel tank shall be welded steel construction (3mm thick) and of capacity sufficient to make the engine to run on full load for at least 8 hours. The tank shall be complete with necessary supports, level indicator (protected against mechanical injury), inlet, outlet, over flow connections drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediment into the fuel line of the engine. A semi rotary hand pump filling the engine fuel tank together with hose pipe 5 mtr. Long with a foot-valve etc. shall also form part of the scope of work.

1.19.8 Lubricating Oil System.

Forced feed Lubricating Oil system shall be employed for positive lubrication. Necessary Lubricating Oil filters shall be provided and located suitably for convenient servicing.

1.19.9 Starting System.

The starting system shall comprise of necessary battery / batteries, starter motor of adequate capacity and axle type gear to match with the toothed ring fly wheel. Suitable metallic relay to protect starting motor from excessively long cranking runs shall be included within the scope of the work. The metallic relay protection shall be integrated with engine protection system.

The capacity of the battery shall be suitable for meeting the needs of the starting system but not less than 180 AH.
The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.
The scope shall cover all cabling, terminals, initial charging etc.

1.19.10 **Exhaust System**.

The exhaust system shall be complete with silencer suitable for indoor installation, and silencer piping including bends and accessories needed. The exhaust pipe shall protrude outside the pump room. The total backpressure shall not exceed the engine manufacturer's recommendations. The exhaust piping shall be suitably supported and the pipe used shall be of medium class MS pipe.

1.19.11 Engine Shut Down Mechanism.

This shall be manually operated and shall return automatically to the starting position after use.

1.19.12 Governing System.

The engine shall be provided with an adjustable governor to control the engine speed with 5% of its rated under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.

1.19.13 **Engine Instrumentation**.

Engine instrumentation shall include the following :

a) Lubricating Oil Pressure Gauge.
b) Lubricating Oil temperature gauge
c) Water temperature gauge.
d) Water pressure gauge
e) Tachometer

f) Hour meter
g) Starting key

The instrument panel shall be suitably mounted on the engine.

1.19.14 Pipe Work :

The piping for exhaust outlet as well as fuel piping between fuel tank and the engine shall be with Medium class M.S.

1.19.15 Anti Vibration Mounting.

Suitable vibration mounting duly approved by engineer-in-charge shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated in the report, which will be submitted to engineer-in-charge before installation.

1.19.16 Battery Charger.

Necessary float and boost charger shall be incorporated in the control section of the power and control panel to keep the battery under trickle condition. Ammeter to indicate the state of charge of the batteries shall be provided.

1.20 POWER AND CONTROL PANEL AND OTHER CONTROL COMPENENTS.

1.20.1 Scope

This section covers the detailed requirements of the power and the control panel for the wet riser system, and also for the various control components in the system.

1.20.2 Power and Control Panel.

1.20.2.1 Constructional

Requirements General

Features.

The power and control panel shall be totally enclosed, free standing floor mounted cubic type, fabricated out of sheet steel not less than 2mm thick. Where necessary, additional stiffening shall be provided by angle iron

frame work. General construction shall be of compartmentalization and sectionalisation such as mains incomes, electric fire pump, diesel fire pump, pressurization pump, and control, so that there is no mix up of power and control wiring and connections in the same sections as far as possible. The panel shall also have the space for cable allays. The space for cable alleys shall be at least 200m wide to the entire depth of panel. The panel shall be front operated type with all connections accessible from the front. Front doors shall be hinged type. Back doors shall be hinged type or removable type for inspection. The door hinges shall be of concealed type. The doors for bus bar chamber shall be of removable type with the help of bolts. The doors shall be provided with quick fixing doors knobs with indication. The general arrangement of the panel shall be got approved before fabrication the cubicle construction shall be to IP 21 as per IS:2147.

1.20.2.2 Cable entries and gland plates.

All cable entries shall be through gland plates which are removable and sectionalized. Where heavy cable are brought in and terminated, suitable clamps shall be incorporated to relieve the stress on the glands due to the weight of the cable. Cable entries may be from top or bottom depending on the equipment layout and cable scheme as approved.

1.20.2.3 Bus bar and Connections.

The Bus bar shall be air insulated, and of aluminium of high conductivity electrolytic quality (grade E 91 E to IS:5082) and a adequate cross section. Current density shall not exceed 1.3 amps. Per sq.cm. All connections to individual circuits from the bus bars shall preferably be with solid connections. The bus bars and the connections shall be suitable covered with PVC sleeves or in an approved manner. Bus bar shall be suitably supported using non-hygroscopic insulated supports. High tensile bolts and spring washers shall be provided at bus bar joints.

1.20.2.4 Earthing Arrangement.

CI strip 24mm x 5mm shall be run at the rate of the board 2 nos., earth terminals shall be provided at the ends of the GI strip for connection to earth system.

1.20.2.5 Terminal Blocks and Small Wiring.

Terminal blocks shall be heavy duty type and generally not less than 15 amps 250V grade up to 100V, and 600V grade for the rest of the functions. They shall be easily accessible for maintenance. All control

wiring inside the panel shall be with PVC insulated copper conductor of 2.5 sq.mm size and 600V grade conforming to IS:694- 1977. Suitable colour-coding may be adopted. Wiring harness shall be nearly formed and run preferably function wise, and as far as possible segregated voltage wise, Identification ferrules shall be used at both ends of the wires.

1.20.2.6 Instruments and Lamps.

All indication lamps and instruments shall be flush mounted type in front of the panel. The voltmeter and ammeter shall of size 100mm nominal (dial size) conforming to clause 1.5 of IS 1248 for accuracy.

Current transformers shall be provided with ammeters.

Indicating lamps to indicate the availability of electric supply shall be provided at the incoming section. Necessary indicating lamps for alarm indication and battery charging shall be provided in the respective sections.

All indicating lamps and meter shall be protected with HRC cartridge type fuses.

1.20.2.7 Labels

All internal components shall be provided with suitable identification labels. Suitably engraved labels shall be fixed at the panel for all switches, instrument push bottons, indicating lamps etc.

1.20.2.8 Painting.

The entire panel shall be given a primer coat of red lead after degreasing and phosphating treatment and two coat of final paint or approved shade before assembly of various items.

1.20.3 Equipment Requirements.

1.20.3.1 General

The power and control panel shall comprises individual section for the various equipment's of the system and controls, in a combined cubicle type design. All switches MCCB. MCBS and fuse/fuses switch unit shall be conforming to relevant IS.

1.20.3.2 Incomer Section & Outgoing Section.

(A) **Incomer section** :

1 no. 300 amps TPMCCB unit complete. One set of 96 mm square Ammeter (0- 400 Amps) complete with selector switch and CTS. One set of 96mm square Voltmeter (0-500 V) complete with control fuses and selector switch. One set of phase indicating lights with control fuses. One set of 4 strips of 300 Amps aluminium busbars.

(B) **Outgoing Feeder**.

(i) One number of 250 A,ps TP MCCB unit complete, SP Preventer, ML 4 type contractor forstar delta starting, start an stop push bottons, auto-manual switch, Ammeter with CTS, A S S , phase indicating lights. Auxillary Contractors for interlocking / sequence of operation, control terminals complete in all respect with interconnections for Hydrant Pump and sprinkler pump.

(ii) Two numbers of 63 Amps rated TP MCCB unit complete, ML 1.5 type contractor D O L starting with overload relay, start and stop button. Ammeter, CTS and selector switch, hase indicating lights, Auxiliary contacts for interlocking / sequence of operation, control terminals complete in all respect for Jockey Pump & fire booster pump.

(C) Control wiring from pressure switches of different settings in Hydrant and Jockey Pumps, for sequence of operation shall be included to complete the system.

(D) Colour code with ferrule marking shall also be make.

(E) The wiring shall be PVC insulated and PVC armoured aluminium conductor cable of 650 /100 volts grade conforming to IS 1554 as required from Fire Pump Board to motor and cable of suitable size.

1.20.3.3 Electric Fire Pump Section.

This section shall incorporate the following facilities.

a) MCCB
b) Control system components ad equipment such as relays, contractors, timers etc. for automatic operation.
c) Starter Unit , Current Transformer and ammeter.
d) Indication lamps, their fuses, terminal block, push bottons,

control and selector switches etc. are as required.

e) Pump look out devices due to faults or abnormalities as specified in operating sequence.

f) Visual/audio alarms, indications and communications facility as specified in operating sequence.

g) Necessary inter-connection and control wiring etc.

1.20.3.4 Engine Section.

The engine section shall incorporate the following facilities**:-**

i) Control system components and equipment such as relays, contractors, timers etc. for automatic operation.

ii) Instruments, indicator lamps, fuses terminal blocks, push buttons, control and selector switches etc. as are required.

iii) Engine shut down and block out devices due to faults or abnormalities as specified.

iv) Visual/audio alarms and indications as specified.

v) Inter-connection and control wiring etc.

1.20.3.5 Auxiliary Pump Section.

The auxiliary pump section for Jockey pump shall incorporate the following:

a) TP&N MCBS

b) Control system components such as relays, times, contractors etc. as are necessary for functional requirements.

c) Starter unit, current transformer and ammeter.

d) Indication lamps, fuses, terminal blocks, push buttons selector, switch etc. as required.

e) Inter-connections and control wirings etc.

1.20.3.6 **Control Section**.

This section shall incorporate the following –

a) Control components integrating the various sections, so as to satisfy the functional requirements.

b) Battery charger unit with boost / float chare facility with voltmeter, capable of independently charging 2 sets of batteries at a time.

c) Visual / audio alarms, not covered in individual sections.

d) Lamps healthy test facility.

e) Instruments, indicating lamps, pushbuttons, fuse terminal blocks etc. as are required.

f) Test facility to simulate operation of hydrants.

1.20.4 Other Control Components

1.20.4.1 **Pressure Switches**.

Pressure switches shall be provided for switching on and off the pressurization pump at present pressures and also for switching off the fire pump at present pressure. Being the main component for initiating the signal for the operation of the pumps, the pressure settings shall be totally reliable, sturdy in construction and of long life. The pressure settings shall be adjustable.

1.20.4.2 Power Supply for Controls.

In order to ensure that the control systems remains co-operational at all times the control system shall be designed for 24 VDC operation fed from the battery. This shall be independent of the starting battery for the engine i.e. battery shall remain trickle charged at all times from the separate battery charger at the control system.

1.21 Electrical Work and Earthing.

Scope.

This section covers the detailed requirements of electrical works including earthing, for the materials installation.

Electric power supply shall be terminated in the incoking switch gear of the power and control panel by the Department. All further connections to the various components of the system shall be the responsibility of the contractor, for a complete and working system, satisfying all the functional requirements.

The scope shall particularly include the following :

Power and Control Panel(s) as given in relevant section.

All inter-connections with multi-core armoured copper cables of size suitable between various control units and control panel(s)

All power cable connections with multi-core armoured aluminium cables of size as specified in BOQ, between panels, motors etc.

Necessary earthing with 2 Nos. G.I. plate electrodes and loop earthing.

The work shall be carried out conforming to CPWD General Specifications for Electrical works Part-I (Internal) amended up to date and Part-II (External) amended upto date.

1.22 Sprinkler System.

1.22.1 **Sprinkler Heads**.

Sprinkler heads shall be of quartzoid bulb type with bulb, valve assembly yoke and the deflector. The sprinklers shall be approved make and type.

1.22.2 Types

1.22.2.1 Conventional Pattern.

The sprinklers shall be designed to produce a spherical type of discharge with a portion of water being thrown upwards to the ceiling side of wall extra. The sprinklers shall suitable for erection in upright position or pendant position.

A. **Side Wall Sprinklers**.

These shall be designed for installation along with the walls of room close to the ceiling. The discharge pattern shall be similar to one quarter of sphere with a small proportion discharging on the wall behind the sprinklers.

1.22.2.2 Construction

i) **Bulb –** Bulb shall be made of corrosion-free material strong enough to with stand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a predetermined level.

ii) **Valve assembly –** Water passage of the sprinkler shall be controlling assembly of flexible construction. The valve assembly shall be held in position by the quartzoid bulb. The assembly be stable and shall withstand pressure surges or external vibration without displacement.

iii) **Yoke :** The yoke shall be made of high quality gunmetal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti corrosive treatment if the same is to used in corrosive conditions.

iv) **Deflector :** The deflector shall be suitable for either upright or pendent erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

a. **Colour Code**.

The following colour code shall be adopted for classification of sprinkler according to nomination temperature ratings.

b. **Sprinkler Temperature Rating**.

c. Size of Sprinklers Orifices.

The sprinklers shall be of 15mm nominal bore size.

1.22.2.3. Pipes and Fittings

Pipes for sprinkler system shall be of black steel conforming to I.S. 1239 (Heavy class).

Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

1.22.2.4 Jointing.

Joint for black steel pipes and fittings shall be metal to metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.

Joints between G.I. or black steel pipes, valves and other apparatus, pumps etc. shall be made with G.I. or M.S. flanges with appropriate number of bolts. Flanged joint shall be made with 3mm thick insertion rubber gasket.

1.22.2.5 Pipes Protection.

All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

Pipes in chase or buried underground shall be painted with two coats of hot bitumen.

1.22.2.6 Pipe Supports

All pipes shall be adequately supported from ceiling or walls from structural clamps fabricated from M.S. structural e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of primer and two coats of black enamel paint. The contractor shall provide inserts at the time f slab casting or anchor fastener later.

1.22.2.7 Valves

Sluice vales of sizes 80mm and above shall be double flanged cast iron conforming to I.S.780. Check valve shall be of cast iron double flanged conforming to I.S.5312.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20 kg/sq.cm. Pressure. Valves shall conform to I.S. 778.

A. Air Valves

25mm dia screwed inlet cast iron single acting air valves on all high points in the system or as shown on drawings.

B. Drain Valves

50mm dia black steel pipe conforming to I.S.1239 medium class with 50mm gunmetal full way valve for draining and water in the system in low pockets.

1.22.2.8 Installation Control valve.

Installation control valves shall comprise of the following :

a) One-man stop valve of full way pattern with gunmetal pointer to indicate where open/shut.

b) One automatic alarm valve fitted with handle & cover.

c) One hydraulic alarm motor and going for sounding a continuous alarm upon out-break of fire. One combined waste and testing valve including 5 mtr. Of tubing and fittings.

d) Alarm stops valve.

e) Strainer

f) Drain plug.

g) Padlock and strap

h) Wall box for installation of valve.

1.22.2.9 **Pressure Gauges**.

Burden type pressure gauges conforming to IS/BS specifications shall be provided at the following locations.

a) Just above alarm valve.

b) Just below alarm valve, on the installation stop valve.

c) One pressure gauge on delivery side of each pump.

d) Required number of pressure gauges on pressure tank.

Piping shall be so installed that the system can be thoroughly drained. All the pipes shall be arranged to drain to the installation drain valve. In case of basement and other areas where the pipe work is below the installation drain valve / auxiliary valves of the following sizes shall be provided.

a) 20 mm dia valve for pipes up to 50mm dia.

b) 25 mm dia valves for 65mm dia pipe.

c) 32 mm dia valves for pipes larger than 65mm dia.

Piping shall be screwed type upto 50mm diameter, Welding of joints will be allowed for pipes of above 50mm dia.

1.22.2.10 The entire piping shall be pressure tested by hydrostatic method upto a pressure of 1.5 times the working pressure. The piping shall be slowly charged with water so that all the air is expelled from the piping by providing a 25mm inlet with a stop cock. The piping shall be allowed to stand full of water for a period of 2 hours and then the piping shall be put under pressure by means of manually operated test pump or by a power driven test pump. The pressure gauges used for testing shall be accurate and shall preferably the calibrated before the testing shall be rectified to the entire satisfaction of the Engineer-in-charge. The system may be tested in sections/parts as the work of erection of piping proceeds. The piping shall with stand 1.5 times the working pressure for at least 2 hours.

1.23 Operating Sequence for the Fire Fighting System.

1.23.1 The operating pressure in the mains is to be maintained at 6.0 kg/cm^2.

1.23.2 The jockey pup shall start automatically the moment pressure drops to 5.5 kg/cm^2 because any leakage or minor draw-off from the system and stop when the pressure reaches 5.5 kg/cm^2 again.

1.23.3 In case, after the start of Jockey pump, the pressure still keeps on falling, the main fire pump shall start at 5.0 kg/cm^2 by triggering of the pressure switch. Jockey pump shall stop when main pump starts.

1.23.4 In the event of electrical or mechanical failure of main fire pump (hydrant) to start, the diesel engine driven pump shall cut in when the pressure in the mains fall down to 4.5 kg/cm^2. The main electric pump shall then be locked out.

1.23.5 In the event of failure of wet rise system, three will be further drop in pressure and when the pressure reaches to 4.0 kg /cm^2 fire booster pump near overhead tank will start automatically .

1.23.6 If within a preset period the standby pump fails to start or fails to develop adequate pressure, the control system shall shut down the standby pump and lock it out and given an audiovisual indication to that effect at the control panel.

1.23.7 Jockey pump shall be shut down automatically when the fire pump electric or diesel, is operating. Necessary integration or pipe work and controls shall be provided for the purpose. A timer may be employed where necessary to distinguish between slow fall of pressure due to system leaks and sudden fall of pressure due to fire duty by opening of valves and thus prevent parallel start up of both pressurization and fire pumps.

1.23.8 The control panel shall status selection for each of the pumps for :automatic" as well as "manual" operation.

1.23.9 Pumps when under 'manual" status shall be operated manually through relevant push buttons.

1.23.10 The fire pumps once started shall not be stopped automatically.

1.23.11 The fire pumps shall be locked out for operation both for "manual" and "automatic" operations, once the low water controls operates and furnish an audio and visual alarm on the panel the audio alarm can be silenced by accepting the alarm. The visual alarm shall be individual for each equipment. It shall be flashing type and on acceptance remain steady. A reset button shall be provided for each pump for returning the pump for fire duty.

1.23.12 Over load or under voltage/mo volt trip device for electric fire pump shall not be provided in the starter. LED type indication lamps to indicate the availability of power shall be provided.

1.23.13 Once tripped the electric fire pump shall remain locked out for operation irrespective of the positive of its operational status selection switch. Look out indication shall be available on the panel.

1.23.14 Rerun to normal operational availability shall be feasible only by manual re-set of locked out units by operation of appropriate push buttons.

1.23.15 When fire pumps are brought into operation an audible tone from turbine type alarm operated by water flow in the mains shall be provided in indicate the healthiness of the system. The healthy running alarm shall not be silenced till the fire pump is shut down, but the tone may be mellowed by the operation, if required.

1.23.16 Alarm for failure and lock out of any pump shall distinct from "healthy" alarm. Failure alarms shall be loud and can be silenced on acceptance.

1.23.17 Repeat indication of various audio and visual indications on a slave remote panel in fire control room in terminal building shall be available. The slave remote panel shall have indication lamps to show the status of :

a) Power healthy in fire pump room
b) Jockey pump 'ON'
c) Main pump "ON"
d) Fire booster pump "ON"

The slave Remote panel shall also have a hooter, which shall sound in case, any pump is "ON". The slave Remote panel shall have a provision to reset the hooter with the help of a push button.

1.24 **Testing**.

1.24.1 Testing on Completion of Installation.
The entire system shall be tested after completion of installation as per the operating sequence specified.

Standard and Codes.

1.	IS-1648-1961 (general)	Code of Practice for fire safety of building Fire fighting equipment and maintenance.
2.	IS-3844-1966 fire	Code of practice for installation of internal hydrant in multi-storied building.
3.	IS-2217-1963	Recommendation for providing first aid and fire fighting arrangement in public

buildings.

4.	IS-2190-971	Code of practice for selection, Installation and maintenance of portable first fire appliance.
5	IS-3589	Electrically Welded Steel pipes (Medium class)
6.	IS-1239	Mild steel tubes, Tubular and other wrought steel fittings (Medium class)
7.	IS-780	C.I. Double flanges sluice valve.
8.	IS-778	Gun Metal Valve.
9.	IS-909-1965	External fire hydrant (underground)
10.	IS-5290-1969	Internal Landing Valve.
11.	IS-884-1969	First and hose reel.
12.	IS-934-1976	Specification for portable chemical fire Extinguisher soda acid type.
13.	IS-2873-1969	Specification for fire extinguisher for carbon dioxide.
14.	IS-2189 & 2109	Automatic fire alarm system or BSS-3116
15.		National Building Code.

2.0 For Detailed Specification of Fire Detection and Alarm System (Based on DSR 2019) mentioned in SOQ shall be as per CPWD General Specification for electrical works Part VI (FIRE DETECTION AND ALARM SYSTEM) 2018. (corrected up to the last date of submission/uploading of bid).

3.0 CCTV & PA SYSTEM:

DESIGN CONCEPT & SCOPE OF WORK:

3.1 IP CCTV SURVEILLANCE SYSTEM

3.1.1 DESIGN CONCEPT:

- ✓ The entire IP surveillance system is designed to control and monitor the different blocks of the CDRI campus. All the corridors shall have IP Fixed dome camera to monitor the connecting corridors
- ✓ There are three types of cameras shall be installed to monitor the movement of the people as follows:

- IP fixed dome camera indoor type
- IP PTZ camera outdoor type
- IP fixed box camera outdoor type

✓ IP fixed dome camera shall be installed at the entrances and connecting corridors of the main buildings like laboratories, administration block, computer hub, special equipment and lab engineering services, library, auditorium, chemical storage and animal house.

✓ IP PTZ camera shall be mounted on the pole at different locations for outside surveillance purpose.

✓ IP fixed box camera shall be mounted on the pole at all boom-barrier and turnstile locations to monitor the vehicles and pedestrians passing by there.

✓ All cameras shall be true IP camera.

✓ All outdoor cameras shall be in IP-66 housing.

✓ All outdoor items for cameras like JBs, power supply, media convertor etc. shall be in water poof and dust proof housing.

✓ Purchaser's LAN network being laid by third party would be utilized to extend the IP CCTV connectivity to central server

✓ All CCTV cameras shall have connectivity to non- PoE port of purchaser's networking switches on LAN.

✓ UPS Power supply for each camera.

✓ Tentative locations of cameras are indicated in the IP CCTV, ACS, Boom Barriers and Turnstiles layout drawing enclosed with this tender

3.1.2 SCOPE OF WORK:

✓ Supply, installation, testing and commissioning high quality fast-acting IP CCTV surveillance system along with power supply, power distribution and required accessories in different blocks of CDRI campus as indicated in BOQ.

✓ The entire system shall be as per BOQ, drawings and technical specifications enclosed with tender documents.

✓ The price coated by the vendor should include all the expenses incurred in commissioning of all cameras with power supply, accessories and other devices complete with software.

✓ The CCTV surveillance system should consist of IP Fixed dome cameras (indoor type), PTZ & fixed box cameras (outdoor type), software, server, power supply and cables.

✓ Video management software shall offer both video stream management and video stream storage management. Recording frame rate and resolution in respect of individual channel shall be programmable.

✓ The system is presently designed for 45 cameras whereas not limited to the same and scalable upto unlimited cameras if required in the future.

✓ Provide supervisory specialists and technicians at the job to assist in all phases of system installation, start up and commissioning.

- ✓ Cat 6cable/fiber cable connectivity with all required hardware upto purchaser's networking switches of LAN, locations of networking switches in CDRI campus are indicated in the list. Enclosed with this tender document.
- ✓ 230 volts AC Power supply distribution from UPS to each location of cameras along with DBs, JBs, cabling work etc. with required accessories.
- ✓ Power supply unit as required for cameras.
- ✓ Integrated testing and commissioning of CCTV system on LAN being provided by the third party in CDRI campus.
- ✓ Training & handing over of all materials, equipment and appliances.
- ✓ **Any other items/accessories required for installation, testing and commissioning of CCTV system.**
- ✓ No extra cost shall be paid for miscellaneous items if required to complete the work as per the design concept.

3.1.3 SUBMITTALS: (IP CCTV)

Drawings: The system supplier shall submit all shop drawings, and bill of materials for approval /reference.

a) Drawings shall be submitted in standard sizes as indicated
b) Four complete sets (copies) of submittal drawings shall be provided.
c) Drawings shall be available on CD-ROM.
d) CCTV layout drawing (A1 size)
e) Installation drawing for each item (A3 size)
f) Bill of Materials (A4 size)
g) Cable connectivity drawings and cable schedule. (A3 Size)
h) Power distribution scheme (A3 size)
i) Specifications and data sheet for each item (A4 size)
j) List of software and software licenses, (A4 size).
k) Test certificates, Internal test reports etc.

(i) System Documentation

- ✓ System configuration diagrams in simplified block format.
- ✓ Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
- ✓ Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.
- ✓ A list of all functions available and a sample of function block programming that shall be part of delivered system.
- ✓ Shop drawings of card reader stand, canopy/shed as approved by Project Architect.
- ✓ Test certificates and internal test reports for each item
- ✓ Quality Assurance Plan
- ✓ Operation and maintenance manuals.

(ii) Project Management

- ✓ The supplier shall provide a detailed project design and installation

schedule with time markings and details for hardware items and software development phases.

- ✓ Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.

(5) QUALITY ASSURANCE:

- ✓ The entire system shall be installed and commissioned from a single vendor to assure reliability and continued service.
- ✓ The vendor shall be required to train and instruct client's personnel in the correct use, operation and supervision of the system, preferably prior to the handing over of the project.
- ✓ The supplier shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.

(6) TESTING:

- ✓ **Component Testing**: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every component shall be individually tested by the manufacturer prior to shipment.
- ✓ **Tools, Testing and Calibration Equipment**: The supplier shall provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.

(7) POWER SUPPLY:

230 V $\pm$ 10 %, 50 Hz $\pm$ 5% shall be made available for UPS input. Bidder's scope shall include complete power distribution for IP CCTV system, Access Control system, Boom Barriers and Turnstiles, including complete cabling work, DBs and required electrical accessories with suitable protection devices from UPS (in bidder's scope) and UPS output to IP CCTV cameras , Access control devices, Boom Barriers and Turnstiles.

E. TECHNICAL SPECIFICATION OF HVAC WORK:

1.0 GENERAL:

Intent of these specifications is to define the requirements for design, supply, installation, testing and commissioning of air conditioning system. The contractor's liability shall not be limited to the scope of work mentioned, but shall also extend to achievement of the desired conditioned as per the BASIS OF DESIGN, complete, safe and satisfactorily operating System as approved by the Project Architect / EIC. Any

alternations / additions, apparatus, material and labour required in order to achieve the completeness of the A/C system as above shall be deemed to be included in contractor's scope without any extra charge whether the same have been covered or not in the specifications and drawings. However, any changes required in design and installation shall be brought to the notice of the Architect/EIC; and due approval shall be obtained therefore.

The entire work shall be performed in accordance with the terms and conditions and generally as per the scope drawings set forth in the documents and shall comply with the relevant Bureau of Indian Standards Specifications and Good Engineering Practices.

The contractor shall employ a qualified Erection/Project Engineer at site and he shall be assisted by adequate number of skilled supervisors and experienced staff.

Any material supplied by the contractor, if damaged in any way during cartage or execution of work or otherwise shall be made good by the contractor at his own cost.

1.1 SUBMISSION BY THE CONTRACTOR:

The contractor shall submit three complete sets of drawings to the Engineer-in-charge after completion of the work. These drawings must give following information.

Installation drawing of air conditioning plant room.

Refrigerant distribution system layout drawing.

Schematic diagram of various controls used in air conditioning System.

Schematic diagram of electrical installation for air conditioning System, and ferrule drawings.

Detailed maintenance schedule for smooth running of the air conditioning system.

List of spare-parts required for two years satisfactory performance of the system.

1.2 GUARANTEE:

The contractor shall guarantee the installation for a period of 12 months from the date of erection / take-over certificate respective of the date of supply / erection of any equipment. Guarantee shall cover all components of the A/C System, irrespective of the nature of item, any consumable items like refrigerant gas, oil, etc. if the loss of the same is due to reasons attributed to contractor. Any damage or defect that may arise or lie discovered or in any way be connected with the equipment or fittings supplied by him or in the workmanship shall deemed necessary by the Engineer-in-charge. The achievement and maintaining of prescribed conditions throughout the Guarantee period shall be the responsibility of the contractor.

Contractor shall also provide routine preventive maintenance to the system/plant for the trouble-free operation of the system, and remove any faults that may arise during the guarantee period without any cost.

1.3 SCOPE AND STIPULATIONS:

This section relates to describe in general scope of work within this contract and stipulations.

Scope: The scope of work includes design, supply, installation, testing and commissioning of the Air Conditioning system installation for the application mentioned herein above.

The scope of work for the air conditioning system shall be as per the schedule of quantities and scope drawings.

Drawings: The tender drawings which are enclosed herewith shall serve as scope drawings. They indicate the general scheme of the air conditioning system requirement. However, actual location, distance, levels will be governed by actual field conditions, contractor shall check architectural, structural, water supply, drainage, false ceiling, lightning and other services plans to avoid possible installation conflicts. Should drastic changes from original plan be necessary to resolve such conflicts, the contractor shall notify the Architect and secure written approval before the installation is started. Contractor must submit the coordinated shop floor drawings prior to execution of HVAC Works and get the approval of Engineer in charge/Project architect/Project architect

Discrepancies in different plans or between plans and actual promptly be brought to attention of the Engineer in charge/Project architect/Project architect for a decision.

Shop / Working Drawings: The contractor shall submit to the consultant detailed shop/working drawings covering all items of equipment and installation.

Shop / working drawings shall show detailed dimensions of all equipment's, space requirements for access, repair and maintenance for equipment's, frame details, support details, foundation drawings etc. The shop/working drawings shall also contain details that require for A/C equipment's installation, cutouts, openings, framework, and foundations etc. that require for the A/C system.

No fabrication and installation should be put into execution until these drawings are approved by the Project architect.

The contractor shall initially submit in triplicate the drawings prepared by him for checking and verification by the Project architect/EIC. The contractor shall submit adequate copies of final drawings as required by Project architect/EIC on approval.

Codes and Regulations:

The installation shall be in conformity with bye-laws and regulations of local authorities concerned in so far as these become applicable to the installation. The installation shall be in conformity with the relevant Indian Standard Codes and Practices of which reference is made in the particular section of these specifications. Wherever a reference of Indian Standard Specification is made in the particular section of these specifications, wherever a reference of Indian Standard Specification is made in this document, it should imply to the latest revision of that standard, including such revisions / amendments as may be issued by the Bureau, during the course of the work contract.

Compliance with all the applicable laws/rules pertaining to materials and workers/personnel shall be the liability of contractor.

In case if the drawings and/or specifications require something, which violates the bye-laws and the regulations shall govern the requirement of this installation and the fact shall be brought to the notice of the Project architect/EIC.

Materials & Workmanship: The materials used by the contractor shall be new, free from defects and of the best quality and workmanship and shall be in conformity with the latest and best engineering practice.

Testing/Quality Assurance programme:

(i) All equipment's and space conditions shall be tested to establish equipment ratings and indoor space conditions. The test results shall be furnished to the Engineer in charge/Project architect/Project architect as per the tender. Instruments required for testing shall be furnished by the contractor, all instruments for measuring performance parameter needs to be calibrated and calibration certificates for those instruments to be produced when necessary. Contractor to submit the material test reports to Engineer in charge/Project architect/Project architect. Contractor must submit a hardcopy of Quality assurance programme for material/AC System, with necessary test templates for getting approval from Engineer in charge/Project architect/Project architect. Once approved the same to be used throughout the phase of project. Any material without approval shall not be brought to site.

(ii) After testing and commissioning, all equipment's shall be labelled in an approved manner.

(iii) All equipment shall be guaranteed for the specified ratings with + / - 3% tolerance.

(iv) After all the tests and adjustments have been made, the plant to be put to running test for a period of daily from 9.00 AM to 5.30 PM or 3-7 days continuously. The temperature readings to be taken on hourly basis and the same test to be witnessed by Engineer in charge/Project architect.

(v) Factory test if required by Engineer in charge/Project architect, then the contractor to organize the same, travel/boarding will be borne by Client.

Training : The contractor shall provide free training at site in operation and maintenance of the system supplied by them to the client. The duration of training shall be minimum ten-fifteen days or till the time client is completely conversant with the operation and maintenance of the System.

h. Supervision: The work shall have to be carried in best workman like manner and supervised by competent erection engineers having adequate experience in the similar kind of work.

i. Clean Up At the Work Site: It is contractor's responsibility to keep site clean during the execution, installation, and after the execution of work, from debris, rubbish and wastage of any material used by him.

1.4 SCHEDULE OF QUANTITIES:

The quantities of piping, cabling, etc. mentioned in the tender documents are tentative and are given for tenderer's guidance and to have uniform basis for tendering.

The accompanied tender drawings show the route of refrigerant piping, and equipment layout. Should there be any ambiguity in plans and specifications or obstructions, the same should be brought to the notice of the Project architect/EIC while submitting the tender documents.

The contractor should carry out detailed calculations for estimating the quantities of variable quantity items on approval of drawings. Any increase or reduction in the quantities of variable items shall be payable or deducted at the unit rate for that particular item. Any extra item not covered under the schedule of quantities but needed for the completion of the work shall be first approved by the Project architect/EIC. In case, the estimated quantity exceeds the quantity mentioned in Schedule of Quantities by over 5% written approval from the owner and the Project architect/EIC should be obtained before delivering the item/s, failing which, no claim for increase in final Contract Value may be entertained on this account.

1.5 APPROVAL OF DRAWINGS:

While it will be attempted to accord the technical approval of the contractor's shop/working drawings on an expeditious basis, it will be the responsibility of the contractor to secure from the other related agencies like the Architect, Interior Designer etc. their approval for the scheme of installation as far as the building and interior layouts, aesthetics etc. are concerned.

The approval of the drawing by the Project architect/EIC shall in no way relieve the contractor from the responsibility of providing a complete and satisfactory installation and achieving and maintaining the stipulated design conditions. Any errors, omissions and shortfalls shall be rectified, and made good free of cost to the owner regardless of the fact that the installation may in the first place have been carried out as per the approved drawings.

1.6 MODE OF MEASUREMENT:

Piping (bare / insulated), cabling, earthling etc. physical measurements and geometrically worked out quantities shall be considered without any additions for bends, reducers, fittings, valves, strainers etc.

1.7 STIPULATED COMPLETION PERIOD:

The entire work including design, manufacture, supply, installation, testing and commissioning is to be completed within the completion period mentioned in the GCC of this Tender Enquiry.

1.8 The Tender Drawings are meant for the purpose of defining the scope and the broad scheme of installation. The Contractor shall, on award of the work, prepare working Drawings based on the Tender Drawings and the final Civil and Interior Drawings; incorporating the actual equipment dimensions, duct sizes, etc.

1.9 The Bidders must check and confirm the adequacy of the installation space for A/C machines vis-à-vis their actual equipment dimensions, piping installation space, etc. shown on the Drawings. Any changes required must be clearly brought to the notice of Project architect/EIC at Tendering stage. No changes shall be possible later. Additional trapdoors if required to be taken approval from Architect.

1.10 Notwithstanding anything indicated in this Document, all the components of the A/C system should be selected, designed and installed in such a manner as to prevent objectionable noise or vibrations being transmitted to the A/C areas.

1.11 On award of the work and from time to time thereafter, area wise priorities and sequence shall be informed to the Contractor, based on which the Contractor should submit break-up of the overall completion time; and strictly adhere to the same.

1.12 The indicated configuration of air conditioners is based on the estimated A/C load to achieve the stipulated inside temperature during peak load conditions (i.e. on a summer afternoon with full occupancy).

Notwithstanding anything stated/specified in this Document / Drawings, it is to be clearly understood that it is the responsibility of the contractor to achieve and maintain the stipulated inside temperature and uniformity of conditions in all the air-conditioned areas.

2.0 HEAT LOAD

2.1 The tenderer should work out heat load and air quantity independently and confirm the same in the tenderer's confirmation.

(a) Description of the work to be carried out:

The estimated peak air conditioning requirement of the various areas with occupancy and all other internal loads as listed in the table.

(i) Each floor is having centralized Variable Refrigerant flow Air-conditioning System as per the attached BOQ.

(ii) Each indoor unit (FCU)/Cassettes should have individual Temperature controller and each floor should have one central station to control the FCU/Cassettes ′s of entire block.

(iii) Necessary power with Panels and DBs will be provided by Electrical agency at site. However, contractor has to arrange for own construction power.

(iv) It is also proposed to install BMS system as specified in the tender elsewhere. VRV to be compatible with BMS System.

(v) It is proposed to install the air cooled VRV condensers at Terrace. Copper piping interconnecting between indoor and condenser will be through the identified shaft.

2.1 BASIC DESIGN AND DESCRIPTION OF PROPOSED A/C SYSTEM

2.1.1 Basic consideration for estimation

Site : Guwahati.

Latitude : 26.1445° North

Longitude : 91.7362° East

Mean sea level : 49 - 55 meters above Sea level

Area to be air-conditioned

Office areas as detailed in data sheet

Occupancy : As per DBR

Lighting load : As per DBR.

Equipment load : As per DBR.

Fresh air quantity : 10-15 cfm per person or 1.0 air change per hour whichever is higher.

Note: The complete design of air conditioning shall be as per latest codes and specification.

3.0 VARIABLE REFRIGERANT FLOW SYSTEM

3.1 VARIABLE REFRIGERANT FLOW TYPE SYSTEM:

The system shall be Variable Refrigerant Flow type multi-unit air-conditioning system complete with indoor and outdoor units with individual controller for cooling & heating type operations. System shall be BMS compatible; contractor shall be shall be responsible for coordination between BMS and Airconditioning. Supply/ Installation of Modular type VRF Outdoor System, equipped with Efficient Scroll 100% Inverter compressor, Hot & Cold both option, special acrylic precoated heat exchanger, low noise condenser fan, auto check function for connection error, auto address setting of following capacity. Outdoor shall be capable to operate in Ambient conditions (Cooling / Heating) from -5 Deg C to 52 Deg C and from -15 Deg C to 24 Deg C. VRF / VRV must be equipped with Variable Energy Efficiency Regulation device feature which shall be enabling the ODU to perform in #3 Modes (Basic Mode / Turbo Mode and High Efficiency Mode) with varied EER in all three modes.

F. TECHNICAL SPECIFICATION OF LIFT WORK:

1.0 SCOPE OF WORK

These specifications cover the details of 2(Two) nos. 15 persons/1020 kgs. capacity Passenger lifts including suitable Brake release tools to be designed supplied, inspection as may be necessary before dispatch, delivery at site, installation, testing, commissioning and handing over to CDRI and the defects liability for a period of 1 year after completion of all works & handing over to client. Scope of work shall also include AMC (Annual maintenance contract) for 3 years after one year of defect liability period after handing over to client.

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

2.0 GENERAL

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

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

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

3.0 DRAWINGS

Before commencing work, the Contractor shall prepare and submit all drawings for individual lifts in required nos. necessary to show the general arrangement and details of lift installation, electrical etc. These drawings must be approved by the EPI/CDRI 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, hoistway and machine room layouts clearly indicating and specifying all connected structural, electrical and architectural works including imposed structural static / dynamic loads (including breaking load on guides, reaction of buffers on lift pits, reaction on support points in machine room, lift well etc.) and electrical ratings including calculations for selection of kW rating of motor. Within 10 days of receipt of letter of award of contract, the Contractor shall obtain from the EPI/CDRI all the information he needs to prepare his drawings and shall have any interaction with the EPI/CDRI to finalise all parameters and data for design. The Contractor will be responsible for any discrepancies, errors and omissions in the drawings or particulars submitted by him even if these have been approved by the EPI/CDRI. On approval of these drawings (within 2 weeks of submission of full documentation), the Contractor shall submit 8(eight) 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 8 (eight) 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 EPI/CDRI.

4.0 WORKS TO BE ARRANGED BY EPI/CDRI

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 main L.T. 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. Free 3 phase power supply for group testing and commissioning of lifts after erection is completed.

v. Lighting installation within machine rooms as required by the lift Contractor including 1-phase main switch with ELCB at machine room.

vi The equipment shall be suitable to operate on 415 Volts 3 phase, 4 wires, 50 Hz. A.C. supply with a variation of $\pm$10% in Volts and +5% in frequency respectively. The supply for illumination and single-phase equipment shall be 230 Volts A.C.

vii Lighting installation within hoistways and pits as required by the lift Contractor including 1-phase main switch at machine room.

viii. Ventilation system of machine rooms with minimum 18" heavy duty exhaust fan in each machine room as per the requirement of NBC / BIS codes.

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

5.0 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 hoistways.

iii. Sill tracks including sill supports, supporting protection at all landings.

iv. Screen guards, facia plates and other protection for installation.

v. To carry out minor civil work, such as chipping & making openings in slabs , grouting of foundation bolts in shaft, pit and machine room, modification and making rail bracket, hall buttons indicators and laying of sills in positions. Or any other work required for smooth operation/ commissioning of lifts. All chiseling and cutting of pockets and making good. (All cutting shall be as approved by EPI/CDRI).

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

vii. Scaffolding and other Tools & Tackles required for installation in the hoist-way required for erection of lifts.

viii. All other items necessary for satisfactory execution & completion of works, whether specified or not.

ix. Power shall be provided at incoming of main DB for lifts. Main DB in the machine room shall be provided by the lift contractor. From main DB to lifts, cables shall be in the scope of lift contractor. However, lighting for machine room shall be done by others.

x. Trap doors, floor gratings, steps / ladders and openings in machine rooms and ladders for pits as required by the lifts Contractor. Contractor shall furnish the details of these items in the layout drawing for lifts to submitted after award of the job.

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

6.0 SOUND REDUCTION

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

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

7.0 TRACTION MACHINE

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

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

Rotating parts shall be statically and dynamically balanced.

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

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

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

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

8.0 HOIST MOTOR

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

shall have overload protection. The motor shall have good speed regulation under different conditions of load and shall be designed to give a noiseless and vibration-free operation. Insulation shall be class F.

9.0 MOTOR CONTROL AND DRIVE

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

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

Frequency shall range fully between zero and rated value.

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

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

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

10.0 GUIDES AND FASTENINGS

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 hoistway and pit , such that It shall be not be possible for any of the car or counter weights shoes to run off the guides.

iv. Guides shall be designed to withstand the action of safety gear when stopping a counter weight or fully loaded car.

v. The max. deviation from true plumb and alignment of guide rails shall be 2 mm.

vi. All support framing shall be rigid and shall be designed to restrict displacement of the point of support of brackets to 3 mm under normal working conditions.

vii. The whole guide rail installation, including expansion joints, shall be designed for a smooth ride.

viii. The guide-rails shall be protected during storage and installation with a rust inhibiting coating which shall be cleaned off on completion of installation.

ix. Guide-shoes shall be adjustable type & mounted so as to provide continuous contact with guide rails under all conditions.

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

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

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

11.0 SAFETY

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

i. Against overload

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

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

iii. Overspeed centrifugal governor operating the safety gear in case of over-speeding of car in the down direction.

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

v. Overtravel limit switches at top and bottom limits of travel to disconnect the power supply and apply brakes to stop the car within a defined safe distance in case of overtravel in either direction

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

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

viii. Toe guard apron to the car platform.

12.0 CAR

a. Cabin Size

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

b. Frame and Safety Device

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

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

c. Buffers

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

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

d. Counterweight

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

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

e. Hoisting and Governor Ropes

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

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

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

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

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

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

f. Enclosure

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

g. Brakes

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

h. Doors

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

i. Door Operators

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

j. Travelling Cables

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

k. Emergency Lighting

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

l. Intercom

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

m. Manual Cranking Facility

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

n. Emergency Stop Switch

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

o. Maintenance Switch

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

p. Landing Door Interlocks

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

q. Overload Indicator (Only in Passenger elevator)

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

r. Other Features

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

s. Lift for Disabled

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

i. Full length handrails shall be provided on the rear and side wall panels.
ii. The door closing time shall be set for min. 5 seconds and the door closing speed shall not exceed 0.25 m/sec.
iii. The "door open" and "door closed" announcements shall be audibly made in the car.
iv. Braile signs / buttons.

t. Operating Panels, Buttons & Switches

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

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

13.0 ELECTRIC WIRING

Necessary insulated wiring to connect all parts of the equipment shall be furnished and installed. Insulated wiring shall be flame retardant and moisture

resistant and shall be run in G.S. conduits. All cables shall be flame – retardant with copper conductors.

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

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

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

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

14.0 PAINTING

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

15.0 WORKS TESTS

The following tests shall be carried out at Works. EPI shall be given notice of the time and procedure of the tests before they are carried out, and shall be given facilities for observing the tests at Works.

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

b. Buffer test.

16.0 TESTS ON COMPLETION

The following tests shall be carried out to the satisfaction of the EPI/CDRI.

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.

17.0 STATUTORY APPROVALS

All statutory approvals from commencement to commissioning of lifts shall be obtained by the Contractor from the Inspector of Lifts and / or other authorities. However, the client will provide all necessary assistance for providing documents, drawings and certificates pertaining to other contractors, if required.

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

18.0 FEATURES REQUIRED FOR VVVF LIFTS

(a) Group / Independent / Attendant Operation

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

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

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

(b) Fireman's Switch

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

(c) Emergency Power Operation

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

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

(d) Profile Generator

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

(e) **Predictive Car Selection**

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

(f) **Home Landing Facility**

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

(g) **Door Safety**

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

(h) **Double Door Operation**

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

(i) **Nudging Door Operation**

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

(j) **Selective floor Service**

Programming for selective floors services shall be software driven.

(k) **Manual Cranking & Slow speed Travel**

A manual cranking facility shall be provided.

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

(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.

19.0 PERFORMANCE PARAMETERS

The following parameters shall be achieved in the installation :

*	Levelling Accuracy	$\pm$ 3 mm for 1.5 m/s speed
		$\pm$ 4 mm for 0.75 m/s speed
*	Jerk level	0.9 – 1.5 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/s^2 (adjustable)
*	Max. car vibration	20 milli gals.

20.0 SUBMITTALS 'ALONGWITH TENDER' AND 'POST AWARD'

(A) The following items are required to be submitted in duplicate **along with the Tender**.

i. Catalogues with offered items highlighted.
ii. List of imported components, if any.
iii. Compliance Statement for guaranteed performance parameters given in Specification 19.0 above.
iv. Confirmation that offer submitted meets the technical specifications & scope of work and there are no deviations and exclusions from NIT.
v. The contractor shall specify in his offer the full capability of his system in this regard.

(B) The successful contractor, **after award of the contract** ,shall furnish following technical particulars of the equipment/devices for the approval by CDRI/EPI.

i) Single line/ schematic diagram of electronic control panel, lift & equipment etc.
ii) Layout of Hoist-way, Lift machine room, showing foundation details in the pit, machine room, electric control panel, Lift & equipment etc.
iii) Earthing layout.
iv) Inspection manual for equipment & accessories covered in the scope of supply (8 copies).
v) Technical literature of operation, control and maintenance etc. (8 copies) along-with CDS.

vi) Schedule of scope of maintenance service during defect liability period and AMC.

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

21.0. MAINTENANCE DURING DEFECTS LIABILITY PERIOD

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

G. TECHNICAL SPECIFICATION OF LANDSCAPE WORK:

1.0 LANDSCAPE WORK:

Landscaping (Horticulture) operations shall be started on ground previously levelled and dressed to required formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or, replaced or it shall be covered over to a thickness decided by the Engineer-in-charge with good earth. In the course of excavation or trenching during horticultural operations, any walls, foundations, etc. met with shall not be dismantled without pre-measurement and prior to the written permission of the Engineer-in-charge.

2.0 TRENCHING IN ORDINARY SOIL:

2.1 TRENCHING:

Trenching is done in order to loosen the soil, turn over the top layer containing weeds etc. and to bring up the lower layer of good earth to form a proper medium for grassing, re-grassing, hedging and shrubbery. Trenching shall be done to the depth ordered by the Engineer-in charge. The depth is generally 30 cm for grassing and 60 cm for re-grassing in good soil.

2.1.1 The trenched ground shall, after rough dress, be flooded with water by making small kiaries to enable the soil to settle down. Any local depression

unevenness etc. shall be made good by dressing and/or filling with good soil.

2.1.2 Weeds or other vegetation which appear on the ground are then uprooted and removed and disposed off and paid.

2.1.3 Trenching shall consist of the following operations: 1. The whole plot shall be divided into narrow rectangular strips of about 1.5 m width or as directed by the Engineer-in-Charge. 2. These strips shall be sub-divided lengthwise into about 1 m long sections. Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceding it. 3. In excavating and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layer of trenched area, the dead plants so buried incidentally being formed into humus. 4. The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with leads is practically eliminated.

2.1.4 Measurements Length and breadth of the plot shall be taken correct to 0.1 m and depths correct to cm. Cubical contents shall be calculated in cubic meters, correct to two places of decimal. No deduction shall be made nor extra paid for removing stones, brick bats and other foreign matter met with during excavation upto initial lead of 50 m and stacking the same.

2.1.5 Rate The rate shall include the cost of all labour and material involved in the operations described above, including cost of all precautionary measures to be taken for protections and supporting all services etc. Met with during trenching. It does not include the cost of mixing of earth, sludge/manure.

2.2 GOOD EARTH

2.2.1 The earth shall be stacked at site in stacks not less than 50 cm high and of volume not less than 3.0 cum.

2.2.2 Measurements: Length, breadth and height of stacks shall be measured correct to a cm. The volume of the stacks shall be reduced by 20% for voids before payment, unless otherwise described.

2.2.3 Rate: The rate shall include the cost of excavating the earth from areas lying at distance not exceeding one km. from the site, transporting the same at site breaking of clods and stacking at places indicated. The rate shall also include royalty if payable.

2.3 SUPPLY AND STACKING OF SLUDGE

2.3.1 It shall be transported to the site in lorries with efficient arrangement to prevent spilling en-route. It shall be stacked at site. Each stack shall not be less than 50 cm height and volume not less than 3 cum.

2.3.2 Measurements Length, breadth and depth of stacks shall be measured correct to a cm. The volume of the stack shall be reduced by 8% for looseness in stacking and to arrive at the net quantity for payment.

2.3.3 Rate The rate shall include the cost of labour and material involved in all operations described above, including carriage up to one km. The rate shall also include royalty if payable.

2.4 SUPPLY AND STACKING OF MANURE

2.4.1 Farmyard Manure: Same as 2.3.1.
2.4.2 Measurements: Same as 2.3.2.
2.4.3 Rate : Same as 2.3.3.

2.5 EXCAVATION AND TRENCHING FOR PREPARATION OF BEDS FOR HEDGE AND SHRUBBERY

2.5.1 Beds for hedges and shrubbery are generally prepared to width of 60 cm. to 125 cm. and 2 to 4 meters respectively.

2.5.2 Beds for hedges and shrubbery shall be prepared in the following manner. The beds shall first be excavated to a depth of 60 cm. and the excavated soil shall be stacked on the sides of the beds. The surface of the excavated bed shall then be trenched to a further depth of 30 cm, in order to loosen the soil, in the manner described in 2.1. No flooding will be done at this stage but the top surface shall be rough dressed and levelled. The excavated soil from the top 60 cm depth of the bed stacked at the site shall then be thoroughly mixed with sludge over manner in the proportion 8:1 by ratio or other proportion described in the item. The mixed earth and manure shall be refilled over the trenched bed, levelled neatly and profusely flooded so that the water reaches even the bottom most layers of the trenched depth of the bed. The surface after full subsidence shall again be refilled with the earth and manure mixture, watered and allowed to settle and finally fine dressed to the level of 50 mm to 75 mm below the adjoining ground or as directed by the Engineer-in-Charge. Surplus earth if any, shall be disposed off as directed by the Engineer-in-charge. Any surplus earth if removed beyond initially lead shall be paid separately. Stones, bricks bats and other foreign matter if met with during

excavation or trenching shall be removed and stacked within initially lead & lift, such material as is declared unserviceable by the Engineer-in-charge shall be disposed by spreading and levelling at places ordered by him. If disposed outside the initial lead & lift, then the transport for the extra leads will be paid for separately. If a large proportion of material unsuitable for the hedging and shrubbery operations is met with and earth from outsides is required to be brought in for mixing with manure and filling, the supply and stacking of such earth will be paid for separately.

2.5.3 Measurements

Length, breadth and depth of the pit excavated and trenched shall be measured correct to a cm. The cubical contents shall be calculated in cubic meter correct to two places of decimal.

2.5.4 Rate

The rate shall include the cost of all the labour and material involved in all the operations described above. The rate shall not include the cost of supply & stacking of the manure unless the same is specifically included in the description of the item.

2.6 DIGGING HOLES FOR PLANTING TREES

2.6.1 In ordinary soil, including refilling earth after mixing with oil cake, manure and watering.

2.6.1.1 Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and excavate soil broken to clods of size not exceeding 75 mm in any direction, shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the size as directed. Useful material, if any, shall be stacked properly and separately. Good earth in quantities as required to replace such discarded stuff shall be brought and stacked at site by the contractor which shall be paid for separately. The tree holes shall be manured with powdered Neam/castor oil cake at the specified rate along with farm yard manure over sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particle not be exceeded 6 mm in any direction) in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then profusely watered and enable the soil to subside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm below the adjoining ground level or as directed by the Engineer-in-charge.

2.6.1.2 Measurements:
Holes shall be enumerated.

2.6.1.3 Rate:
The rate shall include the cost of all the labour and material involved in all the operations described above, excluding the cost of supply and stacking the requisite quantity of manure/ sludge and oil cake.

2.7 M.S. FLAT IRON TREE GUARD

2.7.1 M.S. Iron Riveted Tree Guard

2.7.1.1 The tree guard shall be 600 mm in diameter and 2-meter-high above ground level and 25 cm in below ground level.

2.7.1.2 The tree guard shall be framed of 4 nos. 25 x 6 m M.S. flat 2 meter long excluding displayed outward at lower and upto an extent 10 cm and 8 nos. 25 x 3 mm vertical M.S. Flat Rivetted to 3 Nos. 25 x 6 mm Flat iron rings in two halves, bolted together 8 mm dia and 30 mm long M.S. bolts and nuts. The entire tree guard shall be given two coats of synthetic enamel paint of approved brand and manufacturer of required shade over a priming coat of ready mixed steel primer of approved brand and manufacturer. The design of tree guards shall be shown in the drawing.

2.7.1.3 Measurement:
The tree guard shall be enumerated.

2.7.1.4 Rate:
The rate shall include the cost of all the labour and material involved in all the operations described above.

2.7.2 M.S. Flat Iron Welded Tree Guard

2.7.2.1 The tree guard shall be 600 mm in diameter and 2-meter-high above ground level and 25 cm in below ground level.

2.7.2.2 The tree guard shall be framed of 4 nos. 25 x 6 mm MS. Flat 2 meters long excluding displayed outward at lower and upto an extent 10 cm and 8 Nos. 25 x 3 mm vertical M.S. Flat Riveted to 3 nos. 25 x 6 mm flat iron rings in two halves, bolted together 8 mm dia and 30 mm long M.S. Bolts & nuts. The entire tree guard

shall be given two coats of synthetic enamel paint of approved brand and manufacturer of required shade brand and manufacturer of required shade over a priming coat of ready mixed steel primer of approved brand and manufacturer. The design of tree guards shall be shown in the drawing.

2.7.2.3 Measurement:
The tree guard shall be enumerated.

2.7.2.4 Rate:
The rate shall include the cost of all the labour and material involved in all the operations described above.

2.8 FILLING MIXTURE OF EARTH & SLUDGE OVER MANURE

2.8.0 The separately specified earth and sludge shall be broken down to particles of size not exceeding 6 mm in any directions before mixing. Good earth shall be thoroughly mixed with sludge over manure in specified proportions as directed by Officer-in-Charge. During the process of preparing the mixture as above, trenches shall be flooded with water and levelled.

2.8.1 Measurements
Measurement shall be made in (Length, breadth and height of stacks) cubic meter. The cubical contents shall be worked out to the nearest two places of decimal in cubic meter.

2.8.2 Rate
The rate shall include the cost of all the labour and material involved in all the operations described above, but do not include the good earth, sludge or manure which will be paid separately.

3.0 SPECIFICATIONS OF PLANTS (Plants, Trees Shrubs taken in SOQ) :

3.1 The plants, Trees and shrubs included under SOQ should be as per following specification.

1 The plants should be full of fresh and healthy foliage.
2 The plants should be free from insect, pest and disease.
3 Plant should be healthy and vigorous growth
4 The height of the plants will be measured from top of the pots.

5 The plants should be well settled and should not be newly shifted.
6 The plants should be true to the variety and named Variety should be tagged.
7 Moss stick used should be made on plastic pipe.
8 Moss stick should be straight and properly fixed in the pot.
9 The rejected plants materials should be removed from the site immediately.
10 Moss stick should be covered with the plants in case of plants supplied with moss stick.
11 The Plant should be well stablished and good spread.
12. Good earth and manure used for filling the pot/poly bag free from any inert material and mixed to proper ratio.
13. Pot/ Poly bag used for filling the plants should be proper size good quality not damaged.
14. There should be proper drainage in pots for plants.
15 The flowering plants should also have proper flowering and should be true to the variety.
16 All plant should have the tendency of growth and should not be stunted type.
17. There should be no stagnation of water in the pots.

H. TECHNICAL SPECIFICATION OF STP WORK:

1.0 DESCRIPTION OF PROCESS SCHEME

In order to conserve water, the treatment plant will be designed to ensure that treated effluent (water) characteristics are well below the permissible limits. It is proposed to use Attached Growth system working on the principle of Fluidized Aerobic Bio-reactor process based on the FAB process.

Waste water will flow via gravity through a bar screen chamber & Oil & Grease Trap to an Equalization Tank. A bar screen will be provided at the inlet point in the bar screen chamber and the waste water will flow through this bar screen into the Tank. Bar screen will be so designed that it can be cleaned manually from outside the Tank. The oil & grease from the Oil & Grease Trap would have to be removed manually. Waste water from the equalization tank will be transferred by means of Pumps into the FAB tank where it will be mixed with living organisms also called MLSS (Mixed Liquor Suspended Solids) in presence of air & air will be introduced through submerged air diffusers (MLSS in aeration tank will be maintained 2500-3000 Mg/L). The FAB system will be designed in a way so as to achieve complete mixing of organisms with raw sewage. After achieving a complete mixing of organisms over a retention period of 10-12 hrs, the effluent would flow via gravity into the Tube Settler. In the tube settler, PVC Tube Media would be provided to

enhance settling of the sludge with attached settling process. Through the use of baffles the liquid in the Tube Settler is maintained in quiescent condition which allows the solids to settle to the bottom for collection. The accumulating solids known as "Sludge" will be constantly pumped back into the FAB tank by sludge recycle pumps. This return sludge undergoes further digestion in the aeration tank and also provides the active organism needed to digest the incoming raw sewage.

The Tube Settler will be provided with adjustable overflow weir to collect the treated effluent and a scum baffle will keep any floating matter from passing out in the final treated water. Treated water from Tube Settler will over flow into a chlorine contact tank where hypochlorite solution will be added to disinfect the treated water.

Excess sludge from the bottom of the Tube Settler will be collected in an adjoining aerobic digester cum thickener tank. In this tank sludge will be aerated. The air will be shut off periodically and supernatant water shall flow into the collection tank. This way the sludge will be thickened and its volume will be reduced. The sludge digester cum thickener tank will be sized to hold excess sludge. The excess sludge will be further passed into a filter press where the sludge will be pressed between plates manually and the liquid concentration in the sludge will be further reduced. The sludge will then form into semi-solid cake which can be removed for disposal.
The treated sewage from STP will be used for irrigation system & flushing water with in the complex.

2.0 DOCUMENTS TO BE SUBMITTED WHILE SUBMITTING SCHEME TO ENGINEER FOR APPROVAL

i) Flow scheme with hydraulics

ii) Size of units

iii) Description of process

iv) List of mechanical and electrical equipment

v) Total Power requirement unit wise

vi) Guarantees

3.0 SUBMISSION OF DESIGN AND DRAWINGS

Selected tenderer shall submit detailed drawings for approval to the client.

4.0 SELECTION OF EQUIPMENT

Subject to the requirement of this specification and the design criteria the tenderer shall select the type of equipment and the form of construction and installation, subject to approval of the Project architect/EIC.

The tenderer shall be entirely responsible for the performance of the sewage treatment works in their totality with due regard to capacity, hydraulics, quality of final effluent, suitability of piping, mechanical and electrical equipment complete and shall give due guarantee for the same.

The tenderer shall submit to the Client / Owner GFC drawings together with sufficient details to give a clear indication of the work to be carried out for approval of the Engineer.

The approval of the Engineer shall in no way relieve the tenderer of his responsibilities for the satisfactory functioning of the works.

All construction materials and workmanship shall conform to the relevant section of the specification and to the approval of the Engineer.

5.0 ERECTION

The tenderer shall undertake the erection of the plant under the direct supervision of the plant manufacturer or their nominated agencies, as approved by the Engineer. The tenderer shall also supply and install all the mechanical and electrical equipment's required for functioning of the sewage treatment plant. The tenderer shall provide with all the facilities required by the Engineer for inspection of the installation.

6.0 PAINTING AND PROTECTIVE COATINGS

All surfaces exposed to the atmosphere shall be painted in accordance with relevant section of specification or as per manufacturer's instructions.

All M.S surfaces exposed to sewage treatment plant shall have protective coatings using epoxy-based paint. The tenderer shall submit full details of all the protective coatings proposed, for approval before any of the equipment, pipe work, etc. of the plant is supplied.

7.0 TESTING

The tenderer shall make all arrangements as required or necessary to prove that the completed works fulfil every aspect of the design requirements and specifications. The tenderer shall provide all labour, material and attendance necessary to the Engineer's satisfaction.

8.0 LUBRICATION

The tenderer shall ensure that all moving parts are lubricated in accordance with the equipment manufacturer's recommended procedures prior to commencement of operation of any plant and also during the operating period.

8.1 In general, STP shall comprises erecting, testing and commissioning of the following items of STP. The sewage treatment plant in general shall comprise following items of work.

(a) 1 No. manual bar screen suitable for 500m3/day flow rate.

(b) 3 Nos. Sewage lifting pumps from equalisation tank (one duty + one stand by) self-priming type capacity 10.0m3/hr at 10m head.

(c) 2 Nos. Drainage lifting pumps from drainage sump (one duty + one stand by) submersible type capacity 18.0m3/hr at 10m head.

(d) 1 Lot Air Grids for MBBR tanks for 500m3/day sewage flow.

(e) 3 Nos. Air blowers (two working and one standby) twin lobe rotary air blower each of capacity 400m3/hr at 6000 mm wg.

(f) 1 No. UV reactor of capacity 40.0m3/hr.

(g) 2 Nos. Filter feed pumps (one working + one standby) each of capacity 40.0m3/hr at 30m head.

(h) 2 Nos. Treated water pumps (one working + one standby) each of capacity 40.0m3/hr at 40m head.

(I) 1 Nos. M.S. pressure Dual Media filter with frontal pipe work capacity. Flow Rate 40.0m3/hr and 3.0kg/cm2 working Pressure.

(j) 1 No. M.S. activated carbon filter with frontal pipe work capacity. Flow Rate 40.0m3/hr and 3.0kg/cm2 working Pressure.

(k) 2 Nos. Sludge pumps (one duty + one stand by) self-priming type capacity 10.0m3/hr at 10m head.

(l) 1 No. Filter press feed screw pumps (one working + one standby) each of capacity 2.0m3/hr at 40 m head.

(m) 1 No. Ozonator of suitable for 500 KLD.

(n) All interconnecting piping and valves for above equipment.

(o) Operating platform alround STP.

(p) 1 Lot Electrical cabling, earthing, MCC and local push buttons station to cater phase-I requirements (Electrical Cabling, earthling including the incoming power supply etc shall be provided by the client. However, connections/terminations to the equipment's, testing and commissioning shall be carried out by the contractor).

(q) Operation & Maintenance contract of STP for a period of two years after commissioning. All spares and replacement of any defective part shall be included in the contract.

9.0 ELECTRICAL WORKS

9.1 Cables

a) Contractor shall provide all power and control cables from motor control centre to various motors, level controllers and other control devices.

b) Cables shall conform to IS:1554 and carry ISI mark.

c) Wiring cables shall conform to IS: 694.

d) All power cables shall be aluminum conductor PVC insulated/PVC sheathed FRLS armoured cables of 1100 volts grade.

e) All control and wiring cables shall be copper conductor PVC insulated armoured and PVC sheathed 600-volt grade.

f) All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.

9.2 Motor Control Centers

Cubicles switch board of floor mounted and shall be fabricated from 16-gauge M.S. sheet with dust and vermin proof construction. It shall be painted with stove enameled paint of approved make and shade. It shall be fitted with suitable etched plastic identifications plates for each motor. The cubicles shall in general comprise of the following:

(A) Incoming and outgoing MCCB's of required capacity with rotary handle.

(B) PVC Colour coated TPN Aluminum bus-bar having current density 0.8Amp/sq.mm.

(C) Isolation switch fuse unit one for each motor.

(D) Fully automatic DOL/Star Delta starters appropriate for motor rating with ON/OFF

push buttons and on/off indicating neon lamps for individual motor.

(E) Single phase preventor of appropriate rating for each motor.

(F) Selector switch for pump operation.

(G) Panel type ampere meters of appropriate rating one for each motor.

(H) Panel type voltmeter on incoming main with rotary selector switch to read voltage between phase to neutral and phase to phase.

(I) Rotary switch for manual or auto operation for each pump.

(J) Space for liquid level controllers specified separately in this contract.

The panel shall be prewired with colour-coded wiring. All interconnecting wiring from incoming main to switch gear, meters and accessories within the switch board panel.

I. TECHNICAL SPECIFICATION OF SOLAR PANEL WORK:

Solar photo Voltaic Power Generation System

1) SOLAR PV MODULE:

A) The solar photovoltaic modules will be used Poly/Multi crystalline, Thin film PV technology modules.
B) The capacity of each Solar Modules should be equal to or greater than 300Wp. Solar Modules to be used have to be framed only. At locations where there is constraint of space, it should be considered higher efficiency modules only.
C) Module would be PID Free and of positive Tolerance only.
D) Modules would have an efficiency of not less than 16% and the fill factor should be above 75%.
E) Minimum dimension of the SPV module shall be preferred.
F) Each SPV Module would have IEC/BIS test certificate from any recognized IEC accredited or MNRE approved laboratory.
G) The SPV modules would confirm to the minimum technical specification laid down by MNRE that can be referred on the MNRE website.
H) The PV Modules shall be tested for Salt Mist Corrosion Test as per MNRE requirement.

PV modules used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years.

2) INVERTER:

The Inverter/s used would be robust, intelligent **On-grid** inverters of reputed manufacturer/makes. The inverter/s must conform to the IEC 61683 and IEC 60068-

2, IEC 62116, IEC 61727. The typical specifications required are as under:
a) All inverters should be 3 phase, 415V, 50Hz AC output
b) The AC capacity of the Inverter can be minimum of 80% of the connected DC capacity to the inverter.
c) Minimum Start Voltage should be greater than 200V
d) MPPT Range: 200V-800V
e) Maximum Input Voltage: 1000V DC
f) Euro / CEC Efficiency above 97%
g) Frequency: 50Hz +/- 1.5%
h) Power Factor > 0.99
i) THD < 3%
j) Ambient Temperature range: -5 deg C to + 60 deg C
k) Warranty: 5 Years Comprehensive warranty. This warranty from the manufacturer shall be in addition to the scope covered under defects liability period.
l) Integrated Ground Fault Protection
m) Anti Islanding Feature
n) Transformer less
o) Over Voltage/ Under Voltage Protection
p) Auto Shut down in case or Over Heat/ Over Temperature

3) SOLAR MODULE MOUNTING STRUCTURE:
a) The structure shall be designed in accordance to the requirement of the site with minimum tilt angle of 15 degrees for RCC roof structure. The array mounting structure shall be designed to allow easy replacement of any module and shall be in line with site requirement. Structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly.
b) The module mounting structure shall be mounted on clear roof space availability with fixed tilt. Tilt angle to be decided by the party to maximize annual energy output as per the site geographical location. Recommended minimum angle of tilt for R.C.C Flat roof terrace for the location is 15 degrees.

The minimum thickness of galvanization for MS or MS extruded sections should be of 50
microns.
All fixing fasteners and nuts and bolts should be of Stainless Steel only.
c) The minimum clearance of the lowest part of the module and the RCC roof level shall not be less than 300 mm.
d) All structures are to be pre-fabricated for easy assembly at site.

4) EARTHING:
The array structure of the PV yard shall be grounded properly using adequate number
of earthing pits. All metal casing or shielding of the solar power plants shall be

thoroughly grounded to ensure safety of the solar power plants.

5) ARRAY JUNCTION BOX:

a) The array junction box would be dust, vermin & water proof as per IP65 rating and should be made of FRP/ABS plastic (Test certification is required for IP65 degree of protection).

b) Suitable Fuses/ MCB's should be provided for each string.

c) A DC Surge Protection Device Class II should be provided in the AJB for grounding the surges to protect the inverter.

d) The AJB should have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.

e) Suitable markings to be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification.

SECTION VII

SECTION VII

LIST OF APPROVED MAKES OF MATERIALS- CIVIL, INTERIOR, PLUMBING, HVAC, SOLAR PANEL, STP, ELECTRICAL AND FIRE FIGHTING FOR REGIONAL OFFICE BUILDING, NHIDCL, GUWAHATI

APPROVED MAKE LIST

SR. NO.	DETAILS OF EQUIPMENT/ MATERIAL	MAKES/ MANUFACTURER
A. CIVIL WORK		
1	Cement	ACC, Ultratech, Ambuja, Vikram, Birla cement,JK Cement, Shree cement & Jaypee Cement
2	Reinforcement Steel / Structural Steel	SAIL, Tata Steel, RINL, Jindal
3	ALUMINIUM Extrusion / SECTIONS	Jindal, Hindalco, Indalco
4	Aluminium Accessories and Hardware	Hardima, Everite, Sigma, Argent, Classic make
5	Aluminium Composite Panels	Alucobond, Reybond
6	Anchor Fastner/Dash Fastner	Hilti, Fisher, Canon
7	Ready Mix Concrete (RMC)	Ultratech, ACC, RMC India
8	Concrete Additive	Pidilite / Fosroc / Fairmate / MC Bauchemie/ Sika/ Cico
9	Door closer / Floor spring	Hardwyn, Godrej, Yale, Ozone
10	Door Locks	Ingerroll Rand, Dorma

11	Door Shutters- Flush	Kitlam, National, Swasthik, Corbett Kitply, CNC, Shivalik, Prima Jayna
12	Doors & Windows Fixtures / Fitting.	Everite / Classic/ Crown / Earl Bihari
13	UPVC DOORS/ WINDOWS/ VENTILATORS	WINSTA, WINPLAST, REHAU, DIMEX.
14	PAINTS (Plastic Emulsion Paint (exterior))	Asian (Apex Ultima)/ Berger (Weathercoat all Guard)/ ICI (Dulux weathershield max)
15	Paints - Other Paints / Primer	ICI Dulux/ Asian/ Berger/ Nerolac
16	Paints - Texture paint	Berger / Spectrum / Unilite Heritage /Asian
17	Paver blocks / Tiles (All Types)	KK / Uni Stone Products (India) Pvt. Ltd/ Hindustan Tiles/ NITCO
18	Epoxy Flooring	Fosroc/ Dr. Beck/ Flamaflor
19	False Ceiling - Calcium Silicate Boards & Tiles	India Gypsum/ Armstrong / Hilux / Saint Gobain (Gyproc)/Aerolite
20	False Ceiling - Metal	Armstrong / Hunter-Douglas / USG-Boral/ Saint Gobain/ Unimet
21	False Ceiling - Mineral fibre	Armstrong / Decosonic / USG-Boral/ AMF/ Saint Gobain (Gyproc)
22	Fire Rated Doors & Frames	Navair / Shakti-Hormann / Pacific/Promat
23	Fire Rated Glass	Asahi India Safety Glass Ltd./ Saint Gobain/ Pilington, Schott, Pyroguard, Glaverbel
24	Fire Retardant Paint	Viper FRS 881/ Nullifire/ Berger
25	Fire Seal	Sealz, Alstroflam/ Abacus

26	Fire: Door Closures, Mortice Dead locks	Becker Fire Solution/ Inersoll Rand/ Dorma/Godrej/ Geze/ Hafele
27	Fire: Panic Exit Devices	Becker Fire Solution/ Inersoll Rand LCN Series/ Dorma PHA Series/ D-line/Godrej
28	Glass : Float & Mirror	Modiguard / Atul / Saint Gobain/ Asahi India Safety Glass Ltd / Modi Glass
29	Glass for Aluminum Doors/ Windows/ Structural Glazing	Modiguard / Saint Gobain / Pilkington/ Asahi India Safety Glass Ltd./Modiglass
30	GRC Jali	Unistone/ Kuber Fibrostone/Everest Composites/ Birla white
31	GRC wall cladding	Unistone/ Kuber Fibrostone/Everest Composites/ Birla white
32	Grout: Non-Shrink	Fosroc / Sikka/Pidilite or equivalant
33	Laminates/ Veneers	Century/Archidply/Greenlam/Formica/Sunmica / Merino
34	Night Latch	Godrej / Dorma/ Ozone/Harrison/Link
35	Paints - Cement Based	Snowcem Plus/, Berger (Durocem Extra)/ Nerolac (Super Acrylic)/ TATA Cem, Asian
36	Plywood/Block board/Ply board	Duroply / Greenply/ Archidply/ Century/ Kitply/ National / Anchor/ Merino
37	Silicon sealants /Weather Sealant / Structural Glazing Sealant	GE- Silicon / Pidilite / Forsoc / Cico /Dow Corning / Sikka/ Wacker
38	Stainless Steel	Salem Steel/ Jindal or equivalent
39	Stainless Steel bolts, Screws, Nuts & Washers	Kundan / Puja / Atul
40	Stainless Steel Clamps	Hilti /Intellotech Koncept or equivalent
41	Stainless Steel Hinges	Hettich/ Godrej/ Dorma
42	Stone Adhesives	Fosroc / Sikka/Pidilite

43	Tiles: Ceramic Tiles	Kajaria / Somany/RAK or equivalent
44	Tiles: Glazed (Ceramic) tiles	Kajaria / Somany/RAK or equivalent
45	Tiles: Vitrified Tiles	Kajaria / Somany/RAK
46	Vinyl Flooring	Wonder floor/Responsive or equivalent make
47	Water Proofing Materials	BASF/ Fosroc / Sikka / CICO / STP/ Pidilite/CHRYSO
48	Wooden Laminated Flooring	NITCO /Euro / Pergo
49	Expansion Joints	Sanfield (India) Ltd., MIGUA, TRISTAR
50	Automatic sliding door	Dorma or equivalent make
51	False flooring	Arena, unitile, or equivalent make
52	Roller blinds	Hunter dougles/ Phifer or equivalent make
53	M.D.F	Nuwood(Grade -I AND GRADE II), Durotuff
54	wallpaper	Elemento/ marshall/ tatva/ baron/ tarket
B. **PUBLIC HELATH WORK**		
55	Ball valves with floats	Zoloto / Leader / Sant/ Audco/GPA
56	Brass - Stop & Bib Cock	Zoloto / Sant / Jaquar
57	C. I Pipes & Fittings	Electrosteel/ Kapilansh/ NECO/ RIF/ SKF/BIC
58	C.I. Manhole Covers	NECO/R.I.F./B.I.C./HEPCO/SKF/ KAJECO
59	C.P. Fittings: Mixer / Bib Cock/ Pillar taps/ Angle valve/ Valves Washers / Waste/ Urinal / Spreaders / Accessories etc.	Jaquar /Kohler/ Grohe/Marc
60	Geyser	Spherehot / Racold / Usha Lexus /Bajaj
61	Liquid Soap Dispenser	Euronics/Utec/Kopal

62	MS Saddle with G.I. Riser	Harvel/Alprene/Rain Bird, USA
63	Pipe Fittings: G.I.	R/Unik/Zoloto/K.S./Sun/Swastik
64	Pipe:- G.I.	Jindal / Tata / Prakash Surya/SAIL/ Swastik
65	Pipes & fitting: PVC for SWR Soil, Waste & Vent Pipes and fittings, Type B PVC Casing & Screen Pipes	Prince / Supreme / Finolex
66	Pipes & Fittings: CPVC	Flowguard/ Astral/ Ashrivad/ AKG/Supreme
67	Pipes & fittings: UPVC	Finolex / Prince / Supreme / AKG / Kasta / Vector / Astral
68	Pipes & Gully Trap: Stone ware	Perfect / S.K.F/ R.K/ Hind / Anand
69	Pipes: M.S.	Jindal / Prakash – Surya /TATA
70	Pipes: R.C.C	Indian Hume Pipe / Pragati Concrete Udyog Daya/ KK / JSP
71	SS Gratings/ Soap Dish/Towel Rail etc.	Camry/Glacier/Gem/ Jaquar/ Grohe
72	Stainless Steel Sink	Hindware / Neelkanth / Nirali / Jayna
73	Valve: Butterfly	Zolato/Audco /Sant/ KSB
74	Valve: Solenoid	Rain Bird, USA/Toro/Nelson,
75	Valve: Non Return	Sant/ Leader/ Zoloto / AIP / Kirloskar/ IVC/ Leader/ Audco
76	Vitreous China Sanitary wares	Hindware / Parryware / Cera / Kohler
77	Water supply pumps	KSB/ Grunfos/ Kirloskar/ Crompton/ Mather & Platt
78	Automatic Hand dryer	JAGUAR/ Kopal / Utech Systems / Euronics Automat

79	CI FLOOR TRAP	ROCA/ JAGUAR/ KOHLER/
80	UPVC MULTI INLET FLOOR TRAP WITH ACCESSORIES	FINOLEX/ SUPREME/ PRINCE/ KISSAN/ ASTRAL
C**. ELECTRICAL WORK**		
81	HT Panel with Vacuum Circuit Breaker (VCB)	L&T/ ABB / Schneider/ Siemens or their authorized Channel Partner
82	Batteries	Hitachi/Panasonic/ Yuasa/ SF/ Exide/ Amco/ Amaraja
83	Battery Charger	Amaraja/ Sabnife/ Statcon/ Voltstat/ HBL
84	Bus bar	Jindal/ Hindalco/ Indal
85	Bus trunking , rising mains, end feed unit, top-off box (plug-in type)	L&T/ Schneider/ C&S/ Godrej /Legrand/ EAE
86	Ceiling /Exhaust/Wall fans	Crompton/ Usha/ Orient/ Bajaj/ Havells
87	Control fuse base with HRC fuse / HRC Fuse	L&T/ Siemens/ ABB/ Alstom/ Schnieder
88	Data/Telephone/TV Outlets	Systemax/ Belden/ Simone/ MK/ Legrand/ Havells/ Anchor
89	DG Set - Assembler	Jakson & Company / Jakson Ltd/ Sterling Generators / Sudhir Gensets/ C&S Himoinsa/ Powerica/ Kirloskar (KOEL authorized OEM) / TIPL
90	DG Set - Alternator	Stamford/ Leroy Somer/ Toyo Denki/ AVK-SEG/ Kirloskar (KOEL Green)
91	DG Set - Engine	Cummins/ Mitsubishi/ Perkins/ Volvo/ Caterpiller/ Kirloskar (KOEL Green)
92	Fire Extinguisher	Ceasefire/ Exflame/ Minimax/ Life Guard/ Safex
93	HT & LT Cables (Power & Control Cables, Solar Cables)	Gloster/ Havells/ Nicco/ Finolex/ KEI/Polycab
94	Insulators	Jaya Shree/ Modern/ IEC/ WSI
95	LED Light Fixtures and Lamps	Philips/ Wipro/ Trilux /Havells
96	Lighting for Facade	Philips/ Wipro/ Trilux /Allurays/RZB/BEGA

97	Lightening Arrestors	L&P ELECTRO/ LPI/ Indelec
98	LT Panels / Synchronizing Panels/ Capacitor Panels	L&T/ ABB / Schneider/ Siemens or their authorized Channel Partner
99	MCBs / RCCB/Isolaters / RCBO / Change over switch	Hager/ Havells/ Legrand/ L&T/ Schneider/ ABB/ Siemens
100	Modular Switches/ Socket outlets and wiring accessories with moulded cover plate	MK (wraparound plus) / Siemens (Delta)/ Legrand (mylinc)/ L&T (Entice)/ Havells (Crab tree-Athena)/ Anchor (Roma)/ Schnieder (Opale)/ Wipro (North-West)
101	MS Conduit	BEC/ AKG/ Steel Kraft
102	Street Light Poles & Light Fixtures – Solar & Conventional	Philips/ Wipro/ Havells/ Bajaj/ Keselac Schreder
103	Transformer (Oil Type / Dry Type)	ABB/ Siemens/ Kirloskar/ Voltamp/ Areva/ Schneider
104	UPS	Emerson (Vertiv)/ Schnieder (APC)/ Eaton/ Socomec
D. FIRE FIGHTING WORK		
105	Air Release Valve/Air Cushion Tank	Zoloto/Advance/Leader/Audco/Castle
106	Alarm valve & Hydraulic (Alarm motor with coupling)	HD fire protect/TYCO/VIKING/Newage
107	Ammeter/ Voltmeter/ PF/ kW/ Hz/ meter /Energy Meter/ Multimeter	As per respective electrical make list
108	Anchor Fastener	Fischer / Hilti or equivalent
109	Ball Valves	L&T/ Audco /Zoloto/ Advance/Emerald/ KSB
110	Battery	Exide/ AMCO /Amararaja/ Panasonic
111	Butterfly valves	L&T/ Audco/ Zoloto / Advance/ KSB
112	Cables	As per electrical make list

113	Check Valve/Foot Valve/Sluice Valve/	L&T/Audco / Zoloto Advance/KSB
114	Control / Potential / Current Transformer	As per respective electrical make list
115	Deluge valve/ Solenoid valve/ Spray nozzle	HD / Tyco/Viking
116	Diesel engine driven pump	Ashok Leyland/ Cummins/ Perkins/ WILO-Mather & Platt/ Kirloskar/Armstrong Fluid Technology
117	Fire Extinguisher	Minimax / Newage/ Eversafe/ Tyco – Johnsons Control
118	Fire Hydrant Valves/ Fire RRL Hose Pipes / Fire Hose Reels/ Fire Man's Axe/ Gun metal short branch pipe/ 2/ 3/4 FB inlet/ draw Out connection/Hose Box/ Hose reel drum /Nozzle/ blank Caps & Chains / Coupling	Ceasefire / Newage /Minimax/HD/Tyco
119	Fire Pumps	Mather&Platt(WILO)/Grundfos/Kirloskar /Xylem –ITT/ Armstrong Fluid Technology
120	Electrical Motors	ABB/ Siemens/Kirloskar/C&G/BALDOR
121	Flow Meter	Scientific Equipments(p) Ltd./System Sensor or equivalent
122	GI clamps	Chilly/Hilti or equivalent
123	Gl / MS Pipes	Tata / Jindal- Hissar/ SAIL
124	Sprinkler Heads (Sidewall/ Upright/ Pendant)	Grinnel- Tyco / Viking / HD
125	Fire Suppression System/Gas Flooding Sytem	Tyco/Newage/Minimax/Viking
126	Clean Agent Fire Extinguisher	Kanex/Tyco/Newage/SVS Buildwell/Minimax/Lifeguard/Ceasefire
127	Intelligent Addressable Fire Alarm Panel/Detectors/	Honeywell-Notifier/ Siemens/ Schneider/ Bosch/ GE Edwards/Tyco

	Hooters/ Manual Call Point UL Listed/ Talkback/ Control Module/ Monitor Module/ Control relay Module/ Short Ckt. Isolator/	
128	Panic Button	Eureka Forbes/ Fire Pro / Tyco
129	Termination Control Cable	Dowell's/ Elemex/ Wago/ Phoenix
130	Door Controller, Card Reader, Biometric Reader, Access Control server Software, Smart card	
131	CCTV Camera/ NVR/ Central Monitoring Software / Other Items	Honeywell / Pelco /Cisco /Bosch/ GE/ Axis/ Sony
132	PA Speaker, Voice controller, paging station, Microphone	Bosch/ Honeywell/Bose
E. HVAC WORK		
133	2-Way Pressure Independent Balancing & Control Valve	Siemens/ Danfoss/Oventrop /Belimo
134	Adhesives for Insulation	Pidilite/Superlon / Armacell
135	Air cooled package units	Voltas/ Bluestar/HITACHI or equivalent
136	Air Handling Units with Coils etc.	Zeco/ Edgetech/VTS/ Waves/Flaktwood
137	Air Distribution (Ducting) - GI/GSS Sheets	SAIL / TATA Steel/ Jindal-Hissar
138	Aluminium Sheet for Ducts	Jindal/ Hindalco/ Indal
139	Cable Lugs/Thimbles/Glands	As per Approved Makes of Electrical Works
140	Cable Tray	As per Approved Makes of Electrical Works
141	CAV Box/VAV Box	Trox/ System Air / Ruskin Titus /Honeywell /Johnson's Control/Belimo
142	Centrifugal Fans/Fan section/Plug Fans	Kruger / Greenheck /Comefri/ Wolter/ Nicotra/Systemair

143	Electric Motor	ABB/ Siemens/ Crompton Greaves /BALDOR
144	Fasteners-Dash	HILTI / Fischer / Cannon / Wurth
145	Inline Fans	Kruger / Nicotra/ Greenheck/ Ostberg
146	Humidifier	KEPL / Rapid cool/ Emerald /Enmax
147	Split AC Units /Precision AC	Toshiba/Daikin/ Hitachi/ Carrier
148	VRV/ VRF Outdoor/ Indoor Units/ Refnet Joints/Remote Controllers	Mitsubishi Electric/ Daikin/ Toshiba/ Panasonic/Carrier
149	Chillers	Daikin-Mcquay/ Carrier / Trane / York/Dunhambush
150	Chilled Water Cassette Unit	Carrier/TRANE/Daikin/Johnson Control
F. LIFT WORK		
151	Lifts	OTIS/ Kone / Mitsubishi/ Schindler/ Johnson Lifts Pvt. Ltd.
H. SEWAGE TREATMENT PLANT		
152	Air Blowers	Beta/ Everest/ Kulkarni / TMVT
153	Air Diffusion System	Airfin/Usha Ruba/Rehau
154	Air Vent Valve	Oven trop (Germany) / CIM / Rapid Control
155	Anti-Corrosive Tape for Pipe protection	Pypcoat / Marphalt / Cotek/STP
156	Ball Valve	Zoloto/Honeywell/RB
157	Bar Screen	KSP/AWMS/PAMM
158	Blowers	Kay / airvac /Everest
159	Butterfly valves	Zoloto/Audco/Kirloskar/AIP/Advance
160	Centrifuge	Apollo/United/B.A Engineering

SECTION VIII

Schedule of Quantities

SECTION IX

Tender Drawings