TENDER DOCUMENT

FOR

Appointment of Design- Engineering – Procurement- Construction Contract (EPC) for Construction & Development of Gems & Jewellery Park in Mahape, Navi Mumbai, Maharashtra.

Part 2 – Design Basis Report

**India Jewellery Park Mumbai (IJPM)**

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**Notification No.: IJPM/RFP-CW005/XXX/2022**

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1. Definitions
   1. Owner/Employer: shall mean Indian Jewellery Park Mumbai on behalf of whom tenders are invited and include its successors, assignees and legal and authorized representatives, successors and permitted assigns.
   2. Project : “means Construction and Development of Gems & Jewellery Park by appointing Design, Engineering, Procurement and Construction contractor (EPC) which includes but not limited to Detailed Design, Construction, Testing & Commissioning on EPC Basis including Defects Liability Period of 12 months from issue of completion certificate or takeover of project by IJPM, whichever is later.

* 1. PMC: Project Management Consultants/Owner’s representative” means the firm/agency appointed by Owner for overall supervision, day-to-day monitoring of the Contract, project monitoring, coordinating between Owner and Contractor and certification of all invoices.
  2. Bidder: “Bidder” means firm/ company as stated above who submits proposal in response to this Request for Proposal document.
  3. Contractor: means the firm/ company, selected through competitive tendering in pursuance of this RFP, for providing the work as a Design, Engineering, Procurement and Construction (EPC) build package services under the contract.
  4. RERA Carpet Area: means the net usable floor area of an apartment plus the internal walls, which excludes size of external walls, services shafts, exclusive balcony or verandah area and exclusive open terrace.

Note: The exclusive service area provide to the unit shall be part of RERA carpet area

* 1. Built Up Area (BUA) : Built Up Area (BUA)/ Covered Construction Area : means area covered by a building on all floors including cantilevered portion, mezzanine floors if any, but excluding the area specifically exempted from computation of Floor Space Index (FSI) under these regulations.

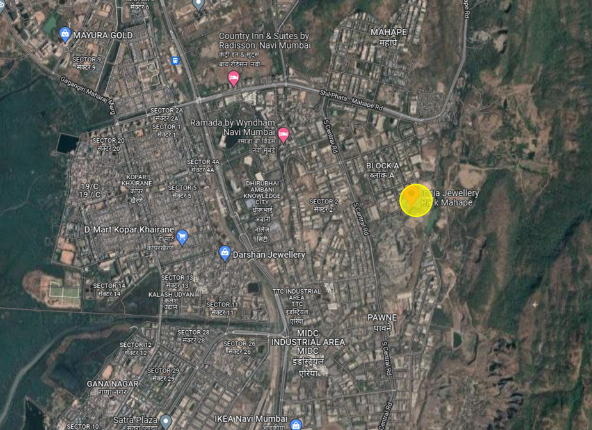
*Note :*

1. Cantilever habitable projection shall only be paid
2. Mezzanine will only be paid if construction is done, EPC to provide provision
3. Staircase, lift lobby or any such habitable areas even if granted free of FSI is included in the BUA.
   1. Floor Space Index: The FSI is the ratio of covered floor area to the available land area.

**SECTION A**

**Executive Summary- Gems and Jewellery Park**

1. Vision
   1. A world-class Jewellery park enhancing global competitiveness and contributing to economic development of Maharashtra and India.
   2. To develop a state-of-the-art organized ecosystem for labor-intensive Jewellery industry addressing the prevalent issues in existing unorganized clusters for Karigar community such as poor infrastructure and safety hazards, living and working conditions, redundant tools and machinery, cumbersome government procedures and legal issues.
   3. To provide effective support to Jewellery manufacturers/traders who are interested to relocate, expand or invest in the state of Maharashtra and the region to initiate new business or strengthen their existing business, benchmarking with the Jewellery Parks created in countries like China, Turkey, Italy, Thailand, etc.
   4. To house approx. 3000 Gems and Jewellery units on 21.3-acre plot of land in Mahape, Navi Mumbai. The emphasis will be on sustainable development goals, as promulgated by the United Nations which include health, safe and de-congested working conditions, better food, hygiene and habitation facilities which can be accessed by the MSMEs.
2. Objective
   1. To develop an integrated facility housing under one roof the complete value chain of the gems and jewellery manufacturing industry and its supporting ecosystem including handmade and mechanized Jewellery units.
   2. To augment the Jewellery manufacturing ecosystem in the State, complemented by ease of doing business initiatives, thereby evolving it into a preferred destination for global manufacturers and investors.
   3. To create state-of-the-art infrastructure, ancillary facilities, training, provide conducive business environment park for enhancing manufacturing and amplifying exports.
   4. To create 1 lakh direct jobs in the sector and multiplier effect through indirect job creation.
   5. To strengthen employment intensive Gems and Jewellery sector through Micro, Small and Medium Enterprises (MSME) promotion and inclusive growth.
   6. To promote tourism with tour of selected factories to show handmade Jewellery process.
   7. To have different categories of large, medium & small units in the parks
   8. To promote local handmade Jewellery and to improve the living standards of karigar and develop interest among the next generation of such workers.
   9. To provide advanced traffic management system with in the park to avoid congestion or hindrances for the large population
   10. To create a pollution free eco-system for jewellery manufacturing in compliance with regulatory guidelines
   11. To facilitate the park with modern machinery and infrastructure that would help reduce gold loss ratio from 10 per cent to 3 per cent.
3. Location
   1. The proposed project site is at MIDC TTC industrial area. TTC industrial area is surrounded by several industrial areas such as Dhirubhai Ambani Knowledge City, MIDC Industrial Area, Sector 3, Millennium Business Park, and Electronic Zone. Located at a distance of 25 kms from Mumbai International Airport and 16 km from upcoming Navi Mumbai International Airport. The site is also connected to JNPT and Mumbai Port, both are about 35.0 km from site.



*Figure: Site Location of Gems and Jewellery Park on Google.*

1. Climate Conditions
2. The climate of Mumbai is a tropical, wet and dry climate. Mumbai's climate is moderately hot with high level of humidity due to its coastal nature and tropical location. The temperatures do not fluctuate much throughout the year.
3. The mean maximum average temperatures is about 32 °C in summer and 30 °C in winter, while the average minimums are 25 °C in summer and 18 °C in winter.
4. Site Conditions
5. The land at site is uneven with huge level difference and will require levelling efforts for construction activity to be carried out. There is a water body on east side of proposed plot. The site is surrounded by well-established industries. Land is filled with muck and excavated materials from other/nearby projects whose homogeneity/composure is unknown, hence, EPC Contractor to ensure due safety regards for all structures and constructions. Site has been demarcated by MIDC with the boundary wall.
6. There is some encroachment at site currently, which is due to be cleared by MIDC, legwork to be pursued by the contractor. The contractor will be fully responsible for all necessary follow up actions and coordination with MIDC and related agencies for clearing up of all encroachments. The same will be included in his quoted cost and nothing extra will be paid against this.
7. Bench Mark for Master Plan Development
8. To provide an internationally competitive and a hassle-free environment for Gems and Jewellery industry in well planned zones with all infrastructural facilities and amenities of international standards.
9. To showcase the entire Gems & Jewellery area both old and new, as a single attractive entity. It shall houses domestic and export-oriented units, providing a one-stop shop.
10. Provide a central service center to facilitate business for its members, Customs, express transportation, and gold jewelry services located inside the center.
11. Market for existing traders and stakeholders at the Zaveri Bazar Jewelers and multi-channel manufacturers in Mumbai area.
12. Modernization and efficiency in the utilization of space shall be envisaged. While meeting the demands of modern gold commerce and trading, the existing character and culture of the establishment to be preserved.
13. Setting up the park shall promote organized setup of jewellery manufacturing which provided safe operating environment along with availability of skilled labour and create local employment opportunities.
14. To provide services including bonded warehouses, import and export customs clearance, logistics and insurance. Initiated shipping of products from factories directly to consumers, in order to keep prices more competitive.
15. Park shall planned for integrating high-density commercial architecture along with efficient climate-responsive design. The construction of large office building follows the best ecological standards followed worldwide.
16. A green belt shall be planned to provide a barrier between the source of pollution
17. To provide facilities like shops, canteen, and recreation area for workers in the project.
18. To improve the efficiency of the whole manufacturing process due to presence of common facilities and the whole ecosystem under one roof, making the process faster and smoother. There shall be adequate inter connectivity between the facilities to create and sustain mutually beneficial relationship with all components, while ensuring security and privacy.
19. State of the art security and surveillance system shall include access controls, frisking, turnstiles, cameras, communication equipment, vaults, fire and medical security, electronic security, IT infrastructure, intelligent building management system to integrate and optimize the building structures, systems, services and management in order to create a productive, cost effective and environmentally approved environment for the building occupants” and state of the art command control center.
20. Maximize the utilization of FSI & BUA while keeping the minimum ground coverage as per the Bye laws so that majority of the plot area is utilized for large open spaces, green belt, soft & hard landscape. Also, maximum floor plate efficiency i.e. RERA carpet area to total covered construction area of floor plate, of equal to or more than 80% should be achieved.
21. Estimated cost

The estimated block cost of the complete project is ₹1835/**S**q.ft (per unit covered construction area), which includes all the components of the project as per the scope of works

1. Guidelines & Standards

Following guidelines & standards shall be considered while designing the Jewellery Park:

1. Effective utilization of various permutation & combination with best markable engineering practice for Design build Green field development & value engineering in consulted form of capex, apex, & SLAs suitable for project.
2. Policy for Industrial Parks comprising of flatted galas for Readymade Garment manufacturing, Gems & Jewellery, Micro Electronics and Engineering units-2018 or any updated version
3. MIDC GDCR (latest edition)
4. National Building Code (latest edition)
5. Public Health & Safety Requirements
6. MOEF, MPCB, CPCB, Forest, AAI, PWD, CRZ, CPHEEO , Factory Act and all applicable Statutory requirements & approvals
7. Maharashtra Fire Norms (latest edition)
8. BIS codes & references
9. Helipad license from DGCA or any relevant authority
10. ECBC standards and guidelines
11. Guidelines for achieving Gold certification from IGBC
12. URDPFI guidelines, Harmonized Guidelines and Space Standards on Barrier Free Built Environment for. Persons with Disability and Elderly Persons (latest edition)
13. Best industrial norms & practices for Jewellery parks including all labour policies & licenses.

Note: In case of non-availability of any national standard & guidelines, best international standards shall be considered and applied.

The decision to choose between two or more guidelines /norms/standards shall be rest with the owner /employee

If there is any conflict between any two or more /norms/standards/guidelines, the EPC contractor shall submit cost benefits analysis along with pros & cons for same and shall take necessary approval from Owner/PMC for the same.

1. Basis of design and design criteria
   1. The Overall Plot is around 86,053.00 sqm (21.3 acres). FSI of 2, 57,995.00 sqm (2.9 FSI) has been approved in-principal from MIDC.
   2. The Master Plan and Design and Construction has to be done for FSI 3 for Industrial units and further additional FSI up to 2 to be utilized for Commercial and B2B units, shops etc.
   3. Full utilization of FSI is to be done with Efficient and Sustainable Planning.
   4. The Project has to be IGBC Gold Rated mandatorily and Certification has to be obtained.
   5. The project has to be designed in consideration with the Vastu Compliance.

The major consideration but not limited to, for vastu compliance:

1. The major construction of the building must be done in south or west side of the complex.
2. Main substation (Utility Building) housing generators, transformer, panels and other electrical equipment in the south-east corner.
3. Bore-well, the underground tank preferably in the northeast direction whereas overhead tank in the south-west direction.
4. Vastu guides to construct the toilet in north-west or western corner.
5. The office entrance and direction are to be placed in the most auspicious direction for the wellbeing of the employees, productivity and growth in the business.
6. The seating arrangements in the office must be planned as per the vastu compliances.
   1. Different size of Karkhana has been envisaged in the proposed plot. Also all units shall be modular to have bigger size unit by combining two or more units available. Design should be flexible for possibility of amalgamation and splitting of units Beside Karkhanas unit of different sizes, one office block shall be planned in the project.

Following are the major requirements of the project:

1. Industrial Large Karkhanas
2. Industrial Medium Karkhanas
3. Industrial Small Karkhanas
4. Commercial Office Building
5. Amenity buildings: Firefighting, Police Chowki, Custom Office, MI Room building.
6. Pick up, drop off , Parking facilities for staff and visitors (as per Employer requirements in Section C
7. Gold Refinery facility and Central Vault Facility
8. B2B Units and allied services, Common amenities such as canteen, cafeterias, shops and recreation area for Karkhana units

The following table represents the allocation requirements of the built-up area of the project between different components of the project:

| **Sr. No.** | **Type of unit** | **Tentative Proposed percentage allocation of total covered construction area (With +/-5% variation)** | **Tentative Unit area (sft) (With +/-10% variation)** | **Estimated Stock of Gold in KG**  **Per Unit** |
| --- | --- | --- | --- | --- |
| 1 | Large Karkhana units - Type 1 | 32% | 5000 | 20 |
| 2 | Large Karkhana units - Type 2 | 8% | 3000 | 15 |
| 3 | Medium Karkhana units – Type 3 | 5% | 2000 | 10 |
| 4 | Medium Karkhana units – Type 4 | 5% | 1000 | 10 |
| 5 | Small Karkhana units - Type 5 | 9% | 500 | 5 |
| 6 | Parking / basement Parking building & Services | 28% |  |  |
| 7 | Commercial Office building with Helipad on the top | 12% | 350 – 2000 \* |  |
| 8 | Amenity buildings (Police chowki, MI Room, Custom Office and Fire station) | 1% |  |  |
| 9 | Gold Refinery facility and Central Vault Facility |  |  |  |
| 10 | B2B Units and allied services, Common amenities such as canteen, cafeterias, shops and recreation area for Karkhana units | Included above in Units at (G+1) with 2nd floor shall be kept free for future expansion |  |  |

Modularity of Office blocks shall be for 350 sqft and combination of various modules shall be planned up to 2000 sqft. Additionally, a provision for all units merging to form a full floor plate at upper 5-6 floors shall be provided.

The Karkhana units, Building services, B2B units and allied services, along with common amenities and recreation area, shops etc. and Commercial office Building, Gold Refinery facility and Central Vault Facility, listed in sr. no. 1 to 5, and 7, 9, 10 above, shall be core and shell buildings. However, 10% of Small Karkhana shall be fully furnished at top floors and 10% commercial office shall be fully furnished at appropriate floor

The Parking and Amenity buildings (Police chowki, Hospital and fire station), listed in sr. no. 8 above shall be completely finished.

1. Building External Skin
2. The Exteriors of the buildings/ skin to have a pleasing scale and appearance, proportion and rhythm, solid-to-void relationship and materiality and should have iconic look for the whole complex.

It is essential that all building elevations shall be considered and treated as an integral part of the overall development.

Natural lighting, ventilation, and thermal protection along with Fire norms/statutory requirements shall be considered in the building skin treatment as per the User Requirements.

Façade/skin should be aesthetic and shall consider energy efficiency, lifespan, and ease of maintenance as major parameters and shall achieve a balance between an attractive look and performance.

The Building Skin shall be in combination of glass /stone/decorative Metal or GRC Jali with Iconic features and design for the Office building block.

The Office Building Block shall provide the Iconicity to the Complex with helipad on top and should be able to stand out from far. It should be the Visiting Card of the Complex.

The Karkhana blocks shall have Building external skin in combination of windows/ glass / stone; aesthetic in appearance, catering to the Security requirements, functional considerations, sustainable and should be cost effective. Considering the sensitivity of the building usage being Gems & Jewellery Park, the contractor shall develop intrusion preventive design in consultation with the Owner /PMC

For each Karkhana unit and allied facilities / amenities etc. space should be provided within the Karkhana unit connected to external face, for keeping Air-condition outdoor units,DG sets, Gas Cylinders etc .The building skin /exterior treatment has to be done in manner so that aesthetic are not compromised.

1. Infrastructure and Services

The Infrastructure MEP services for the entire campus will be provided based on standard guidelines and approved design. The Contractor shall engage the Subject Matter Expert (SME) from Maharashtra state /MOEF with past experience of handling or dealing with similar kind of effluents like acids, cyanide etc.

Major Requirements are as follows:

1. High side electrical system with N+1 transformer.
2. 100% DG power backup for External campus facilities, lights and Common areas, Lifts, lobbies, in all buildings and Amenities & Central Vaulting Facility
3. UPS backup for Emergency lighting, CCTV, IBMS, Access Control
4. Power backup for Karkhana units shall be provided by karkhana owners
5. STP, WTP, Drainage system, rain water harvesting system etc.
6. ETP system as per MIDC/ pollution rules/ guidelines
7. Central air-conditioning for office block and common area of Karkhana Blocks.
8. Provision for individual AC units in Karkhana units shall be catered, in terms of space and Electrical load.
9. External and Internal Electrical, Lighting, Power systems.
10. Façade and Landscape lighting.
11. Firefighting and Fire Detection system & safety as per applicable norms and standards
12. Low Voltage systems viz Fire alarm, Public address, CCTV, Networking & IBMS etc. in Block C and common area of Karkhana Blocks. The provision of the same shall catered in the Karkhana units.
13. 3-tier Security system and access control system in Block C and common areas of Karkhana units.
14. Underground water tanks for 2 days storage reserve and complete water supply & distribution network
15. Complete roads, driveway, drop off, pick up, bus bays, bus stop, golf carts, rickshaw, taxis & electric vehicle charging points etc.
16. Entry portal/gateways at the start of the approach roads to the site with proper signage, lighting and branding.
17. List of Specialized System

The following major specialized services shall be provided in the facility in additional to codal requirements:

1. Smoke extraction system
2. Solar hot water system
3. Solar power system
4. Façade Cleaning and maintenance system
5. Solid Waste Management system
6. Hazardous Waste Management system
7. PNG Gas supply
8. Compressed air system
9. Gold Recovery system
10. Centralized Vaulting System
11. Brief specification of materials

The Brief Specification of Materials to be used for the Project is as follows:

1. RCC framed building with infilled AAC Blocks. The partition wall between two units will be 230 MM thick brick wall.
2. Polished Kota stone floor for Common area, Staircases etc in Karkhana units
3. Polished Kota Stone dado in lift lobbies, staircases and common areas in Karkhana units.
4. False ceiling in Common areas in all Buildings, however, there shall be no false ceiling in the corridors of Karkhana buildings.
5. Italian marble stone floor & dado common area in office block
6. Rigid Pavement road for entire complex
7. Pedestrian pathways along the Roads, interconnected covered/ semi covered pathways between various blocks finished with Semi pervious Paver Tiles/ Natural Stone.
8. Grass pavers for ON site Parking.
9. VDF flooring for Basement/ podium parking.
10. Decorative & native plants in landscape area
11. LED light fixtures in Common area in Karkhana & office
12. Reference projects for Development of IJPM

The Park has to be developed in lines with other Major Projects in Operation Internationally and in India.

Reference Bench marks project for Development of IJPM Park are:

1. Gold Souk Extension, Dubai
2. Shawan Jewellery Park, China
3. Grand Bazaar, Turkey
4. Gold and Jewellery cluster at Batu Kawan Industrial Park, Seberang Perai on Penang mainland
5. Surat Diamond Bourse, Gujarat
6. Gem and Jewellery Park, Surat, Gujarat
7. Gems and Jewellery Park, Ankurhati, West Bengal
8. Zaveri Bazar, Mumbai
9. Bharat Diamond Bourse (BDB), Bandra Kurla Complex, Mumbai
10. DMCC, Dubai
11. Koneko Chan, Turkey
12. GIFT City- Ahemadabad.

It is expected that a Holistic Approach be taken for Design and Development of the Project catering to the Functional Requirements; Aesthetic Experience; Energy Efficiency; Environmental Friendly and Sustainable Measures to make the Park an Iconic Development for any User or Visitor to the Complex.

The shortlisted EPC contractor is required to visit the reference projects for studying the park facilities and operations . A comprehensive report of the visit covering all areas of activities to be submitted by the EPC contractor.

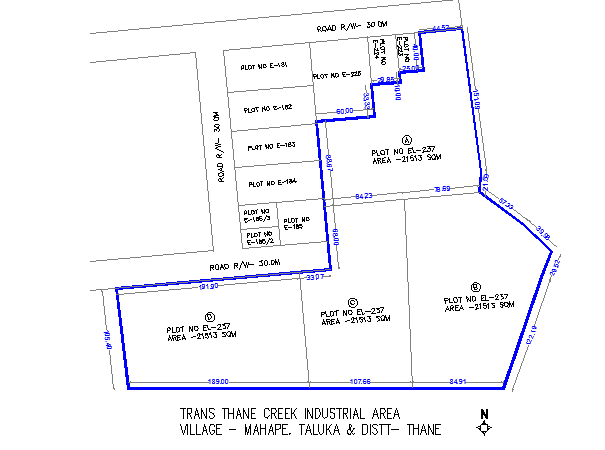
**SECTION B- PROJECT BRIEF**

1. Introduction

The development of Gems and Jewellery Park in Mahape, Navi Mumbai, is envisaged with a view to provide an internationally competitive and a hassle-free environment for Gems and Jewellery industry in well planned zones with all infrastructural facilities and amenities of international standards. It shall focus on development of medium and large-scale industries, as well as trading and services. All facilities required for Gems and Jewellery industry will be combined. Also it will ensure sustainable development of medium and large-scale industries and service activities with sufficient provision for future growth and expansion. Gems and Jewellery Park will broadly range from logistics and warehousing hub to social, commercial and recreational facilities. Emphasis will be placed on creating a functional and high visual urban environment within the park with proper landscaping. Hence the Aim & Vision of the development of Gems and Jewellery Park in Mahape, Navi Mumbai is**:-**

“To provide an internationally competitive and a hassle-free environment for the industry in well planned manner, with delivery of all infrastructural facilities and amenities, including a range of activities from logistics and warehousing hub to social, commercial and recreational uses”

1. Location
2. A plot of 21.3 acres has been embarked for gems and Jewellery Park at MIDC TTC industrial area at Mahape, Mumbai. The proposed project site at MIDC TTC industrial area. TTC industrial area is surrounded by several industrial areas such as Dhirubhai Ambani Knowledge City, MIDC Industrial Area, Sector 3, Millennium Business Park, and Electronic Zone.



1. Site is located at a distance of 25 kms from Mumbai International Airport and 16 km from upcoming Navi Mumbai International Airport. The site is also connected to JNPT and Mumbai Port; both are about 35.0 km from site.
2. Bharat Diamond Bourse (BDB), Bandra Kurla Complex, is located 24 kms from the site and the Zaveri Bazar at 33 kms. They are connected via Vashi Bridge and Eastern freeway.
3. Project description

The general character and the brief scope of work to be carried out under this contract is illustrated in this document. The scope of work shall comprise of (but not limited to) the master planning , architectural design ,structural design of the building as per latest IS code and references, infrastructure design MEP services design, coordinated detail design, supply, construction, installation, testing and commissioning and maintenance during the defect liability period

All works, material selection for design and construction shall confirm to prerequisites requirements to achieve LEED GOLD certification from IGBC.

All common areas shall be finished in the Karkhana buildings and internal finishing & services shall be completed by the owner of the units. However, the internal firefighting arrangement in the units are to be provided as per Fire norms and statutory norms.

The project shall be planned adopting the existing site contoured profile with difference in ground levels to save the cut & fill. The verified HFL (highest Flood Level) (to be taken by Contractor from authorized agencies) shall be taken into consideration while designing the proposed levels in the project, to ensure that there is no water logging/flooding at site. The CRZ clearance also to be obtained for the project.

The project shall be integrated with the transportation system inside the campus for easy connectivity of the Unit workers. There shall be Bus bays/Bus stops provided at sufficient locations with pick up and drop points. There shall be space allocated for bus parking, cabs/taxi parking/bays and Auto/Rikshaws also in the park.

1. Project Components

The Master plan shall have adequate numbers of Vehicular and Pedestrian entry/exit points along with Guard rooms based on traffic study carried out by the Contractor. Each Entry/Exit shall be equipped with high-end security system.

The project has been envisaged with different categories of Karkhana units along with office building and Amenity buildings as follows:

1. Industrial Large Karkhanas
2. Industrial Medium Karkhanas
3. Industrial Small Karkhanas
4. Commercial Office Building
5. Amenity buildings: Fire Station, Police Chowki, MI Room building,
6. Gold Refinery facility
7. Centralized Vaulting System
8. B2B Units and allied services, Common amenities such as canteen, cafeterias, shops and recreation area for Karkhana units
9. Shuttle busses - Bus Bays/Bus stops, taxis, Rickshaws bays with parking areas, Golf cart in the park/site.

## **Area detail**

1. Site Area - 86,053 sqm (21.3 Acres)
2. Approved FSI from MIDC- 2,57,995.00 sqm (2.99 FSI)
3. The Master Plan and Design and Construction has to be done for FSI 3 for Industrial units and further additional FSI upto 2 to be utilized for Commercial and B2B units, shops etc.

## **Tentative unit areas for Buildings**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No.** | **Type of unit** | **Tentative Proposed percentage allocation of total covered construction area (With +/-5% variation)** | **Tentative Unit area (sft) (With +/-10% variation)** | **Stock of Gold in KG** |
| 1 | Large Karkhana units - Type 1 | 32% | 5000 | 20 |
| 2 | Large Karkhana units - Type 2 | 8% | 3000 | 15 |
| 3 | Medium Karkhana units – Type 3 | 5% | 2000 | 10 |
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| 5 | Parking / basement Parking building & Services | 28% |  |  |
| 6 | Commercial Office building | 12% | 350 – 2000 \* |  |
| 7 | Amenity buildings (Police chowki, Hospital and fire station) and Gold Refinery facility | 1% |  |  |
| 8 | B2B Units and allied services, Common amenities such as canteen, cafeterias, shops and recreation area for Karkhana units | Included above in Units at (G+1) with 2nd floor kept free for future expansion |  |  |

1. Project Considerations

The specific considerations for each of the systems are described under the respective sections:

1. International level master plan and design of the park to make the development one of its kind competing with beat of the developments.
2. Formulating a structural system to achieve the unique profile of the Building with minimum disruptions to the functional layout.
3. Optimizing structural member sizes for increased efficiency in the floor plate and usable space.
4. Ensuring satisfactory performance under Seismic and wind loads for human comfort.
5. Adopting an optimum structural system to balance structural requirements and costs.
6. Identifying a safe and buildable construction sequence and methodology.
7. The electrical supply will be fully supported by high voltage standby diesel generators with sufficient capacity so that the failure or routine maintenance on one generator will not affect the standby capacity. High voltage generators are preferred to low voltage type on maintenance and cost considerations
8. Bus bar with metering system to be provided along with meter at each unit.
9. Supply from 2 Feeders for electrical supply, Contractor to approach the relevant agency and get the Power supply to the project, electrical load sanction to be taken by contractor.
10. Maintaining a quiet environment through installation of low noise, high efficiency motors and equipment with added acoustic treatment wherever required.
11. Provide negative pressure ventilation systems for kitchens, toilets and dining areas to contain the food and other odour from spreading to other areas.
12. Infrastructure provided for Fiber Technology to The Home (FTTH) cable system will result in higher reliability, and faster access speed to the internet. The base building infrastructure will be planned to support this feature.
13. Provision of piped natural gas (PNG) supply system (350-500 mbr) supply for units, food court and restaurant. The supply of PNG will be ensured by the distribution agency MGL.
14. Use of telephony intercom system for the development, integrating with the house telephone or mobile phones as an intercom device to communicate.
15. Provision for all network systems like Data, Telephone etc. to be provided including raceways, pipes, etc. and also assistance and support including rectification to be given the service provider to lay line and installation.
16. Solar water heating system for supplementing hot water supply to be provided.
17. Solid waste management will be based on area garbage collection and will be managed by operation team of client.
18. Space for Bio-waste storage
19. Space for Hazardous waste storage
20. Dual Plumbing system, concealed pipelines, hubless PLPE
21. Overhead tanks – ½ day storage capacity – by pumping system from UGT to OHT, then further supply by gravity system. Stop cock at tap off point.
22. Collection and harvesting of rain water run-off to recharge the underground aquifer as per Environment Impact Assessment Authority (EIA) requirements.
23. Use of integrated building management system (IBMS) to optimize the control and monitoring of operation and energy usage of the entire development.
24. Adopt brightly painted car parks, using proper demarcation lines or painted floors to identify different area
25. REMS System – CCTV cameras to be installed at 3-5 locations at site and live feed of the same shall be projected at clients HO, PMC, PSU offices to monitor the site progress.

**SECTION C**

**SECTION C 1 – Architecture**

## **Site Level Requirements**

The External Area Development works shall comprise of detail design and construction and operation and maintenance of complete Road Network, Pathways, Drop offs, Surface Parking, Signages and branding for the complete Project site area. Project Site area is defined by 30.0 wide proposed roads from 2 sides on North, water body on east side and boundary wall demarcated at Site Plan on all sides. The approach from S Central Road, Pawane MIDC Road, Shil Phata Mahape Road and Thane-Belapur Road to the Site, making Entrance Gateways with street lighting , landscaping,CCTV, branding and signages on these roads and adequate entry/exit to site from approach roads, are all included in this portion of works.

The Master Plan shall be designed as per applicable Local Bye-laws, latest NBC requirements and International standards, in accordance with the interrelationships of the various facilities and internal road network considering the internal traffic movement and as per Topographical survey conducted by the EPC Contractor. The master plan shall be envisaged keeping the following principals:

* 1. The iconic complex shall be planned with all state of art facilities & services.
  2. The master plan shall be prepared considering the Building Bye laws and all other relevant regulation applicable on the plot.
  3. Building block should be planned in North – south Orientation to receive the diffused lights and cut the harsh east west radiation.
  4. Proposed method for sub-structure/ parking to be submitted along with calculations in the proposal. Necessary soil investigation to be carried out at own cost. Required permission for soil investigation from MIDC/ Regulatory authorities will be provided by Owner/Client
  5. Grand entrance with vehicle management system shall be planned at each entry gates, and at main access road (Shilphata road junction and Millennium IT Park).
  6. Modular planning shall be done to have flexibility in the layout plan. Design should be flexible for possibility of amalgamation and splitting of units.
  7. All Karkhana units shall have interconnections at Ground level and at every 6th floor levels
  8. At least one shaded interconnectivity to be provided connecting all the blocks for movement during monsoon at Ground level.
  9. Office block can be a separate block without any connections from Karkhana, but can be connected at ground level
  10. G+2 floor shall be kept for supply and support services, equipment, tool manufacturers having units vary from 100-300 sqft. Tower for karkhana shall start above these floors
  11. Three level security shall be provided in the project. Segregated entry/exit to be provided for vehicular and pedestrian movement.
  12. Vehicular movement should be restricted to site periphery to have pedestrian friendly movement, however necessary provisions for fire tender movements to be provide as per statuary provisions
  13. External signage’s shall be provided for convenient movement in the complex
  14. Ensure minimum 1 car parks for 750 Sq.ft and 1 two wheeler parking for 250 Sq.ft.
  15. Vehicle management system shall be provided for parking management
  16. Drop off and pick up facility from Shuttle busses shall be provided inside the complex by providing bus bays/Bus stops along with other facilities like taxis, Rickshaws bays with parking areas, Golf cart etc. in the park.
  17. The parking shall be provided at semi basement level/ podium levels .Separate zones shall be provide for 2 wheelers and 4 wheelers in the parking area. No provision for Mechanical parking shall be done in the podium.
  18. Provisions for MLCP in future shall be done the master planning of park.
  19. Podium level shall have the landscape courts with covered pathway connecting the all blocks at podium level.
  20. Functional and decorative lighting in the landscape area shall be provided
  21. An open Recreational area shall be provided for approx. 200 pax at site
  22. Outdoor games area for badminton, volleyball, etc. shall be provided in open at site
  23. Gold refinery to be a separate building/structure (G+2 or G+3) within premises

## **Block Level Requirements**

The scope of work shall comprise of (but not limited to) coordinated detail design, supply, construction, installation, testing and commissioning for all works for Masonry, Flooring, Wall Finishes, Internal Wall Cladding, False Ceiling, Internal Painting, Doors, Windows, Railings, Fixed landscape Furniture, Murals, Paintings, Artefacts, Signages, branding, Conference rooms Acoustic Design and Finishes, External Finishes, Façade Glazing, Glass Canopies, Ramp covering, Façade Cleaning, etc, approval from owner/consultants/statutory authorities for Building Architecture and Interior comprising of following components:-

* 1. Large & Medium Karkhana block- Large & medium Karkhana units having carpet area from 1000 - 5000 sft
  2. Small Karkhana block -Small Karkhana units having carpet area 500 sft
  3. Commercial Office block- Office units having carpet area from 350 – 2000 sft in modules
  4. Common facilities like canteen, cafeteria, shops, recreation area, B2B facilities and allied services shall be provided on G+1 floor level. Second floor shall be kept free for future use.
  5. Amenities block having Fire station, Police chowki & MI Room, Custom Office
  6. Centralized parking system at semi basement level/podium levels
  7. Entrance lobbies at all levels to be provide with grand entrance lobby at podium with beautiful view and access to landscape podium
  8. Gold Refinery Unit and Centralized Vault Unit for various types of vault, like –
* Vault for Traders and Owners of Units
* Vault for Gold distribution
* Vault for Customs
* Vault for Miners for Exhibition purpose

## Large & Medium Karkhana block

* 1. Large Karkhana shall be provided on lower floors and medium Karkhana shall be provided on upper floor.
  2. The building shall be provided as core and shell building.
  3. Modularity of flexible floor space from 2000 to 4000, 6000, 8000, 10000, 15000, 20000 sqft. by clubbing of Karkhana units shall be provided
  4. The provisions shall be made for Toilets & Laundry inside each Unit.
  5. Provision for recovery system through Settlement tank from Hand wash and foot wash to be provided in form of Loft in all Toilets. The structure loading of min. 2.5 ton to be considered in the Structure design of Toilets/slab/Loft for the recovery/settlement tank. All the arrangements like insert plate in columns etc. to be done. Location and size of the Loft to be provided as per the standards and norms.

## Small Karkhana block

* 1. Separate block for small karkhana shall be provided as core and shell building
  2. The floor space of 500 sft for small Karkhana units shall be provided
  3. 10% of units shall be finished on top floor
  4. Common toilets shall be provided at core at all floors for the Small Units.

## Karkhana blocks – Common Requirements

The following common requirements are to be provided in all blocks

1. Modular Planning to ensure maximum Efficiency and Flexibility of Workspace Design
2. Minimum size keeping for length: breadth ratio should be 1:2
3. Core and services shall be provided centrally for ease of access and maintenance
4. The core with Staircases/Fire Escape staircases, Lifts, Service shafts to be provided as per latest NBC, Fire norms and all statutory norms.
5. Common toilets at core level to be provided for Visitors and Differently Abled persons.
6. The Reception/Main Entrance Lobby at Ground floor and the Main Core shall be provided with architectural features showcasing the identity of the Block.
7. Staircase width shall be minimum 2.0m
8. Refuge area shall be provided as per latest NBC/Fire norms
9. Service Floor shall be provided as per latest NBC/Fire norms
   1. Three layer security shall be provided. First layer will be at main entry point and perimeter wall and second layer will be at each block entry level and third layer will be at each unit entry, which shall be installed by the Unit holder.
   2. Provision for Recovery system at 1 – 2 locations to be provided in each unit
   3. Provision for air exhaust /piping system for acid disposal /chimney for dust fumes
   4. Every unit holder will have their separate scrubber inside which shall act as primary source of filter and thereafter it wll be connected to the header of main scrubber. Similar nature of grouping shall be done by the EPC Contractor as per design requirement
   5. LV provisions, access control, fire detection and fire alarm system, intercom system provisions shall be provided at each entry point of each unit. The office owner has to provide for system within unit and integrate with the main system which shall be connected to IBMS
   6. Metering system shall be installed at unit for measuring effluent from each unit to ETP plant
   7. RO drinking water supply at each floor and tap off till unit
   8. Maintenance of water proofing & plumbing system inside units
10. The space provision for Karkhana equipment, HVAC outdoor units at outer face of the blocks shall be provided.
11. The Karkhana blocks shall have façade/ Building skin in combination of windows / glass / stone; aesthetic in appearance, catering to the Security requirements, functional considerations, sustainable and cost effective.
12. The Façade treatment/design for that Space in all Karkhanas outer face to be done with aesthetical elements like louvers, jalli, etc.

## Commercial Office block

1. Office block shall be designed as iconic building with fore court to showcase iconicity of IJPM.
2. The Building Skin/ façade shall be in combination of glass /stone/decorative Metal or GRC jali with Iconic features.
3. The building shall be provided as core and shell building.
4. Multiple Conference halls with atleast one with 100 pax, and seminar rooms shall be provided at G+1 level
5. Roof top food court shall be planned
6. Helipad shall be provided on the top of building
7. Modularity of flexible floor space from 350 to 2000 sft by clubbing of office units shall be provided
8. The core with Staircases/Fire Escape staircases, Lifts, Service shafts to be provided as per latest NBC, Fire norms and all statutory norms.
9. Staircase width shall be minimum 2.0m
10. Corridor width shall be minimum 2.0m
11. Refuge area shall be provided as per latest NBC/Fire norms
12. Service Floor shall be provided as per latest NBC/Fire norms
13. Three layer security shall be provided. First layer will be at main entry point and perimeter wall and second layer will be at each block entry level and third layer will be at each unit entry, which shall be installed by the Unit holder.

## Core Level Requirements

The following provisions shall be provided at core level:

1. All core areas with Staircases/Fire Escape staircases, Lifts, Lift Lobby, Fire shaft, Service shafts along with Corridors shall be fully finished.
2. 02 Nos of Goods lifts shall be provided in all core having load capacity of minimum 2500 kg
3. Lifts shall be provided as per latest National Building code with minimum 20 person lift and speed of 3.0 m/sec or as per requirements.
4. All lift shall be provided with minimum 2.40 m high door opening
5. Fire lifts shall be provided as per fire requirement
6. Fire tower shall be provided as per latest NBC / Fire norms
7. Shafts shall be provided in the core for LV/Electrical/Pluming/Air-conditioning or any other related services.
8. Electric panel room shall be provided at each core
9. Exit from the units shall be provided as per fire norms
10. Functional & recreational signage’s and branding signages shall be provided in all cores
11. Digital boards for branding in all lobbies to be provided.
12. Medical stretcher lift as per norms

## Unit Level Requirements

* 1. Large & Medium Karkhana units

1. All units’ shall be given as core and shell to unit holders. All inside finishing shall be done by the owner of unit
2. Provision for following services shall be provided in the unit:

* Toilet as per National building code
* Pantry
* Washing area
* Drinking water provision from RO plant
* Individual Unit Space Vault provision to be provided as per RBI guidelines.
* Gold recovery unit from air, water, dust, fumes etc.

1. Exit from the units shall be provided as per fire norms
2. Live load of 1000kg/sqm shall be considered for structural designing
3. Minimum floor to floor height shall be 4.20 m
4. Provision for Mezzanine/Loft shall be provide in all Karkhana up to 50% of unit area/loft upto 33%. Clear head room under loft /mezzanine shall be 2.10 m
5. Services shafts shall be planned for all services i.e. plumbing, electrical, firefighting, LV etc. Shaft should be planned such that one or more units can be combined.
6. 150 Sft of space shall be embarked in the units for construction of vaults. The contractor shall take all loads of vaults and leave the dowels (tong bars) for construction of vault by owner in the future. The positioning of the vault shall be in the S-W corner of the unit. The construction of the vault shall be as per RBI guideline for strong room.
7. Electrical services shall be provided at one point up to distribution board of the unit and rest all works shall be done by the owner
8. No power backup shall be provided for units. The owner shall make provisions for own power backup.
9. The power consumption shall be metered through energy meter located optimally and efficiently as per requirement
10. Detailed electrical load calculation should be submitted
11. Plumbing shaft shall be provided with all vertical stacks and water line with provision for connections to units
12. RO Drinking water tap off point
13. Shaft for gas pipe shall be provided from centralized plant
14. Shaft for compressed air pipe to be provided
15. Every unit holder will have their separate scrubber inside which shall act as primary source of filter and thereafter it will be connected to header of the main scrubber.. Similar nature of Grouping shall be done by the EPC contractor as per design requirement
16. All Firefighting system shall be provided inside unit also. However, if there are any changes as per interior layout, same shall be done by the owner of unit and NOC obtained from fire department
17. Space for keeping outdoor units of air conditioning system at regular interval shall be provided with proper screen, as per Façade design. All air conditioning work shall be done by the owner of unit
18. Unit security system shall be installed by the owner of unit
    1. Small Karkhana units
19. All units’ shall be given as core and shell to unit holders. All inside finishing shall be done by the owner of unit. However, the complete finishing for 10% of the units shall be done on top floors.
20. Small provision for Wash basin and Urinals/Water closet shall be mandatorily provided inside the unit.
21. Drinking water provision from RO plant
22. Exit from the units shall be provided as per fire norms
23. Live load of 1000kg/sqm shall be considered for structural designing
24. Minimum floor to floor height shall be 4.20 m
25. Services shafts shall be planned for all services i.e. plumbing, electrical, firefighting, LV etc. Shaft should be planned such that one or more units can be combined/Split
26. Electrical services shall be provided at one point up to distribution board of the unit and rest all works shall be done by the owner
27. No power backup shall be provided for units. The owner shall make provisions for own power backup
28. Plumbing shaft shall be provided with all vertical stacks and water line with provision for connections to units
29. Shaft for gas pipe, compressed air pipe shall be provided from centralized plant
30. Smoke extraction shaft shall be provided with all units
31. All Firefighting system shall be provided inside unit also. However if there are any changes as per interior layout, same shall be done by the owner of unit
32. Unit security system shall be installed by the owner of unit
33. Space for keeping outdoor units of air conditioning system at regular interval shall be provided with proper screen, as per Façade design. All air conditioning work shall be done by the owner of unit
    1. Office units
34. All units’ shall be given as core and shell to unit holders. All inside finishing shall be done by the owner of unit
35. Provision for following services shall be provided in core for the office unit:

* Toilet as per National building code
* Pantry
* Drinking water provision from RO plant
* Business Center for 100 pax
* Conference/meeting room

1. Exit from the units shall be provided as per fire norms
2. Live load of 500kg/sqm shall be considered for structural designing
3. Minimum floor to floor height shall be 3.60 m
4. Services shafts shall be planned for all services i.e. plumbing, electrical, firefighting, LV etc. Shaft should be planned such that one or more units can be combined.
5. Electrical services shall be provided at one point up to distribution board of the unit and rest all works shall be done by the owner
6. UPS power back shall be provided for emergency lighting for all core, corridors, lobbies, CCTV, IBMS, access control system for 15 minutes.
7. LV provisions, access control, fire detection and fire alarm system, intercom system provisions shall be provided at each entry point of each unit. The office owner has to provide for system within unit and integrate with the main system which shall be connected to IBMS
8. Plumbing shaft shall be provided with all vertical stacks and water line with provision for connections to units
9. All Firefighting system shall be provided inside unit also. However if there are any changes as per interior layout, same shall be done by the owner of unit
10. Central air-conditioning system shall be provided in block with individual AHU for each unit. Chilled water line shall be provided up to AHU and further work shall be done by owner
11. Unit security system shall be installed by the owner of unit

## **Semi Basement /Podium**

The semi basement/Podium, in consideration and utilization of site natural topography shall be planned for all parking facility and other services of the buildings. The same shall function as vehicular parking for workers, staff, visitors etc. and MEP services rooms and other rooms as per the design requirements and norms. The floor to floor height of the basement/semi basement shall be 4.2m. The three level parking shall be planned in the semi basement/ Podium as per the requirements.

Vehicular entry/exit ramps of clear width and slope as per latest NBC/ statutory norms along with drop off zones to be provided. Adequate number of ramps to be provided for the free flow of traffic movement. These ramps exit shall further connect to the main road network of the campus merging with the landscaped garden area at site.

Boom Barriers with access control shall be provided at all the ramp entrances. This ensures only authorized entry to the building.

The entire Podium area shall be efficiently planned with proper network of covered drains, sumps, ventilation system, firefighting system etc.

## **Plinths**

The plinth level of the buildings shall be at 600mm above the adjoining finished road level nearby the buildings. The plinth level shall be provided above the HFL near the site. The Plinth protection shall be minimum 750mm wide unless otherwise specified in the drawings. The level of plinth protection shall be 150mm above the corresponding finished ground levels or finished road levels as applicable. The Plinth protection horizontal and vertical surfaces shall be finished with pre-polished Granite stone slabs as per approved shade, specifications and drawings.

## **Masonry Walls**

The masonry works shall be of AAC blocks (Autoclaved Aerated Concrete blocks) of size 600mm X 200mm X 200mm, as per specifications provided in the Tender document. Unless otherwise specified, all external walls, partition walls between two rooms, walls in core areas/ wet areas shall be 200mm thick block wall. However partition wall between two units shall be 230 mm thick brick wall. All the walls shall be neatly constructed with finished pointing of Masonry.

## **Building Skin/ Facade**

The building Skin/Façade works includes design, engineering, documentation, testing, manufacturing, delivering, installation, protect and commission of all components of the façade proposed for the buildings like, Unitised Structural glazing system with double-glazed units, Spider glazing system, Glass Canopies, Glass railings, all complete with all glass, glazing accessories, fixings, trims, finishes, Spider glazing, louvers, flashings, sealants in accordance with the details and specifications provided in the Tender Documents.

The Iconic Building facades shall be provided with adequate Natural lighting, ventilation, and thermal protection as per the User requirements along with LEED Gold rating requirements. The façades shall be proposed as follows:

* The Building Skin/ façade for the Commercial Office building shall be in combination of glass /stone/decorative Metal or GRC jali with Iconic feature. It shall stand out and form a landmark to the whole project with its Iconicity.
* The Karkhana blocks shall have façade/ Building skin in combination of windows/ glass/ stone; as per the User requirements. However, it shall be aesthetic in appearance and shall flow with the Commercial Office building to provide the same look of entire campus.
* The building facades shall cater to the Security requirements of the Karkhanas.
* The Façade treatment/design for that Space in all Karkhanas outer face to be done with aesthetical elements like louvers, jalli, etc. so that the their equipment, HVAC outdoor units kept in space provided on face of building are not visible in the Façade.
* Shading devices shall be used to avoid unwanted heat gains
* Façade should be aesthetic and shall consider energy efficiency, lifespan, and ease of maintenance as major parameters and shall achieve a balance between an attractive look and performance.

## **Infrastructure**

The complete infrastructure works includes (but not limited to) design, engineering, installation, laying, testing, and commission of all components of the Infrastructure in accordance with the details and specifications provided in the Tender Documents. The scope includes supply from source to the site, tapping off at the site at desired location, main supply/storage at site, and further distribution to the buildings and to the end points of supply.

The Infrastructure shall be provided as follows:

1. Underground water storage tank for domestic and fire, with two days storage shall be provided.
2. The water supply system from Underground storage tank to overhead water tanks shall be through Hydro pneumatic water supply system. The Overhead tanks shall have half day storage capacity. Further distribution shall be through Gravity system.
3. Sewage treatment Plant (STP) and Effluent treatment plant (ETP) shall be provided.
4. Space for setting up of MRSS shall be provided on site. Same shall be provided by the Local Authority
5. Electric power shall be sourced from two alternative source to have uninterrupted power to the project.
6. High side electrical system with N+1 transformer ( Effective connected load and maximum demand load)
7. Calculate and provide Power load based on typical unit of 5000,2000,1000& 500 sft units, however minimum load of 1KW/ 100 sft shall be provided
8. Provision for transformer as per power company /MIDC/ECBC rules
9. Electric metering provisions to be done optimally and efficiently for units
10. 100% DG power backup for External campus facilities, lights and Common areas, Lifts, lobbies, in all buildings and Amenities: all essential requirement like STP, ETP, WTP, water pumps, fire pumps etc.PLC Integration in DG sets
11. UPS backup for emergency lighting , CCTV,IBMS , Access control
12. External and internal electrical lighting , power system , facade and landscape lighting
13. Firefighting and fire detection and alarm system & safety as per applicable norms and standards
14. Centralized air conditioning system for common area of Karkhana ‘s and office building through water cooled chiller shall be provided
15. To optimize the mechanical and electrical services Passive design should be considered
16. Dual Water Supply piping system shall be provided for flushing supply
17. Water sourced chillers shall be used for central air-conditioning in office block
18. Advanced structure cabling solution on cat 6A i.e. 10G platform should be provided with provision for future upgradeability of the active components
19. CCTV systems shall be designed to deliver the highest quality video in the harshest environments and lighting conditions.
20. Access control system shall be provide for controlling the movement of people in the complex
21. Intercom facility shall be provided in all unit with centralized exchange.
22. Underground water tanks for domestic and fire 2days storage reserve and complete water supply and distribution network
23. The water supply from underground storage tanks to overhead tanks shall be through hydro pneumatic water supply system
24. RO water for drinking purpose
25. 100% use of Recycling of Waste water shall be done
26. Storm water management system with rain water harvesting system shall be planned
27. Integrated Building management system shall be provided for all services
28. Exhaust system in individual units for large and medium karkhana shall be provided
29. Common exhust system for small Karkhana unit shall be provided
30. Pipe natural gas system shall be provided by gas Distribution Company however space shall be provided as per service provider requirement.
31. Native trees and shrubs shall be planted in the green area
32. Drip irrigation shall be provided for landscaped area
33. Integrated Building management system shall be provided for all services
34. Solar hot water supply shall be provided in each karkhana at one location.
35. Solar power system shall be connected to internal substation for external lighting
36. Core an shell facilities shall be provided on standalone basis, further the service provider shall finish, furnish the same.
37. Every unit holder will have their separate scrubber inside which shall act as primary source of filter and thereafter it will be connected to header of the main scrubber.. Similar nature of Grouping shall be done by the EPC contractor as per design requirement
38. Space for solid waste/ Bio Meical waste/ Hazardous waste storage, handling, segregation and disposal, PNG & Compressed gas plant shall be provided on the site. These facilities shall be built and operated and maintained by service provider.

## **Security System**

The Security system shall be provided with three level security system along with at the Boundary wall as follows:

1. First level security system shall be provided at Main Gate Entry points. The Boom Barriers for the Vehicular entry shall be provided and the visitors shall be filtered out at Main Gate level. Further entry to the campus shall be through security check and Access card only.
2. The entrance Gates to the park shall be carefully designed to be able to filter approx. 1.0 lakhs people entering the park and to do traffic engineering, to ensure the security.
3. Boom barriers shall also be provided at Basement/Semi Basement/Podium entry/exit points along with Vehicle Scanners entries.
4. There shall be dedicated entries and dedicated zones for the shuttle busses, taxis, rikshaws etc. with internal layer of security to enter the buildings areas.
5. Complete new boundary wall throughout the perimeter 2.1 m height in RCC columns an AAC block filler wall
6. Security with 900 mm high electrical fencing on Boundary wall shall be provided along with Concertina coil and Razor blade wires going through it.
7. The view of the campus at eyelevel from outside shall be such that person cannot see any activity happening inside the campus and from inside only boundary wall and gates are visible.
8. Second level security system shall be provided at building Entry points with Access Card only. The Access card shall provide entry to specific office/karkhana at particular floor only.
9. In First and Second level security, all security installations such as X-ray baggage scanner, Door frame metal detector, access controlled flap-barriers shall be provided.
10. Third level Security system shall be at the Unit Entry Level. The provision for the same at Unit entry shall be provided, further, security system shall be installed by Unit holders.
11. Watch tower provisions with search light towards back side/water side and mountain all along the perimeter at regular interval
12. The provision for internal security infrastructure comprising of (but not limited to) Cameras, alarm systems, speakers, screens, PA systems, sensors, cabling, iris, palm scanners etc. shall be provided.

## **Façade Cleaning System**

The complete external façade, internal glazing, shall be provisioned with mechanised cleaning and maintenance system. The scope includes (but not limited to) design, engineering, documentation, manufacture, supply, testing, installation, a façade cleaning system appropriate for the buildings, including all necessary coordination in design, supply and execution with Structural, Architectural, Façade and MEP systems for the buildings.

The Façade cleaning system / Building Maintenance system (BMU) shall be designed appropriately to provide mechanized cleaning of all shapes/forms of façade and all types/materials of Façade for all buildings by means of roof mounted / parapet mounted traversing trolley jib system with two men Power Cradle (gondola) or by means of travelling ladder system or latest technology as approved by the PMC/Owner.

The complete system shall be design by taking into consideration required necessary the safety features and statutory requirements.

## **Signages**

The scope of work includes design, detailing, drawings, supply, installation for Signages for the complete campus and buildings as per latest NBC guidelines, IS codes, Fire norms, good practices, User requirements and specifications provided in the Tender document.

Signages shall be provided for all the areas of the Buildings as per details provided below

1. Informative Signage / Building Directory at Main entrance of each building – This shall provide information about the Karkhana/ Facilities/Office housed in the building block along with floor number. These signages shall be SS embossed lettering over lacquered glass. The signage shall be illuminated.
2. Informative and Directional Signage / Floor Directory at strategic locations – This shall specify the Karkhana Units / Facilities like lifts, staircases, drinking water, Toilets, services etc. housed in the particular floor with directions. These signages shall be laser cut lettering/symbols on SS sheets.
3. Karkhana Unit/Office Numbering – All Units/Office within the building shall be provided with Unit/Office number. The same shall be provided above the Entry door of the Unit/Office. These signages shall be laser cut lettering on SS sheets.
4. Functional Signages for Karkhana Unit/Office names – The Entry doors of all Karkhana Unit/Office, all common facility rooms, shall be provided with signage board specifying the name of the room.
5. Functional Signage for Facilities – Signages shall be provided for all Male / Female Toilets and Differently-abled Toilets in common area and in core of Small Karkhana and Office Building, Drinking Water points, Pantries, Electrical rooms, LV rooms, AHU rooms, UPS rooms and any other services rooms etc. These signages shall be laser cut symbols/lettering on SS sheets.
6. Directional Signages – Parking area shall be provided with driveway directional signages, entry/exit directional signages, parking areas signages, lift lobby and staircase signages, etc. These signages shall be embossed lettering/ symbol on acrylic/ vinyl sheets.
7. Fire Safety and Emergency signage - The complete campus and Building internal areas shall be provided with Fire Safety and Emergency Signages as per latest NBC guidelines and Fire norms. The Fire safety signage system shall be designed to provide all information regarding (but not limited to) Fire safety equipment like Fire Hose cabinet & Fire extinguishers, Safe assembly points, Fire Hydrant points, Fire exits directions, Fire escape Staircase, floor-wise Emergency evacuation plans etc.
8. The External fire safety signages and signages for Fire safety equipment, shall be photo luminescent type. All emergency exit signages inside the buildings shall be illuminated by electric light wired to an independent electrical circuit on an alternative source of supply. All landings of floor shall have floor indicating boards prominently indicating the number of the floor.
9. The signages for the facilities shall be both in internationally accepted symbols and letters.
10. All external signages, Building Directory signage, floor directory signage shall be properly electrically illuminated for night visibility.

## **Boundary Wall**

The entire perimeter length of the site shall have boundary wall with adequate number of Gates for entry / exit to the site. Scope of works includes supply, construction, installation, testing and commissioning for construction of Boundary walls including necessary earthworks, finishing works, material required for completion of the works as per the specifications to the satisfaction of the Engineer in charge.

The boundary wall shall be in combination of block wall and RCC columns as per structure at 3m center to center with an expansion joint as per the IS Codes. The Boundary wall shall be provided with 900mm high Y-angle with 1 row of Concertina coil and 9 Rows of Razor blade wires going through it. An electrical fencing is also proposed with the concertina coil running through the full length of the boundary wall for security purpose.

The total height of the Boundary wall shall be 2.1m from finished road level, finished ground level or natural ground level, whichever is higher, as per design. The boundary wall shall be finished with plaster and painting works/stone cladding as per the specifications.

## **Power Fencing System for Boundary Wall**

The project being a vital Gems and Jwellery park, it requires high security system to ensure that there is no unauthorized entry to the campus or damage inflicted to any part of the campus. Under the 3-Tier security system proposed for the campus, perimeter protection system is a part of the Tier -1 installations.

Scope of works covers supply, installation, testing and commissioning of Power fencing system for the entire perimeter boundary walls for the site including necessary Aluminium conductor wires, Cables, Insulator, Energizer, GI / Powder coated Aluminium Strain posts, equipment enclosure, warning sign board, integration with IBMS system, Lightning protection and earthing etc all complete with all requirements necessary for functioning of the system.

It also includes integration and interfacing of the Power fencing system works with IBMS system of the project.

## **MS Sliding Gates**

The entry/exit gates shall be provided with sliding gates for entry and exit requirements of the site. MS Automated Bi-parting Sliding Gates (of equal panels) shall be provided at the center of the boundary wall for the vehicular entry and Rolling shutter shall be provided for the pedestrian entry/exits. All MS sliding gates, rolling shutters etc. shall be finished with enamel paint as per approved shade, make and specifications.

All works to be carried out as per specifications and shall be complete in all respect meeting all the functional requirements and design intent.

## **Landscape and Arboriculture**

The complete site shall be provided with Landscape scheme to enhance the surroundings and give an aesthetic foreground to the prestigious buildings.

The Landscaping works for the project can be classified into following categories:

* Perimeter tree planting - the complete peripheral boundary shall be provided with trees with large foliage and flowering species. These areas shall also cater to the compensatory planting required for trees which are proposed to be cut.
* Areas with Landscaping elements –ntense landscaping shall be provided for open areas
* Areas with green cover – The green lawns, ground covers and planting of shrubs to beautify the road edges, open gathering space, and some special focal points shall be provided.
* Surface covers through Grass paver blocks for parking area shall be provided as per the green building feature.
* Maximum use of soft landscape to enhance ground water recharge.

The Scope includes supply, execution, providing all horticultural operations and services specified in the specifications, Tender documents, including planting material, hardscape materials, Landscape elements, landscape lighting, water bodies, fountains, Main Signage, labour, equipment, services and transport for all plant materials, Good earth, top soil, manures, pesticides etc.

* All plant species shall be proposed in accordance to the LEED Gold rating requirement.

Maximum use of native plants that grow in harmony with the environment, save natural resources and form part of the natural ecosystem.

* Provide all plant material, topsoil for all plants, fertilizers, chemicals and manure including labour, equipment, services and transport.
* Preparation of planting locations.
* Prepare plants pits, back filling, prepare “saucers” for watering, adding soil after settlement.
* Spraying before planting.
* Staking, supporting, wrapping and tying plant material.
* Transplanting, if any.
* All works for the pathways, seating, toe walls, planters, steps, mounds, paved areas including surface preparation, PCC / RCC works, masonry works, finishing works etc.
* Supply, installation of sculptures as per approval by PMC/Owner/Engineer in charge.
* Landscape lighting works for all landscaped areas including lighting for sculpture, water body, fountains, etc.
* All civil, electrical, plumbing works for water bodies and fountains including integration and interfacing with the main MEP systems of the project.
* Disposal of debris and unused materials.
* Guarantee of trees and plants for a period of 12 (Twelve) months after completion.

## **Schedule of Finishes**

The below specifications are only indicative and not exhaustive and shall be correlated with the specific details and architectural, structural and other drawings as approved. The contractor has to plan and execute all the missing fittings, fixtures, items to make premises to the full use and functional. Nothing extra shall be paid on this account.

Superior/ stringent specifications shall be followed in case of any ambiguity in specifications given herein, particular specifications, drawings or any other part of this tender document. Decision of the Owner‘s/PMC n this regard shall be final, binding and not arbitral.

1. Applicable to all Structures and buildings unless otherwise mentioned

| **Sl. No.** | **Items of Work** | **Specifications** |
| --- | --- | --- |
| 1. | Building structure |  |
| 1.1 | Foundation(Substructure) | * RCC Cast in situ foundation system as per Good For Construction (GFC) drawings approved by the proof checking agency and cleared by the Employer‘s Representative based on the recommendations as in the approved Soil Investigation Report. * The contractor shall carry out its Geo-technical investigation to arrive at soil bearing capacity, soil configuration, type of soil etc necessarily required for the structural design of the building. Sufficient number of boreholes with bore hole drilled upto 30m or such a depth as given in IS 1893 Part 1. to be conducted as per the relevant BIS Codes, NBC 2016 as applicable. At least 02 Nos of borehole to be done for each building/structures site. Also the same shall be vetted by specialist Geo Consultants and any additional investigations required for the same shall be done by the Contractor at no additional cost to the Employer. * Locating foundation of a building/ structure on sloping ground should be preceded by detail examination of the hill slope stability conditions and identification of necessary retaining wall structures for counteracting the effects of the adverse conditions. Scope of work also includes planning, designing and construction of all such retaining structures, for which nothing extra shall be payable to the contractor. * Surplus excavated earth shall not be taken out of the campus and shall be used in campus itself as per direction of the Owner ‘s Representative. Additional good earth, if required, for the work shall be brought from outside the campus and nothing extra shall be paid on this account. |
| 1.2 | Plinth Filling:  Sand filling under floor | The sand filling is to be done under the floors and plinth beams or like areas, with river sand 150mm thick. The sand shall be evenly graded, as per the relevant IS Code |
| 1.3 | Concrete under footings (if applicable) | Min Grade of PCC M15 shall be used below foundations. |
| 1.4 | Superstructure | * The Building shall be RCC framed structure Modular System for construction, with uniform column spacing and spans, minimum M25 grade of concrete, earthquake resistant and as per structural design duly vetted by IIT Mumbai and approved good for construction drawings. * All windows and ventilators on external walls shall have RCC chajja/ sun shade or similar protection members to protect against rain and direct heat. |
| 1.5 | Filler Walls | * The external walls of the building shall be normally 200 mm thick (minimum) AAC Block wall. All the internal partition walls may be 100/200 mm thick AAC Block, unless required otherwise as per approved drawings. * Partition wall between two units shall be 230 mm thick brick wall * Toe walls below the plinth level shall be resting on plinth beams and shall be provided for protection against floor bed erosion by rodents/water etc. * Bricks: The Brick shall be of first class designation 75 FPS bricks approved by the Owner‘s Representative and free from grit and other impurities such as lime, iron and other deleterious salts, conforming NS 1 2035 / relevant IS code (latest revision) as applicable. |
| 2. | Roofing: |  |
| 2.1 | Seismic Joint/Expansion joint | The vertical &horizontal expansion joints/seismic joints shall as per structural design. It should be covered by stainless steel grade 304 plate of thickness 1 mm in vertical joint with polysulphide sealant. In Floor joint, tongue and groove plate system of SS 304 grade for joint should be provided. Standard ready-made products of approved makes shall be used.  At roof seismic joint treatment should be as per CPWD Specification. |
| 2.2 | Water proofing treatment | Water Proofing Treatment on Terrace, Podium slabs, vertical surfaces of footings, retaining walls, Toilets, sunken slabs, underground structures/tank, lift pit, etc. (as applicable to the particular building/structure) to be done as per the approved Water Proofing Scheme by Owner/PMC |
| 2.3 | Rain Water Pipes: | All the RWP pipes including fittings shall be PVC Pipes of design pressure exposed on walls / in the shafts to be executed as per CPWD specification and approved drainage and plumbing drawings. |
| 3. | Finishing: |  |
| 3.1 | Plastering on walls  {Internal & External (wherever applicable)}: | * RCC Ceiling Surface: Ceiling shall have 6mm thick cement plaster of mix 1:3 (1cement: 3 fine sand). * All wall surfaces (internal):12mm / 15mm thick ready-mix cement plaster of mix 1:6(1 cement: 6 Fine sand) as per requirements. * Plastering on External walls: 18 mm cement plaster in two coats under layer 12mm thick cement plaster 1:5 (1 Cement: 5 Coarse Sand) finished with a top layer 6 mm thick cement plaster 1:6 (1 Cement: 6 Fine Sand). * Necessary drip course shall be provided in Chajja, Balcony, Projecting Roof, Beams etc. * Chicken wire mesh to be fixed on wall surface at junction of masonry work and RCC works. |
| 4. | Miscellaneous: |  |
| 4.1 | Anti-termite treatment with Chlorpyriphos/ Lindane E.C. 20% with 1% Concentration/with approved chemicals | Providing and injecting chemical emulsion for post constructional anti termite treatment along the external wall up to depth of 300mm as per CPWD specifications. |
| 4.2 | Plinth Protection: | 1000mm wide plinth protection of 100 mm thick M-15grade over 75mm thick bed of sand, half brick masonry edging laid lengthwise to 150 mm depth and finished with 18-20 MM thick sand Stone as per approved color and shade by Owner/PMC colour, shade as approved. |

1. **Applicable to interior area  unless otherwise mentioned**

| **S. No.** | **Area Type** | **Flooring** | **Walls** | **Ceiling** | **Equipment & Fittings** |
| --- | --- | --- | --- | --- | --- |
| 1 | **Office Building (Type C)** | | | | |
| 1.1 | Reception /Waiting, Entrance Foyer | 18 MM thick Italian Marble Flooring | 18 MM thick Italian Marble cladding on in combination with with Low VOC acrylic Emulsion /Texture paint /lacquered glass, feature wall finish | False Ceiling- combination of Moisture resistance Gypsum board/ grid tile Ceiling |  |
| 1.2 | Lift Lobby | 18 MM thick Italian Marble Flooring | 18 MM thick Italian Marble cladding in combination with Low VOC acrylic Emulsion /Texture paint /lacquered glass, feature wall finish | False Ceiling- combination of Moisture resistance Gypsum board/ grid tile Ceiling |  |
| 1.3 | Corridors | Polished Granite Stone Flooring | Wooden paneling upto 1000 MM height finished with 4 MM thick veneer and melamine polish.  Low VOC acrylic Emulsion /Texture paint | False Ceiling- combination of Moisture resistance Gypsum board/ grid tile Ceiling |  |
| 1.4 | Staircases | Granite Stone Flooring with 150 mm high Dado | Low VOC acrylic Emulsion /Texture paint | Low VOC Oil bound distemper |  |
| 1.5 | Common Toilets/ Wash- room | 600X600 MM Anti-skid double charged vitrified tile flooring | 600X600 MM double charged Vitrified tiles Tiles cladding upto bottom of false ceiling all around. Modular cubicle partitions of 2100 MM high system as per the Owner requirement. | Calcium silicate false ceiling /Low VOC Oil bound distemper | Stainless Steel Accessories, Push Type Low Flow Taps, Full length Mirror, Granite Counter Top, All Chinaware, Exhaust Fans with Louvers as required. |
| 1.6 | Common Kitchen / Pantry | 600X600 MM Anti-skid double charged vitrified tile flooring | 600X600 MM double charged Vitrified tiles cladding upto 2100 MM height all around. Low VOC Oil bound distemper above upto ceiling. | Low VOC Oil bound distemper | SS double sink over granite counter top with mixer & SS accessories. Provision of Hot water, Exhaust fan with louvers. |
| 1.7 | Store/Service Areas/ Electrical Room | 30 MM thick Kota Stone Flooring | Low VOC Oil Bound Distemper | Low VOC Oil Bound Distemper | Exhaust Fans with Louvers as required. |
| 1.8 | Toilet Doors | 40 mm thick wooden Flush door with 1.0 mm thick laminated finish, 125X65 MM wooden chawkhat and accessories. | | | |
| 1.9 | Railing | 1000 MM high SS glass railing of Grade 304/316, 10 MM thick toughened glass with SS Balusters & Accessories as per approved drawings and finishing. | | | |
| 1.10 | Entry Steps & Platform | Polished granite stone with approved shade. | | | |
| 1.11 | Ramps at entrance for DAP | 18-20 MM thick-flamed granite finish with stainless steel railings and handrails on both sides arranged in anti-skid strips. | | | |
| 2 | Large & Medium Karkhana (Type A) | | | | |
| 2.1 | Reception /Waiting, Entrance Foyer | 30 MM thick Polished Kota stone Flooring | Plastic emulsion paint | False Ceiling- combination of Gypsum board/ grid tile Ceiling |  |
| 2.2 | Lift Lobby | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Combination of glazed vitrified tiles and textured paint. | False Ceiling- combination of Gypsum board/ grid tile Ceiling |  |
| 2.3 | Corridors | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Low VOC acrylic Emulsion /Texture paint | Open |  |
| 2.4 | Staircases | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Low VOC acrylic Emulsion /Texture paint | Low VOC Oil bound distemper |  |
| 2.5 | Common Toilets/ Wash- room | 600X600 MM Anti-skid double charged vitrified tile flooring | 600X600 MM double charged Vitrified tiles cladding upto bottom of false ceiling all around. Modular cubicle partitions system of 2100 MM high as per the Owner requirement. | Calcium silicate false ceiling /Low VOC Oil bound distemper | Stainless Steel Accessories, Push Type Low Flow Taps, Full length Mirror, Granite Counter Top, All Chinaware, Exhaust Fans with Louvers as required. |
| 2.6 | Common Kitchen / Pantry | 600X600 MM Anti-skid double charged vitrified tile flooring | 600X600 MM double charged Vitrified tiles cladding upto 2100 MM height all around. Low VOC Oil bound distemper above upto ceiling. | Low VOC Oil bound distemper | SS single bowl sink over granite counter top with mixer & SS accessories. Provision of Hot water, Exhaust fan with louvers. |
| 2.7 | Store/Service Areas/ Electrical Room | 30 MM thick Kota Stone Flooring | Low VOC Oil Bound Distemper | Low VOC Oil Bound Distemper | Exhaust Fans with Louvers as required. |
| 2.8 | Toilet Doors | 40 mm thick wooden Flush door with 1.0 mm thick laminated finish, 125X65 MM wooden chawkhat and accessories. | | | |
| 2.9 | Railing | 1000 MM M S Railing with wooden hand rail | | | |
| 2.10 | Entry Steps & Platform | Polished granite stone with approved shade. | | | |
| 2.11 | Ramps at entrance for DAP | 18-20 MM thick-flamed granite finish with stainless steel railings and handrails on both sides arranged in anti-skid strips. | | | |
| 3 | **Small Karkhana (Type B)** | | | | |
| 3.1 | Reception /Waiting, Entrance Foyer | 30 MM thick Polished Kota stone Flooring | Plastic emulsion paint | False Ceiling- combination of Gypsum board/ grid tile Ceiling |  |
| 3.2 | Lift Lobby | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Low VOC acrylic Emulsion /Texture paint. | False Ceiling- combination of Gypsum board/ grid tile Ceiling |  |
| 3.3 | Corridors | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Low VOC acrylic Emulsion /Texture paint | Open |  |
| 3.4 | Staircases | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Low VOC acrylic Emulsion /Texture paint | Low VOC Oil bound distemper |  |
| 3.5 | Common Toilets/ Wash- room | 300X300 MM 10 MM thick ceramic tile flooring | 300X450 MM, 10 MM thick ceramic wall cladding upto 2100 MM height. | Calcium silicate false ceiling /Low VOC Oil bound distemper | Stainless Steel Accessories, Push Type Low Flow Taps, Full length Mirror, Granite Counter Top, All Chinaware, Exhaust Fans with Louvers as required. |
| 3.6 | Common Kitchen / Pantry | 300X300 MM 10 MM thick Anti-Skid ceramic Tiles flooring | 300X450 MM, 10 MM thick ceramic wall cladding upto 2100 MM height. Low VOC Oil Bound Distemper | Low VOC Oil bound distemper | SS single bowl sink over granite counter top with mixer & ss accessories, Exhaust fan with louvers. |
| 3.7 | Store/Service Areas/ Electrical Room | 30 MM thick Kota Stone Flooring | Low VOC Oil Bound Distemper | Low VOC Oil Bound Distemper | Exhaust Fans with Louvers as required. |
| 3.8 | Toilet Doors | 40 mm thick wooden Flush door with 1.0 mm thick laminated finish, 125X65 MM wooden chawkhat and accessories. | | | |
| 3.9 | Railing | 1000 MM M S Railing with wooden hand rail | | | |
| 3.10 | Entry Steps & Platform | Polished granite stone with approved shade. | | | |
| 3.11 | Ramps at entrance for DAP | 18-20 MM thick-flamed granite finish with stainless steel railings and handrails on both sides arranged in anti-skid strips. | | | |
| 4 | Fire Station Police Chowki, M I Room, Gates (Type D) | | | | |
| 4.1 | Hospital Reception /Waiting, Entrance Foyer | 600X600 MM 10 MM thick Double Charged vitrified floor | Low VOC acrylic Emulsion /Texture paint wall finish | False Ceiling- combination of Gypsum board/ grid tile Ceiling |  |
| 4.2 | Corridors | 600X600 MM 10 MM thick Double Charged vitrified floor | Plastic Emulsion paint. | Open |  |
| 4.3 | Staircases | 30 MM thick Polished Kota stone Flooring in combination with marble stone strips, | Plastic Emulsion paint. | Low VOC Oil bound distemper |  |
| 4.5 | Toilets/ Wash- room | 300X300 MM 10 MM thick ceramic tile flooring | 300X450 MM, 10 MM thick ceramic wall cladding upto 2100 MM height. | Calcium silicate false ceiling /Low VOC Oil bound distemper | Stainless Steel Accessories, Push Type Low Flow Taps, Full length Mirror, Granite Counter Top, All Chinaware, Exhaust Fans with Louvers as required. |
| 4.6 | Kitchen / Pantry | 300X300 MM 10 MM thick ceramic tile flooring | 300X450 MM, 10 MM thick ceramic wall cladding upto 2100 MM, height.Low VOC Oil Bound Distemper | Low VOC Oil bound distemper | SS single bowl sink over granite counter top with tap & ss accessories. Exhaust fan with louvers. |
| 4.7 | Toilet Doors | 40 mm thick wooden Flush door with 1.0 mm thick laminated finish, 125X65 MM wooden chawkhat and accessories. | | | |
| 4.8 | Railing | 900 MM M S Railing with wooden hand rail | | | |
| 4.9 | Entry Steps & Platform | Kota Stone | | | |
| 4.10 | Ramp (ground Floor near main entrance) | Polished granite fixed in segments for skid. | | | |

## **Topographical Site Survey & Drone Survey**

The scope of work includes carrying out topographical survey works at complete site as per relevant IS Standards and preparation of topographical survey drawings and report as per specifications provided in the Tender document.

Topographical survey including GPR Survey (Ground Penetrating Radar Survey) shall be conducted in topo extent area in a grid of 5mx5m and preparation of contour map on 1:500 Scale with Contour interval of 1.0 m including spot leveling (field distance between any two of the spot levels is not more than 10 m in any direction) in soft/hard copies complete, including connecting GTS Benchmarks by double leveling and establishment of required number of bench marks in the area at specified places as approved by Owner/PMC.

The survey for the approach/access road up and abutting roads on all sides (including marking of existing structure level, top level & invert levels of drains, catch basis, manholes etc.), all existing buildings, features, tress, vegetation, water bodies, overhead and underground services (telephone lines, signal lines/equipment, HT/LT lines, water supply, drainage/gas lines and OFC cables etc.), including Cutting of bushes / dense vegetation, all type of jungle including making path, if any, etc. required for the conducting the topographical survey.

Topographical Survey and Report shall include the following details:

* Carrying level from GTS benchmark (from the nearest authorized benchmark)
* Existing Structures, Existing roads, foot paths, pavement edges, shoulders, toe lines and trees etc. within the required area.
* All existing physical features, contours, depressions, levels, slopes etc.
* Survey of sewerage system with MH, sewage lines, Pumping station, Existing sewerage manholes, marking and top levels and invert level of manholes in and around area of project boundary.
* Survey of Water supply system with valve chamber, Pipe line alignment, dia., etc., Existing water supply connection points; tap points, etc. in and around area of project boundary.
* Survey of Storm drainage system with Existing storm water drain size, type of structure and invert level including those outside the site boundary but adjacent to the site.
* To carry out Topographical survey for 5m x 5m Interval Grid levels for project area and 30m from outside of the project boundary.
* The complete area shall be surveyed capturing all the details like, buildings, temporary/ permanent structures with names, height, plinth levels, roof top level, fences, entry points etc. boundary,
* All Utilities (above and below ground),
* Trees along with names and girth, width, species, height etc. all features complete.
* The survey map shall be super imposed on land use map/FMB and shall be submitted.
* Survey of all drains, nallah coming in site or abutting the site showing the top width, bottom width, invert level and culverts etc., complete.
* Survey of reservoir, pond, river, forest, hills, rock, boulders etc.
* Monuments, Cremation ground, places of worship with names.
* AMSL of sites, access road, invert levels of water bodies to be marked in the drawings.
* The GTS coordinates to be located and to be transferred to the site location of survey. Bench marks levelling to be done and benchmark to be traversed to our site.
* HFL of all site to be marked on the drawing.

The survey map shall be prepared based on field data using computer program such as Auto CAD, Total Station etc. In the event of any landmark or permanent features BP, Permanent buildings, river, well etc. falling within / along the route of survey, the same are to be shown in the maps.

The scope of works also includes Aerial videography and orthophoto/photogrammetry survey with UAS-Drone technology or latest technology. The survey area shall include all the adjacent roads around the plot including marking of trees, existing, structure levels, top level & invert level of the drain.

Topographical Survey and Report indicating base line survey report shall include GPS bench mark, triangulation network points (temporary benchmark), close traverse survey details along with the photographs and videography of the survey conducted. The survey report shall include Index Map, scope of work, methodology, description of area, list of Bench Marks, list of traverse points, list of existing buildings, list of trees, along with all above details. All natural features such as reservoir, pond, nallahs, river, forest, hills, trees etc. are to be shown on survey sheets in distinct colours. All man made features such buildings, telephone/ telegraph/ power lines etc. should also be on survey sheets.

## **Geotechnical Investigation**

The scope of work includes carrying out Geotechnical Investigation works, Physical Layouts of Buildings and Liquefaction Potential Assessment as per relevant IS Standards including preparation, submission and vetting of reports as per specifications provided in the Tender document. Degree of geotechnical investigations shall include Laboratory and Field Test along with the analysis of results and recommendation of foundation requirements in the report for the proposed structures to determine nature of construction.

**The Geotechnical Investigation shall be carried at borehole locations as per the approved Master plan and the number of boreholes shall be provided as per IS Codes.**

The scope of work involves carrying out the following operations: -

* Mobilization, Demobilization, Site clearance and shifting of equipment with all accessories and deploying the survey engineers and technical personnel’s.
* Marking of Bore holes at Site as per the Coordinates given in approved Bore Hole Location Drawing submitted by the EPC Contractor.
* Shifting of boring equipment with all accessories from one location to another location including all labour and materials. Boring minimum 6” dia in all types of soils upto rock strata.
* Drilling NX size boring minimum upto 4m into rock and collection of core samples in hard rock.
* Carrying out standard penetration test (SPT) as per latest IS codes at site at the required depths
* Depth of water table, collection of ground water samples and water test report.
* Mobilization and Transportation of the personnel, plant and equipment to the site of work and with drawing the same after completion of work.
* Drilling of boreholes up to minimum 20m depth, in soil strata or upto refusal/rock strata (where N value>75) whichever is earlier, and if N value is < 15 or refusal not encountered, till 20 m, then upto 1m deep after receiving N value > 15 or refusal/rock strata whichever is earlier.
* Conducting Standard Penetration Test (SPT) in the soil at every 1.5m depth or wherever strata change up to the Refusal or as per Indian Standard Specifications (IS-2131).
* Permanent marking of boreholes at site
* Collecting disturbed/undisturbed soil samples from the bore holes at regular intervals of 1.5m or change of strata or wherever possible as per IS Code of Practice, sealing, numbering and preserving them as per the requirement for Laboratory tests.
* Collecting Rock core samples continuously with a record of Core recovery
* Collecting water samples and conducting various laboratory tests on collected water sample
* Recording ground water table, if met.
* Carrying out the required Laboratory tests on the Soil and Rock samples in order to establish their engineering characteristics.
* Recommended SBC to be given for all bore holes, minimum for all depths at interval of
* 0.5 m viz. 1.5m, 2.0m, 2.5m, 3.0 m etc. till the exploration depth. SBC should be worked out for the following sizes of footings: -

a. 1.5 x 1.5m

b. 1.5 x 2.5m

c. 2.0 x 2.5m

d. 2.0 x 3.0 m

e. 3.0 x 3.0 m

* Recording, videography and submitting photographic evidences with date-stamp for all bore holes, sample collection and other on field investigation activities.
* RL of the Ground level/founding level with ref to a BM should invariably be mentioned in the soil investigation report.
* Recommendation for filling under floors.
* Swelling index and Swelling pressure in respect of Black cotton soil and its depth/layer.
* Depth of Ground water table (GWT) in peak monsoon (lowest) and peak summer (highest) after correlation of result with seasonal variation of water table in the station.
* Preparation of Geotechnical investigation report comprising the following aspects
* Lab test results of soil
* Engineering Analysis of soil
* Analysis of results & recommendation

# **Note:**

1. Borehole to be properly cleaned before taking any sample in soil.
2. Casing to be used as per the prevailing soil conditions, to stabilize the borehole.
3. Investigation works has to be done in the presence of PMC/ Client representative.
4. Lab should be NABL accredited.

The laboratory tests on soil samples such as (but not limited to) sieve analysis, Atterberg’s limit, field moisture content, bulk density, specific gravity, DFS, Permeable Test, consolidation test, unconfined compressive strength test, chemical test on subsoil/sub-water sample, shear test for cohesion and angle of shearing resistance shall be conducted.

The Geotechnical Investigating report dully vetted shall be submitted showing test points, results of field investigations, laboratory test results, calculation of SBC, recommendation and precaution regarding type of foundation and as per scope. The report shall include (but not limited to) recommendation for bearing capacity of soil, type of foundation and related engineering properties including pile design, pile load test as per site requirement along with calculation details, Assessment of Liquefaction, recommended foundation type and details and RL based on soil investigation report and special requirement for foundation if any due to ground condition e.g. black cotton soil, costal area, water body, nallah, low lying or filled up area, Ground Water Quality, etc. along with all points mentioned above.

## **Gold Refinery facility and Central Vault Facility**

**Gold Refinery** -The scope of the works includes construction of separate building for the undertaking the process of Gold refining as per the Owner requirement, codal provisions and best national/international standards. The contractor shall be responsible to collect all necessary information regarding the process of gold refining and the particular requirements of the industry. In accordance the building shall be designed and constructed with provision of integrating all the requisite MEP services at the building level.

**Central Vault Facility**- The scope of the work includes provision of Central Vault Facility at the ground floor of block tower for easy handling, loading and unloading of an area of approx. 5000 Sqft. Central vault to be divided into two sections:

1. Based on local requirement – Min 2500 sft carpet area
2. Based on custom requirement – Min. 1500 sft carpet area provided in the central ault system

The vault to be high security vault and adequate load bearing capacity to be provided for floor of vault facility. Two door/check barrier system to be adopted for security van entry for the vault. Adequate space to be provided for easy access to security vans for transferring goods. Common area for vault exit directly into the security van. The walls of the Vault will be inlay tang bars. The walls are cladded with 5 MM thick MS Sheet. The provision of small holes to be strategically provided meeting safety requirements of the vault for air passing to avoid any jamming of the vault door. Separate doors to be provided for each sections however Internal doors to be provided between sections for internal movement. Provision of a Trap door as a secondary door for exit in case of emergency. Provision of separate parking for the security vans. Separate toilet/pantry shall be provided outside vault.Provision of required security parameters by means of barricading, S turns for speed barrier, bollards etc to avoid any possible threat. Provision of following services, but not limited to, shall be made inside vault

UPS backup service

* 1. Air conditioning
  2. D.G backup service
  3. Vault system for security and surveillance
  4. Smoke alarm, motion and vibration sensors, xray screening (100% screening) , CCTV with night vision
  5. Water sprinkler
  6. Connect to the nearest police station
  7. Provision for customs office in nearby location
  8. Provision of bifurcation of vault in to various compartment/racks for different services like diamond, customs, gold etc.

**SECTION C 2 – Structure**

## **General**

The Structural System works shall comprise of design, engineering and construction of buildings which includes Large & Medium Karkhana Units, Small Karkhana units, Commercial Office building block, Amenities building (MI Room, Fire Station, Custom office, Police Chowki) and Gold refinery & Cental vault facility.

The buildings are planned as RCC farmed/Steel composite Modular System of construction, with uniform column spacing and spans, permitting repetitive structural framing, symmetrical Structural grid pattern leading to speedy construction and increase in efficiency and avoiding wasteful expenditure on formwork/shuttering, as a fundamental design principle.

*Note:-The bidder shall necessarily* submit vetted adopted structural scheme of the building preferably by IIT Mumbai or any other IIT in the Technical Bid.

The contractor has to carry out the “Geo Technical Investigation” for completeness and adequacy for the design works. The contractor shall perform the investigations on his own as per the design requirements at no extra cost payable and shall carry out geotechnical investigation with bore hole drilled upto 30m or such a depth as given in IS 1893 Part 1. Also the same shall be vetted by specialist Geo Consultants and any additional investigations required for the same shall be done by the Contractor at no additional cost to the Employer.

The Structural design shall be proof checked by Structural Consultants as per Employer’s requirement and only the approved drawings shall be released for Construction. The contractor shall update the designs for any changes arising as an outcome of the Proof check and the same shall be deemed to be included in the quoted cost. The third-party proof check bodies shall be IIT Mumbai or any other institution or company as approved by the Employer. The Cost of Proof Checking shall be borne by the Contractor.

## **Scope of Works**

The general character and the brief scope of work to be carried out under this contract is illustrated in this document, and specifications. The scope of works shall comprise of (but not limited to) Design, Engineering, Calculations, Drawings, Supply, Construction, Installation, Testing And Commissioning approval from Employer/Engineer In Charge/Statutory authorities for Structural System works comprising of following components:

* Industrial Large Karkhanas
* Industrial Medium Karkhanas
* Industrial Small Karkhanas
* Commercial Office Building
* Amenity buildings: Firefighting, Police Chowki, Custom Office, MI Room building.
* Podium
* Gold Refinery facility and Central Vault Facility
* shops and recreation area for Karkhana units

The floor to floor height of Large/Medium/Small Karkhana shall be 4.2 M, and & commercial office building and other all buildings shall be 3.6 M

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Engineer in Charge.

The contractor shall furnish all labour, materials and equipment as per scope of works, transportation necessary for the complete Structural works as described in the Tender document and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract.

For all the layouts and details attached with Tender documents shall be verified by the Contractor as per applicable Local Bye-laws, Indian Standard codes, NBC-2016 requirements, and any other relevant statutory / codal requirements, before execution and any alterations required shall be submitted to the Owner/PMC Charge for approval.

All works for design and construction shall confirm to prerequisites requirements to achieve LEED Gold rating.

## **Structural Design Standards and Codes**

Following Indian Standard codes may be followed for the Safe and Economical design of all Structure to ensure the safety in all respect. The following are the Standard codes which are generally used in design of structures. The codes and standards generally applicable to the work of this section are listed hereinafter.

IS 456: 2000 - Plain and Reinforced Concrete - Code of practice

IS 516:1959 - Method of test for strength of concrete

IS : 800 - Code of practice for general construction in steel.

IS : 801 - Code of practice for use of cold formed light gauge steel structural members in general building construction.

IS : 806 - Code of practice for use of steel tube in general building construction.

IS : 807 - Code of practice for design , manufacture erection, testing of crane and hoists

IS : 811 - Specification for cold formed light gauge structural steel section

IS : 816 - Code of Practice for use of Metal welding under General Construction in Mild Steel.

IS 875(Part 1): 1987 - Dead Loads - Unit Weight of Building Material and Stored Material

IS 875(Part 2): 1987 - Imposed Loads

IS 875(Part 3): 2015 - Wind Loads (Amended in 2017)

IS 875(Part 4):1987 -Code of practice for design loads Snow loads

IS 875(Part 5): 1987 - Special loads and load combinations

IS : 914 - Code of practice for covered electrodes for metal arc welding.

IS : 1200 - Method of measurement of building and civil engineering works

IS : 1786 - Specification for high strength deformed bars

IS : 1838 - Performed fillers for expansion joints in concrete- non-extruding and resilient type.

S 1893(Part 1): 2016 -Criteria for earthquake resistance design of structures (Reaffirmed in 2017)

IS 1904 - Indian Standard Code of practice for design & construction of foundations in Soil: General Requirements

IS 2386(Part 1 to 8) - 1963 Methods of test for aggregates for concrete

IS 2502:1963 - Code of practice for bending and fixing of bars for concrete reinforcement

IS 2645:2003 - Specification for integral waterproofing compounds for cement mortar and concrete

IS : 2751 - Recommended Practice for welding for reinforcement bars.

IS 3370 (part I to IV) -Code of practice for concrete structure for storage of liquid

IS : 3414 - Code of practice for design and installation of joints in buildings.

IS : 4014 -Code of practice for steel tubular scaffoldings.

IS 4326: 2013 - Earthquake Resistant Design and Construction of Buildings

IS 10262:2009 - Guidelines for concrete mix proportioning

SP 23(S&T): 1982 - Handbook on concrete mixes (Based on Indian Standards)

SP 16 -Structural use of concrete. Design charts for singly reinforced beams, doubly reinforced beams and columns

SP 34 - Handbook on Concrete Reinforcement & Detailing

SP 64(S&T): 2001 -Explanatory Handbook on Indian Standard Code of practice for Design Loads (Other than Earthquake) for Buildings and Structures: Part 3 Wind Loads [IS 875(Part 3):1987]

SP-7 -National Building code of India

National Building Code of India-NBC-2016

IS 13920: 2016 – Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces (Reaffirmed in 2017)

IS 3809:1979 -Fire resistance test for structures (first revision)

IS 800: 2007 - Code of Practice for General Construction in Steel

SP: 6 – 1964 – Hand Book for Structural Engineers Part 1 – Structural Steel Sections

IS 4000: 1992 – High strength bolts in steel structures – Code of practice.

IS 16700 Structural safety of tall concrete building

Note: -

1. The codes which are not listed above may be followed to ensure safe and economical design.
2. All the recent and newly revised Indian and International Standards shall be followed for the design of structures.

## **DESIGN PARAMETERS**

The mean probable design life of structure is 50 years is to be considered for design of structures. Appropriate value of K1 shall be used. Importance factor of 1.2 shall be used in Earthquake forces.

## Material of Construction

1. RCC works

* Density of reinforced concrete : 25 KN/m3.
* Grade of Steel : Fe500D (500 N/ mm2.)
* % Elongation : 20

## Grade of Concrete

1. The min. Grade of Concrete in all RCC structural members and PCC shall be as follows: -

* Cast in situ RCC Columns : M40
* Cast in situ RCC Shear walls : M40
* Exposed RCC Non-structural walls (M25) : M25
* Cast in situ RCC Footing (M25) : M25
* Water Retaining Structure (M30) : M30
* Cast in situ RCC Beams (M25) : M25
* Cast in situ RCC Slabs (M25) : M25

1. Min Grade of PCC M15 shall be used below foundations.
2. Min Grade of PCC M10 shall be used in filling, plum concrete, levelling courses and other non-structural items.

## Other Parameters -

* Minimum cement content, water cement ratio etc. shall conform to IS 456:2000 provisions for durability and strength criteria.
* Ordinary Portland cement of grade 43 or higher conforming to IS 8112 and IS 12269 shall be used for RCC works.
* The sizes of aggregates shall conform to IS 383. Nominal maximum size of coarse aggregate is 20 mm, suitably graded as per the requirement of mix design.
* Water used for construction shall conform to IS 456: 2000.
* High yield strength deformed bars Fe 500D conforming to IS 1786:2008 with Fy = 500 N/mm2 shall be used.
* Structural component should be satisfying requirements of 2 hrs fire rating.
* Structural steel conforming to IS 800 / IS 816 and shall have min yield strength Fy = 250/310 N/mm2 shall be used.
* High strength bolts conforming to IS 3757: 1985 shall be used.
* High strength nuts conforming to IS 6623: 1985 shall be used.
* Hardening & tempering washers for high strength structural bolts and nuts conforming to IS 6649: 1985 shall be used.
* All steel members shall be painted with epoxy based fire proof paint satisfying requirements of 2 hrs fire rating.

## **COVERS TO REINFORCEMENT**

Clear cover for all exposure conditions for RCC members shall be in accordance with IS-456-2000. Clear cover for 2-hours Fire Resistance

1. For Footings (Side and Bottom) : 50 mm
2. For Columns : 40 mm
3. For Beams

a)Simply Supported (Top & Bottom) : 40 mm

b) Continuous (Top & Bottom) : 30 mm

1. For Slabs

a)Simply Supported : 35 mm

b) Continuous : 25 mm

1. For Ribs

a)Simply Supported : 45 mm

b) Continuous : 35 mm

## **DURABILITY CONSIDERATIONS**

Factors affecting the durability of concrete are as follows

1. The environment.
2. The cover to embedded steel.
3. The type and quality of constituent materials.
4. The cement content and water cement ratio of the concrete.
5. Workmanship to obtain full compaction and efficient curing.

## **LIMIT STATES OF SERVICEABILITY**

1. Control of Deflection: - For beams and slabs

a) The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members, should not normally exceed span/250

b) The deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and the application of finishes should not normally exceed span/350 or 20mm whichever is less.

c) The vertical deflection limits may. Generally, be assumed to be satisfied provided that the span to depth ratios are not greater than the values obtained as below:

d) Basic values of span to effective depth ratios for spans up to 10m:

Cantilever 7

Simply supported 20

Continuous 26

e) The total deflection includes the deflection due: (Annex-C-IS-456-2000)

1. Short Term deflection
2. Deflection due to Shrinkage
3. Deflection due to creep

ii. Control of Cracking: -

In general, the surface width of crack should not exceed as given below. (Ref- Cl.-35.3.2-IS-456-2000)

* In general, the surface width of cracks should not exceed 0.3 in members where cracking is not harmful.
* Where members exposed to weather or continuously exposed to moisture in contact soil or ground water 0.2mm
* For Aggressive environment such as severe category – 0.1 mm.

iii. Drift Limit: -

The Story drift in any story due to minimum specified design lateral force with partial load factor of 1.0 shall not exceed 0.004 times the story height. (Ref. Cl.-7.11.1-of IS-1893-(Part-I) 2016) for structural wall system as per Table 9 (iii and iv) and shall not exceed 0.001 times the story height at roof level for flat slab with structural wall system.

The above limits of Deflection, Cracking and drift limit shall satisfy all respective clauses of the relevant standard codes of reference.

## **DESIGN LOADS**

1. Self-Weights: -Self-weight of the structural members shall here to be considered on the basis of the following properties. The self-weight of the structural component other than the listed below shall be taken as per the actual load.

* Density of Reinforced Concrete : 25.0 KN/m3.
* Density of Plain Concrete : 24.0 KN/m3.
* Density of Steel : 78.5 KN/m3.
* Density of Floor Finishes / Plasters : 20.4 KN/m3.
* Density of Soil (Unsaturated) : 18.0 KN/m3.
* Density of Soil (Saturated) : 20.0 KN/m3.
* Density of Light Weight Cinder Filling Material : 12.0 KN/m3.
* Density of Brick masonry : 21.2 KN/m3.
* Density of Light weight AAC block masonry : 8.35-9.81 KN/m3.
* Density of Water : 9.810 KN/m3

ii. Imposed Gravity Loads

The following imposed gravity loads shall here to be adopted in addition to the self-weight of the structure. (Self-weight of slab / beam / columns will be as per the actual designed dimensions adopted in the respective drawings.)

For Office rooms with separate storage or without separate storage, basement parking, Record/file room, Boiler room/plant room Kitchen & cafeterias, Toilet etc.

iii. Live Load to considered for various type of occupancy are listed below

* For Kitchen and Laundries : 3.00 KN/m2
* For Toilet and Bathrooms : 2.00 KN/m2
* For Corridor Passages, Staircase including Fire Escape : 20.00 KN/m2
* For Store Rooms : 4.00 KN/m2
* For karkhan units : 10.00 KM/m2
* For Vaults and Strong Rooms : 10.00 KN/m2
* For Office Rooms with Separate Storage : 4.00 KN/m2
* For Office Rooms without separate Storage : 4.00 KN/m2
* For Terrace (Access Not Provided) : 0.75 KN/m2
* For Terrace (Access Provided) : 1.50 KN/m2
* For Terrace (Solar Panel/HVAC Fans/Plumbing pumps/

Air washer & Scrubber). : 3.0 KN/m2

* For Terrace (Façade Cleaning System) /(Or as per Actual). : 3.0 KN/m2
* For Basement Parking : 5.00 KN/m2
* Records/files store rooms and storage space : 5.00 KN/m2
* Boiler Room/ Plant Room (To be calculated) min. : 5.00 KN/m2
* AHU Room, Electrical Room, UPS Room : 5.00 KN/m2
* Central Library : 6.00 KN/m2 for a minimum height of 2.2m + 2.0 KN/m2 per metre height beyond 2.2m.
* Cafeterias and dining rooms : 4.00 KN/m2
* False ceiling : 0.20 KN/m2
* For Meeting rooms

Seating area : 5.00 KN/m2

Stage area : 5.00 KN/m2

Corridor, Passages, Staircase including fire escapes : 4.00 KN/m2

Steel Roof : 0.75 KN/m2

Dead Load -Steps for seating area (200mm avg.) :5.00 KN/m2 (includes waist slab concrete + Tread and Riser concrete)

Floor finishes (bedding +tiling) : 1.80 KN/m2

Suspended MEP services below roof : 0.50 KN/m2 (Lighting, Sprinkler and AC)

* Suspended MEP service corridors : 1.00 KN/m2 (Location as per architecture)

Note: - The loads which are not included in the above list shall be considered as per the relevant Standard codes and based on material specification used.

viii. Seismic Loads

The seismic load calculations, analysis and design shall be carried out in accordance with IS 1893(Part 1):

As per this code, Mumbai lies in Zone III, the seismic zone considered for design is consider to be Zone IV with zone factor Z = 0.24



Where, Importance factor (I) will be taken as ‘1.2’ and response reduction factor R will be as per IS 1893 or relevant IS codal provisions

Depending on the selected option for vertical load carrying system Sa/g is the normalized Response Spectrum value for the structure which is the function of the fundamental time period of vibration of the structure and the type of the founding soil. W is the Seismic Weight of the building, which will be calculated in accordance with the relevant clause in, IS 1893(Part 1):2016. And the soil type is medium is taken from soil investigation report. Since **the building** is a R.C.C. structure, damping value of 5% shall be considered. Space frame analysis of the **structure shall** be carried out using response spectrum method.

viii. Live Load Reduction as per IS 1893(Part 1):2016.

The percentage Imposed load to be considered in Seismic Weight calculations are as follows:

* When Imposed load up to or <3 KN/m2 : 25%
* When Imposed load up to or >3 KN/m2 and <5 kN/m2 : 50%
  1. Wind Loads

Buildings are subject to horizontal loads due to wind pressure acting on the buildings. Wind load is calculated as per IS 875(Part III)-1987. The horizontal wind pressures act on vertical external walls and exposed area of the buildings. Some of the pressure acting on exposed surfaces of structural walls and columns is directly resisted by bending of these members. The infill walls act as vertical plate supported at top and bottom by floor beams, thus transferring the loads at slab level. The parapet wall is at terrace transfers the wind loads to the surface slab by cantilever action. For simplicity, the wind loads acting on exposed surfaces of a given storey are idealized to be supported by upper and lower floors. As per this code,

Design wind speed (Vz):

Vz = Vb K1 K2 K3 K4

Where,

Vb=Basic wind speed in m/sec. (it depends on location of the building).

For Mumbai location wind speed is 44m/sec.

K1=Risk coefficient (Table--IS-875-Part-III Clause 6.3.1)

For Basic wind speed 44m/sec

For All general buildings with mean probable design life of 50 years

K2=Terrain roughness and height size factor. (Table-2-IS-875-Part-III Clause 6.3.2)

Category -3

K2- Coefficient vary with the height of building based on the Class and category

K3= Topography factor (Clause-6.3.3)

K3- Ranges Between 1 to 1.36

K4=Importance Factor

K4 shall be considered as 1.0 (clause 6.3.4)

Design Wind Pressure (pt):

Basic wind pressure Pz = 0.6 v2z (Vz is design wind speed at height z)

Design wind pressure Pd = kd ka kc Pz

Where

kd = wind directionality factor (clause 7.2.1)

ka = Area averaging factor (clause 7.2.2)

kc= Combination factor (clause 7.3.13)

kd and kc shall be considered as 1.0, ka shall be determined using Clause 7.2.2.pz= Design Wind pressure in N/m2 at height z

Vz= Design wind speed in m/s.

**x. Temperature Stresses.**

Temperature stresses shall be considered for a maximum rise of 10° and maximum fall of 10°.

## **STRUCTURAL SYSTEM**

The structural system will be as per codal provisions duly vetted by IIT Mumbai.

## ANALYSIS SOFTWARE

1. The structure shall be analysed as per the Standard Analysis and Design Software using the latest version.
2. The Structural 3D models of the structures shall be generated in the software with all Beams and Columns have to be modelled as a Special Moment Resisting Frame system. The slabs shall be designed for strength and long term deflection preferably using SAFE software
3. The followings are the commonly used software for analysis and design of the structure and their components
4. ETABS
5. STAAD Pro
6. SAFE

## **LOAD COMBINATIONS**

The results obtained from the computer analysis in the form of member forces and reactions will be used for designing the structural members. The Structure shall be analysed and designed for all possible load combinations of Gravity (Dead+Live) and lateral loads due to wind and earthquake

Following are load combinations but not limited to shall be considered for arriving at the design forces.

1. Basic Load Cases

DL - Dead Load

LL - Live Load

EQ - Earthquake Load

WL - Wind Load

TL -Temperature Load

AL -Accidental Load (such as fire tender load)

1. Load Combinations for Concrete Design as per Indian Standards
2. Strength Combinations

* Partial safety factors for loads are considered as per Table 18 in IS: 456
* Combinations of loads are considered as per IS: 875 (Part 5)

Following load combinations are considered

* 1. 1.5DL + 1.5LL
  2. 1.5DL ± 1.5EQ
  3. 0.9DL ± 1.5EQ
  4. 1.2DL + 1.2LL ± 1.2EQ
  5. 1.5DL ± 1.5WL
  6. 0.9DL ± 1.5WL
  7. 1.2DL + 1.2LL ± 1.2WL

Where temperature load cases are applicable, the following combinations are considered.

* 1. 1.4 DL ±1.4TL
  2. 1.05 DL ±1.05 TL + 1.28 LL
  3. 1.05 DL ± 1.05 TL ± 1.20 EQ
  4. 1.05 DL ± 1.05 TL + 1.05 LL ± 1.05 EQ
  5. 1.05 DL ± 1.05 TL ± 1.20 WL
  6. 1.05 DL ± 1.05 TL ±1.05 LL ± 1.05 WL

Where accidental / fire tender load case is applicable, the following load combination is considered. .

* 1. 1.05 DL + 1.05 AL + 0.55 LL

A separate note is being issued for fire tender load.

ii. Serviceability Combinations

1. 1.0 DL + 1.00 LL
2. 1.0 DL + 1.00 EQ
3. 1.0 DL + 0.8 LL + 0.8 EQ
4. 1.0 DL + 1.00 WL
5. 1.0 DL + 0.8 LL + 0.8 WL

Where temperature load case is applicable, the following load combinations are considered:

1. 1.0 DL + 1.0 TL
2. 1.0 DL + 0.75 LL + 0.75 TL
3. 1.0 DL+0.5 LL + 0.75 TL + 0.75 EQ
4. 1.0 DL + 0.5 LL + 0.75 TL + 0.75 WL
5. Note: The above are the possible load combinations, however the load combinations to be adopted and increase in the permissible stresses will as per Codal provisions.
6. Proposed Procedure for Live Load Reduction

As per old IS: 1893 (Part 1), maximum seismic and live load may not occur simultaneously. Therefore only probable part live load is considered for calculating seismic weight and seismic base shear. The part live load is specified in clause 7.3.1. and comes out to be as given below.

Residential - 25%

Office - 50%

Warehouse / Storage - 100%

As per IS: 1893 (Part 1), it was permissible to consider this reduction for design of all members. If this reduction was considered for design of members then no further reduction was permitted on account of number of floors supported or large spans supported. Hence if 50% live load is considered, load combination could have been followed as

1.2DL + (1.2 × 0.5 =) 0.6LL ± 1.2EQ

In this procedure all members including columns supporting single storey and small span beams are designed for 50% live load.

Though it is true that live load shall be partly present if whole structure is considered, it is also possible that particular columns and beams have full live load during seismic activity.

In the revised Code of IS: 1893, this provision is removed. Hence part live load is to be considered for calculating seismic weight and seismic base shear. (This reduction will not be considered in design load combinations). Live load reduction on account of number of floors supported or large spans supported can be considered as per IS :875 Part 2.

With this approach, design loads will be same for lower columns in high rise structures. However beams supporting small areas and columns in top floors will be designed for full live load. The effective load combinations will be

1.5DL + 1.5LLR\*

1.2DL + 1.2 LLR**\* ±** 1.2 EQ

**Where** LLR\* is reduced live load on account of number of floors supported and large spans supported. This live load reduction will be considered as per IS: 875 (Part 2).

## **SPECIAL CONDITIONS FOR STRUCTURAL AND OTHER SERVICES DESIGN WORK**

## EPC CONTRACTOR’S GENERAL RESPONSIBILITIES

1. The Contractor shall perform all services specifically allocated to it by the Contract Documents as well as those services reasonably inferable from the Contract Documents as necessary for completion of the Work and the Project. EPC Contractor agrees to perform these services using its best efforts, skills, judgments and abilities.
2. The Contractor shall coordinate with the Owner/PMC and endeavour to further the interests of the Employer and the Project. EPC Contractor shall furnish Pre-Construction Phase Services and Construction Phase Services and complete the Project in an expeditious and economical manner consistent with the interests of the Employer and in accordance with the Project Schedule.
3. **The Contractor** shall submit for the Owner/PMC in charge review and acceptance a CPM Milestone Schedule in accordance with the Project Planning and Scheduling requirements of the Owner/PMC Specifications. The CPM Milestone Schedule shall encompass the entire Project duration, including performance of the both the Pre-Construction Phase Services and the Construction Phase Services with sufficient total Project float to allow for a minimum of Construction Phase float as specified.
4. The CPM Milestone Schedule for the Pre-Construction Phase of the Project shall include reasonable amounts of time for the Owner/PMC in charge review and approval of design drawings and specifications and for approval of authorities having jurisdiction over the Project.
5. The Contractor shall monitor the progress of the Project in relation to the CPM Milestone Schedule and provide the Owner/PMC with at least monthly updates and status reports as outlined in the Project Consultant’s Specifications. The time periods established in the CPM Milestone Schedule for the Pre-Construction Phase and the Construction Phase and the overall duration of the Project shall not be changed without written consent from the Owner/PMC. Modifications to the CPM Milestone Schedule logic, coding, layouts and filters, detail, and activity durations shall be in accordance with the Tender Documents and Owner/PMC Specifications.
6. The Contractor shall designate a representative authorized to act on the his behalf with respect to the Project.

## **REVIEW OF STRUCTURAL DESIGNS**

**The Scope of Services inter-alia includes but not limited to the following:**

The basic object of Peer Review will be to conduct an inquiry into:

1. Applicable codes and regulations and appropriateness of codes referred.
2. Design assumptions and Design Basis including loads and combinations.
3. Structural System and the appropriateness of selection from alternatives.
4. The application of judgment.
5. Input files and output files of analysis and design and a check on accuracy of calculations
6. Constructability of design considering material selection and availability.
7. Ability to meet the **Employer’s and** design and **functional objectives**.

The third-party proof check bodies shall be IIT Mumbai or any other institution or company as approved by the Employer. The contractor shall update the designs for any changes arising as an outcome of the Proof check and the same shall be deemed to be included in the quoted cost. The cost of Proof checking is included in the quoted price by Contractor.

All review comments shall be incorporated in the Analysis, Design and Details. All GFC drawings shall be signed and stamped by the approved review consultants.

**SECTION C 3 – External Electrical Works**

## **System Description**

The external electrification system under this tender comprises of all high side electrical works from the source to complete distribution in the building. Tap off point of HT will be at Main Receiving Station (MRS) with in the plot, then further distributed to GIS Panel, Transformers, HT & LT Panels, DG sets, DG Synchronization Panels, HSD Tanks, HT & LT cables etc.

The EPC contractor has to calculate. Demand & Connected load based on the area requirements for FSI 3 for Industrial units and further additional FSI upto 2 to be utilized for Commercial and B2B units, shops etc. The same has to be got approved by Owner/PMC as the basis for working out further on the external electrical scheme.

Electrical power supply shall be sourced from two different sources by the clients/owner to the Main Power Grid Substation (220/132/33KV) through Maharashtra State Electricity Board (MSEB) at site. The EPC Contractor shall make all necessary space provisions for Main Power Grid Substation as per Vastu compliance in the proposed master plan. The EPC contractor will liaison and coordinate with the agency for installing the receiving station.

Tap off shall be taken from the Main Power Grid Substation to the HT Substations as per the design and requirements of the project. Two feeders shall run to various HT substations in Ring main format and shall preferably be housed in RCC covered cable trench. One working line shall be further connected to work out capacity of transformers to various distribution transformers through RMU by underground cables. Further, the same shall be tap off to the Compact Substations (CSS) as per the design, through underground cable buried in ground. The cables shall run in Hume pipes in all road crossings.

Every block tower/building shall have individual block transformer installed individually with 25% redundancy

Separate feeder shall be considered as per fire norms and ring topology.

Further, the complete distribution shall be done through 433 V LT Power Supply distribution system in the campus.

Hospital grade silencer type DG Sets along with HSD fuel storage tank shall be proposed to cater for 100 % power backup for External campus facilities, lights and Common areas, Lifts, lobbies, in all buildings and Amenities. The changeover between grid & DG shall be through main HT breaker panel with synchronization panel in the panel room.

Power system should be supplemented by use of Solar Energy for buildings, common area and for the street lighting. Minimum solar energy should be provided as per the requirement of LEED Gold Rating Certification and EIA NOC requirements. Solar PV system shall be installed on roof top of Karkhana blocks and if required on office building. Solar power shall be fed to grid/main panel as per final approved scheme.

The electrical installation works should be carried out in accordance with the Indian standard codes as mentioned in latest NBC and in conformity with ECBC, BEE, CPWD “General Specifications for Electrical Works” Part-I (Internal), Part-IV (Sub-Stations) and Part-VII (DG Sets) with the latest amendments as per Owners requirement and system design requirement.

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from owner/consultants/statutory authorities for External Electrification System comprising of following components:

1. HT Power supply system (Supply voltage as per MSEB norms)
2. Sub-station and HT Power distribution system
3. 100% Power Back up System – DG sets with exhaust system for DGs
4. HSD Oil Storage Tank
5. 433 V LT Power Supply and distribution system
6. Power factor improvement
7. Street Lighting
8. Earthing system and Ground Fault Protection
9. Materials for Conductors, Insulation
10. HT Meter rooms & Sub-station construction and internal services for housing complete system
11. Substation Safety Equipment

Demand load – Connected load & contingencies shall be submitted by EPC Contractor based on the design calculations, block size and machineries etc., along with details of Rising main. Separate feeders shall be considered as per fire norms and ring topology. The contractor can use typical units of 5000, 2000, 1000, 500 sq.ft unit power consumption for reference. The contractor to engage SME for the same.

The Contractor shall carry out and complete the said work under this contract in every respect conformity with the contract documents and with the direction of Owner’s site representative upto his satisfaction.

The EPC contractor to provide minimum one DB for each karkhana unit at the nearest point with flexibility of splitting.

EPC contractor shall make provision for transformer as per Power Company / MIDC /ECBC rules

Each karkhana unit to have Separate metering facilty for MSEB power and DG set power consumption. Meter room provision to be done optimally and efficiently as per requirement.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and preliminary schematic drawings for complete External electrification system.

This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

The contractor shall ensure that the required interfaces between HT/ LT power supply & distribution system and Electrical works for other services systems such as HVAC, IBMS, STP, WTP & Plumbing, Fire Fighting etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

All equipment under the scope shall be fully compatible, communicable, operatable and should be controlled and monitored through IBMS system and shall have BEE star rating.

## DESIGN PARAMETERS

* 1. HT Power supply system

The power supply shall be obtained from MRS and received at GIS HT Panel (provided by MRS) at the HT meter room as per norms. The 33/11 kV supply from HT meter shall be connected with 33/11kV XLPE insulated aluminium conductor armoured cable for further distribution to HT Panel and Transformers. The selection of size of the system should be designed considering fault level @ 25 kA at source (33/11 kV) and further short circuit calculation shall be submitted by ETAP software (Two licence of the same version to be provided with the validity till the completion of DLP), considering 65/70 KA at MAIN LT Panel.

XLPE insulated aluminium conductor armoured cable shall be laid in NP3 class RCC Hume pipes. Top of Hume pipes shall be at least 1000mm below the site formation level. The Inspection chambers for cabling shall be given for inspection, maintenance and laying of new cables as per IER and approval of owner/ consultants.

* 1. 33 kV Substation & HT Power distribution system

3.2.1 Electrical Load calculations

Electrical Power requirements for the project shall be estimated as per ECBC guidelines, local norms and approved by owner/PMC. The calculation of load to be done as per following parameters:

i. all equipment like Air conditioning, Ventilation, Plumbing & WTP, STP, Lifts, LV system etc.– actual equipment load

ii. Internal lighting load – to be calculated on lux level (on actual built-up area basis)

iii. Street lighting – average lux to be considered as 15-20 lux.

iv. Power load - to be calculated on actual built-up area basis as point basis

The load calculation to be calculated based on above parameters and shall be submitted in required format considering the diversity factor and shall got approve from owner/consultants.

3.2.3. 33/11 kV HT Panel

HT GIS Panel as per specifications shall be suitable for incoming and outgoing provision for design capacity, Transformers and additional space of HT outgoing for additional future transformer. The HT panels shall be located in HT Panel room with the provision of direct access in case of emergency.

3.2.3. 33/11 kV Transformers

Required number of 33/11 kV, ONAN/ ONAF Transformer (with OLTC) shall be installed in the substation area. The transformers shall have switching facility to transfer the load fully or partially in case of general maintenance/faulting of 1 transformer/ preventive running maintenance. Based on the total worked out load requirements as approved by Owner/PMC the EPC contractor will provide adequate numbers and capacity of transformers Additional required space for 33/11 kV transformer to be provided for future extension.

3.2.4. Cabling work from HT meter room to 33/11 kV transformer

33 kV HT cable shall run from HT meter room and terminate at HT panel located in Sub-station. 33kV XLPE insulated aluminium conductor armoured cable shall be laid in NP3 class RCC Hume pipes. Top of Hume pipes should be at least 1000mm below the site formation level. The Inspection chambers for cabling shall be given for inspection, maintenance and laying of new cables as per IER and approval of owner/ consultants.

* 1. 11 kV Substation & Power distribution system

3.3.1. 11kV HT Panel

11 kV HT Panel should be suitable for incoming and outgoing provision for required number of Transformers and ring supply to further site and all buildings. The same shall have synchronizing/EM interlocking facility with DG Synchronizing Panels. The 11 kV HT panels shall be located in HT Panel room with the provision of direct access in case of emergency.

3.3.2. 11kV/433V Transformers

11 kV substation shall contain multiple 11 kV breaker panels consisting of VCB as incomer and outgoings as per the design. 11 kV/433 V shall be Oil cooled Transformers and all 33kV and 11 kV panels shall be provided with Cu bus.

The transformer shall be star 5 category as per latest ECBC requirements.

* 1. **Cabling work within Sub-station area**

Laying of all Electrical cabling work shall be of respective capacity XLPE insulated aluminium conductor armoured cable. It shall be laid in RCC trench, covered with 6mm thick chequered plate with openable cover inside room and RCC cover in open space within the Sub-station area.

And the cables shall be laid directly buried in the ground with 1000 mm depth as per specifications/codal provisions and at road crossings & paved areas, cables shall be taken in NP3 class RCC Hume pipes, outside the Sub-station area in the campus.

* 1. **100 % Power Back-up system – DG sets**

3.5.1 DG Load calculations

The 100% DG power backup shall be provided for External campus facilities, lights and Common areas, Lifts, lobbies, in all buildings and Amenities, generated by Diesel generators as per the design.

The silent type DG sets shall run in synchronization with sound level less than 75db at 1m distance or as per CPCB norms/latest norms whichever is higher, in the Sub-station area. In case of power failure, Synchronization panel shall switch over the entire load on to DG supply. In case of repair/ maintenance or operational difficulty with any DG set, DG sets shall be manually interchangeable to cater only to the critical loads. DG sets shall also be compatible with automatic fuel filling from HSD tanks.

3.5.2. Cabling work for DG

Laying of cables from DGs to DG synchronization panel and Synch. Panel to 11 kV HT panel in substation area shall be of 11kV XLPE insulated aluminium conductor armoured cable in RCC trench covered with 6mm thick chequered plate with openable cover.

3.5.3. Reduction in Pollution

Hospital grade silencer for DG set to be provided to reduce noise and lubricants shall be disposed through Government authorized agency in a proper manner so as to reduce pollution as per codal norms.

3.5.4. DG Exhaust stack

DG Exhaust Stack of required height shall be provided including MS supporting structure as per latest CPCB Norms in order to dispose exhaust above the building heights, upto permissible height as per AAI norms. In case of height restriction, proper treatment of exhaust air with scrubber should be considered for approval of concerned authority.

DG exhaust pipes should be cladded with thermal insulation and grouped together and raised till the required height ground using a suitable structural arrangement as per design.

3.5.5. Day tanks for DG

Day tanks of 990 Liter capacity made out of MS sheet for each DG shall be provided as per the specifications/codal provisions.

3.5.6. HSD Oil Storage Tank

The HSD oil storage tank for the DG sets shall be provided for at least one day days capacity, as per explosive Norms. The capacity of the HSD tanks shall be as per actual requirement/ specifications/codal provisions/applicable BIS codes and approval from owner/consultants. Automatic fuel filling form the HSD tank shall be with flow meter & Flame proof pumps.

However, if the Petrol Pump is in close vicinity, the feasibility of the requirement of the shall be checked and provided as per requirements of owner/PMC as per norms.

3.5.7. Construction of HSD Tank

The HSD tank shall be fabricated from MS Sheet of min. 6mm thick for shell & 8mm thick plain ends. The fuel tank top shall be fully bolted type and shall have a bolted type inspection manhole cover with a handle for ordinary inspection and minor cleaning of tank.

The top cover & inspection cover fitting shall be waterproofed, fitted with minimum 5 mm thick neoprene rubber gasket. In case of floor mounted tanks, the tank shall have fabricated footing on four corners so that the bottom of fuel tank is atleast 150 mm above resting level or floor level, to enable cleaning of space below, drain the tank etc. In case of structure mounted high level day tank, instead of footings an appropriate channel base shall be provided.

**Painting of HSD Tank**

The HSD tanks, after fabrication & calibration shall be thoroughly cleaned & spray painted with two base coats plus two finish coats of special diesel resistant paint.

The supporting structure also should be cleaned & painted with two coats of base primer and two coats of enamel paint base primer Zinc cromate and epoxy paint.

**Inspections, Approval & Licence**

The contractor shall arrange for the inspection and get approval and license for the HSD oil installation by the Chief Inspector of Explosives as given below:

* Pre-installation Approval

Upon the award of the work, the EPC contractor shall prepare working drawings for the HSD installation and submit to the PMC/Owner for their provisional approval. The drawings provisionally approved by the PMC/Owner, shall be submitted to the Chief Inspector of Explosives for his scrutiny and final approval by the EPC Contractor.

* Test & Safety Certificates

The contractor shall arrange test and safety certificates under rules 126 after the installation is commissioned.

* Inspection / Storage License

The contractor shall arrange for inspection of the installation by the Chief Inspector of Explosives and carry out any modifications/additionsif required by the Chief Inspector of Explosives and obtain storage license and submit the same to the Owners. Also, drawing approval from CCOE Nagpur shall be considered.

**Fuel Oil Piping**

Laying of pipes, fittings and valves and testing, balancing of all HSD piping required for the complete installation shall be done as per design. All piping inclusive of fittings and valves shall follow the applicable BIS Code

* 1. **433V LT Power Supply and Distribution system**

3.6.1 LT panels

Expandable type LT panels for HVAC Chiller plant panel, Capacitor panel, Firefighting panel, Plumbing panel, STP panel, External Lighting Panel etc. shall be provided in Utility services building conforming to (TTA) Totally type Tested arrangement and IEC 61439 Part I & II in case of incomers is 630A or above and PTA in case incomer is below 630A. Distribution to Karkhana /Office units will be of 440V supply.

3.6.2. Cabling work to LT Panels

Laying of 0.433kV XLPE insulated aluminium conductor armoured cable from Transformers to LT panels shall be in RCC trench covered with 6mm chequered plate/FRP covers with openable cover within the Utility services area.

3.6.3 MDB Panel

The Main LT Panel and sub panels above 630A should be TTA confirming to IEC 61439 Part 1 & 2 and up 630A rating panels shall be PTA type.

3.6.4 Cabling work to MDB Panels

Laying of LT XLPE insulated aluminium armoured cable from LT Panel to MDB panel and further to the Street lighting feeder pillars and Main Distribution Panel at Guard room shall be direct buried in the ground at 750 mm depth. Road crossings & paved areas shall be taken in RCC Hume pipes NP3 class as per specifications.

All the cables GTP is to be submitted and get approved from Owner/Consultant.

* 1. Power Factor Improvement

Besides the requirement of State Electricity Authority, improving the power factor is required as it reduces the overall demand on the Supply Authority thereby adding to overall economy. Thus, for power factor improvement of suitable size thyristor based design, HVAC, other utility services and norms, the capacitor panels in the Bank formation shall be provided. The capacitor panel shall be located inside the compact substation/LT Panel room. Automatic power factor correction relay of reputed/approved make shall be provided to improve the power factor of the system and switch on the capacitor depending on the system requirement. The power factor shall be maintained minimum 0.95 and as close as to unity & base power factor to be considered as 0.8.

* 1. Street Lighting

External Street Lighting for all roads with GI Octagonal Factory made posts with in-built termination facility as per Landscape/Street design and LED light fixtures and gate lights at Entry gates shall be provided as per design, specifications and approval from owner/consultants.

* 1. Lighting Control

Single point control shall be provided for external lighting with timers at Guard rooms along with contactors to switch ‘on’ & ‘off’ the lights for peak, lean and night mode operation for power save.

* 1. Cabling work

Laying of underground XLPE cables from MDB panel Utility services building to the feeder pillars and further to the Street lighting poles to be done directly buried in ground.

* 1. Earthing

Separate earth stations shall be provided for earthing of the poles/bollards/luminaries etc. as per latest norms with in-built distribution box. One Earth-station for each 5 poles/bollards/luminaries shall be provided as per earth resistivity or IER requirement and shall be within 1.0 ohm. Foundation shall be given in pre-casted bolted approx. 450x450x600mm or as required as per pole height/Manufacturer.

* 1. Earthing & Ground Fault Protection

Earthing of Electrical Installation - Considering the hazardous nature of electrical energy, safety measures in using this energy is of paramount importance. Earthing system shall be provided in accordance with Indian Standards IS-3043-1987 and other statutory regulations in combinations with chemical earthing

All non-current carrying metal parts forming the Electrical System shall be connected to the Earthing System as per the requirements of Indian Electricity Rules and local statutory requirements. The Earthing system shall be so designed that the resistance of the Earthing network shall be less than 1.0 ohm at any point of the system.

All the cable trays shall be provided with suitable size of 2 Nos. G.I. strip in full length.

All Earthing conductors shall be sized based on short circuit current calculations for electrical system by ETAP (Two licence of the same version to be provided with the validity till the completion of DLP).

All the Earthing pits near receiving station and main earthing bars shall be connected to each other to make a common equal potential earthing electrode grid & maintain overall resistance less than 1 Ω. GI Earthing shall be provided for Body earthing and the Copper earthing shall be provided for Neutral of DG and Transformer.

The building structural earthing for lighting protection shall be chemical earthing as per latest NBC and codal provisions.

The scope of Earthing System works shall be as follows:

1. Sub Station Equipment:
2. Transformer Neutral Earthing - Copper plate600x600x3mm Earthing
3. Transformer body Earthing - G.I.plate 600x600x6mm Earthing
4. H.T switch-gear Earthing -G.I.plate 600x600x6mmEarthing
5. D.G. Set body Earthing - G.I. plate 600x600x6mm Earthing
6. D.G. Set Neutral Earthing - Copper plate 600x600x3mm Earthing
7. L.T. panels Earthing (Body) - G.I.plate 600x600x6mm Earthing
8. Distribution boards Earthing - G.I. plate 600x600x6mm Earthing
9. Equipment Earthing -G.I./Copperplate 600x600x6mm/3mm

Earthing

2. Lighting/Power Point circuits - Copper Wire Earthing

* 1. **Material for Conductors, Insulation**

The materials used for conductors and insulation shall be:

1. Bus Bar - Bus bar material shall be of copper and insulation shall be class ‘F’.
2. Cables - The H.V. Cables shall be aluminium conductor CROSS LINKED POLYETHYLENE Steel Tape armoured cable. The insulation shall be of high quality cross linked Polyethylene.
3. Medium voltage cables shall be aluminium conductor XLPE insulated, PVC sheathed Armoured conforming to latest IS. Insulation shall be with high quality XLPE base Compound.
4. Wires - The material for Wire shall be PVC insulated FRLS copper conductor wires, conforming to latest IS Code.
5. Type of armouring shall be round wire Upto 10sqmm cable and above 10sqmm cable, it shall be strip type.
   1. **Sub-station & HT Meter Room Construction and Internal Services for Housing Complete System**

**HT Meter Room & Sub-station Building**

The HT Meter room shall be provided near the Entry/ Exit Gate as per the Statutory norms. Substation shall comprises of HT Panel room, LT Panel room, 33kV Transformers platforms, 11 kV Transformer platforms, DG sets room, DG Exhaust stacks, Fuel Day tanks, HSD Fuel storage tank, Unloading Platform for HSD tank and any related requirement along with additional space all these for the future expansion.

* 1. **Associated Civil Works**

The civil works associated with Electrical installation shall be executed in accordance with approved design and drawings and tender specifications for other packages. The same shall include (but not limited to):

1. RCC foundation for Transformer, RCC pedestal / platform for DG etc.
2. RCC pedestals for HT and LT panels etc.
3. Transformer soak pit (local to transformer) and remote burnt oil tank, with draining arrangement etc. as per relevant statutory requirements
4. RCC Trenches\floor cut outs\Trench covers inside Sub-station and wherever required including cable supports for laying of HT/ LT cables etc.
5. Chain link fencing with gates around all outdoor platforms.
6. Doors and Rolling shutters as per design and requirement/approval from Owner/PMC.
7. Baffle wall between Transformers.
   1. **Internal electrification works**

All internal electrical works of the Substation building and HT Meter room shall be provided including (but not limited to) the following:

1. Cabling from Main distribution board to all Distribution boards in the Utility services building area and Maintenance office.
2. Point wiring of all light points, General power points, Ceiling fan points, Exhaust fan points and socket outlet points for all points complete in all respects.
3. Light fixtures of min 300 Lux level, Ceiling fans, Distribution boards, Switches and switch boards, Sockets, Exhaust fans, wall bracket fans etc.as per requirements/ approval.
   1. **Solar Power Generation**

ON Grid solar system to be provided on roof top area of Buildings and other areas as per LEED Gold Certification/EIA NOC Requirements shall be provided.

The following shall be observed:

1. Solar panels shall be sized such that they can provide sufficient energy to the system for the intended service life of 20 years.
2. System losses shall be taken into account including dust and dirt, wiring losses, electronics losses, and charging losses.
3. A system shall be able to connect to mains as on Grid Supply.
4. The solar lighting system shall be based on a 12V (nominal) or 24V (nominal) system voltage only.

**Solar Module**

The solar module shall be designed to meet the criteria as per applicable norms and LEED Gold rating and shall be submitted for approval from Owner/consultants. It shall be provided 10-year product warranty and Linear 25-year performance warranty.

**SECTION C 4 – Internal Electrical Works**

## **System Description**

The Internal electrification system under this tender comprises of all low side electrical works from external electrical supply at buildings entry points to complete distribution inside the building. It includes Buildings internal illumination, General Power, distribution wiring, UPS & distribution, rising mains, Light and Power distribution, exit signage Lighting, Power cabling, Cable trays etc.

11 kV HT Supply shall be received at 11/0.433 kV Compact substation having transformers of required capacity. CSS shall be connected to Main LT Panel with Bus duct and further LT Panel shall distribute Power to building distributive load by cables, Rising Mains, Floor Panels etc.

UPS system shall be provided to take care of building essential and emergency requirements like emergency lighting for all core, corridors, lobbies, CCTV, IBMS, access control system for 15 minutes. UPS shall be feed by LT Panel and further UPS Supply shall be distributed to entire building by cables, Rising Mains, Floor Panels etc.

Distribution system shall be designed according to latest IS & NBC from floor panel to point wiring, all equipment like, Distribution Boards, MCB, SPD, RCCB, wiring, conduiting, switch boards, sockets, lighting fixtures etc.

The building shall be designed in accordance to the requirement of LEED Gold Certification. And the whole system shall be integrated with IBMS system and all equipment should be selected for operational, monitoring and control through BMS.

The electrical installation works shall be carried out in accordance with the Indian standard codes as mentioned in Technical Specifications of the document and in conformity with the CPWD “General Specifications for Electrical Works” Part-I (Internal), with the latest amendments upto dates as per Owners requirement and system design requirement

## **Scope of Works**

* 1. Scope of work

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from owner/consultants/statutory authorities for Internal Electrification System comprising of following components:

1. Internal Lighting, lights points, power points
2. Cable Tray/ Raceway/ Wire Management system
3. Internal light as per required LUX
4. UPS Power supply & Distribution system
5. LT cables
6. Building Main Block LT Panels and distribution panels.
7. Bus Duct & Rising Main (Sandwitch construction)
8. Earthing & Ground Fault Protection
9. Lightning protection and SPDs
10. Goods& Passengers Lifts
11. Steel Wire Rope Hangers & Supports:

All the above Internal Electrification works shall be provided in Core, i.e. Staircases/Fire Staircases, Lifts, Lift Lobbies, and Corridors, Entrance Lobbies, Common Toilets, Shafts, common service areas etc. in the Large & Medium Karkhana Buildings, Small Karkhana Buildings, Commercial Office building, Gold Refinery facility and Central Vault Facility, B2B Units and allied services, Common amenities such as canteen, cafeterias, shops and recreation area for Karkhana units.

The provision of Electrical supply in form of DB/Panel as per design shall be provided in the Units. Further Internal electrical works shall be done by the Unit holders.

All the complete Internal Electrification works shall be provided in the Parking in basement/Semi Basement/Podium & Services areas along with Amenity buildings - Police chowki, MI Room, Custom Office and Fire station.

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Owner’s site representative upto his satisfaction.

All works shall be carried out as per approved specifications and approved drawings from Owner/Consultant and shall be complete in all respect meeting all the functional requirements of the system & Building.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and preliminary schematic drawings for complete Internal electrification system. This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

Whether specified or not, Distribution boards (three phase/ single phase) shall be provided as required to make power supply available for completeness of the electrical power distribution system.

The contractor shall ensure that the required interfaces between HT/ LT power supply & distribution system and Electrical works for other services systems such as HVAC, IBMS, STP, WTP etc. & Plumbing, Fire Fighting etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

All equipment under the scope should be fully compatible, communicable, operatable and should be controlled and monitored through IBMS.

## **Design Parameters**

* 1. Internal Lighting, lights points, power points

All electrical panels and electrical service equipment shall be located in protected service areas or have lockable cabinets. The panel shall not be located in corridors of public areas. All electrical panels and circuits must be labelled using circuit ID Tags / name Plates etc. All panel manufacturers will be CPRI approved and as per list makes only.

* 1. Cable Trays/ Raceway/ Wire management system

Cable tray shall be provided for building floor’s panel to main distribution of lighting, power and UPS supply and Raceway shall be provided for under floor distribution, as per the design and requirements.

* 1. Internal light as per required LUX & power distribution system.

Lighting design and calculations shall be carried out by Contractor and provided as per approval from the Owner/Consultant. The illumination levels shall be as per latest NBC, Lux level calculation by DiaLux EVO (including VO modeling) and LEED Gold rating requirements. All light fixtures shall be LED lights. Type of light fixtures – LED Type, high efficiency and minimum 120 lumen per watt actual output.

Emergency lights shall be provided to achieve the minimum coverage as per norms. Stairways, 20% lighting in circulation space, Server room, corridors, lift lobby, car parking and plant room shall be provided through UPS supply having 15 minutes battery backup. In addition, light fittings for escape routes shall be provided with the conversion kit and half an hour battery backup.

Basement/Semi Basement/Podium parking areas shall be planned with occupancy \ motion sensors (proximity) \ timers to control lighting in the drive ways & parking bays.

Dimming systems for Conference rooms and Business Center in Commercial Office building as per ID \ AV requirements shall be provided.

* 1. Internal UPS Power Supply & Distribution System

Services such as emergency lighting, building automation, CCTV, Access Control security system, etc. shall be provided with UPS backup. Separate UPS system for IBMS core equipment shall be provided & placed within IBMS room.

1. Emergency lighting - Centralized UPS system with in-built transformer for every building core, corridors, lobbies, shall be provided with 15 minutes backup. In addition, light fittings for escape routes shall be provided with the conversion kit and at least half an hour battery backup.
   1. **HT & LT Cables-**

## **Building Main Block LT Panels and Power distribution.**

Main LT Panel with adequate size of ACB’s & MCCB’s, Capacitor panel, Common area panel, UPS panel, Ventilation Panel etc. shall be provided as per design. Switching arrangement at various locations shall be planned keeping in view the ease with which isolation can be achieved and also the level of fault protection desired at the particular current rating. In the panel, switching on incoming circuits shall consist of air circuit breaker (ACB) whereas switching on outgoing circuits up to 630A shall be Moulded Case Circuit Breaker (MCCB) and above 630 amps shall be ACB’s or as per approval from Clients/consultant.

Main distribution panels and sub-distribution panels shall incorporate moulded case circuit breakers. Final distribution panels shall incorporate Miniature Circuit Breakers (MCB) Residual Current Circuit Breaker (RCCB), Residual Current Circuit Breaker with over current Protection (RCBO). Boards shall also be provided for initial load along with space\feeder provision to cater for future load.

Three phase power distribution with advance neutral feature for safety, shall ensure connecting first and breaking last of the neutral contact and avoiding high voltage in the single phase circuits. Four pole breakers shall provide further safety against the unbalance floating current in the neutral, which could be dangerous, especially to the maintenance staff in case the floating voltage is more than 50 volts.

Air circuits breakers (ACB) moulded case circuit breakers (MCCB) and miniature circuit breakers (MCB) shall be of 4 pole/TPN/TP+NL as per specifications and approved drawing.

The breakers shall be provided with padlock with a Tag (Lock-Out-Tag-Out). The bus bars of the panel shall be made of aluminium strips and the panel shall be in compartmentalized design.

Main Blocks Panel shall further distribute power supply to entire block complex and feed, servers, UPS, Rising Mains and other services also. All LT panels, Distribution Panels, Floor Panels etc shall be totally Type tested (TTA) in case incomer is 630A or higher and Partially Type Tested (PTA) in case incomer is below 630A in rating.

It includes Cables on cable trays and / or within suspended ceiling spaces including installation, cable trays, hangers, supports, cable terminations and all fixing accessories. It also includes Rising Mains / LT Bus Ducts, all conduit work including junction boxes, outlet boxes and wiring for lighting and power circuit along with Switches, plug sockets, cover plates etc. and other wiring accessories

1. LV power from 11 \ 0.433 kV substation shall feed to building Main LT panels with sandwich type AL bus ducts.
2. Further power distribution from Main LT panel to the various MDBs, DBs & end feed units for rising mains shall be with XLPE insulated inner sheathed and FRLS PVC outer sheath LV cables of 1100-volt grade.
3. The wiring in the Common areas, Floors shall be provided with copper wiring in recessed/surface MS/PVC Conduits. The wiring installation shall conform to IS: 732 year 1963 or latest version. All point wiring shall be in heavy duty PVC conduit recess in ceiling/wall. The wiring for lights and small power outlets shall be with PVC insulated FRLS copper conductor wires of 1.5 Sq.mm size and power wiring shall be carried out with 4.0 Sq.mm PVC insulated FRLS copper conductor wires. Colour coding shall be strictly maintained for the entire wiring installation i.e. Red, Yellow and Blue for the phases and Black for the Neutral.
4. Double earth wires for three phase system and single earth wire for single phase system will be used.
5. All Main \ sub main panels except for UPS system downstream distribution shall be provided with Aluminium bus bars. All panels for UPS system downstream shall be provided with Copper bus bars.
6. All riser shafts \ openings at each floor shall be sealed and all floor wall penetration shall be sealed by using fire sealant as a fire protection measure.

Cables trays shall be used as per site requirements. All cables passing through walls shall run through GI Pipes sleeves of adequate diameter 50 mm apart maintaining the relative position over the entire length. Cable trays of various sizes shall be of doubled bend channel design unless otherwise stated. Trays shall be hot dip galvanized and factory fabricated with standard accessories like tee, bends, couplers etc. as specified. Cable trays shall be exposed and accessible.

* 1. **Rising Mains (Sandwich Type)**

Raw Power and UPS Power distribution shall be done with the help of Rising Mains system, Sandwich type rising main shall be considered for floor wise distribution and further floor panes shall feed all distribution boards of the floor for further point wiring and power point wiring.

All MCCB above 250A rating shall be with microprocessor based releases.

Automatic Transfer Switches (ATS) \ auto change over switches (auto manual interlock with motorized MCCB) shall be provided as required for entire electrical distribution

* 1. **Solar Power System**

Grid interactive Solar PV system as per codes with all components, accessories, including connections to the LT panels shall be provided.

* 1. **Power Factor Improvement**

Besides the requirement of State Electricity Authority, improving the power factor is required as it reduces the overall demand on the Supply Authority thereby adding to overall economy. Thus, for power factor improvement of suitable size capacitor panels in the Bank formation to be provided. The capacitor panel shall be located along with the Main LT Panel in the Main LT Panel Room. Automatic power factor correction relay of reputed/approved make to be provided to improve the power factor of the system and switch on the capacitor depending on the system requirement. The power factor shall be maintained minimum 0.95. and as close as to unity.

* 1. **Earthing & Ground Fault Protection**

Earthing System shall be provided for all Indoor Equipment & Electrical Installations within Internal Electrical works.

* 1. **Earthing of Electrical Installation**

Considering the hazardous nature of electrical energy, safety measures in using this energy is of paramount importance. Earthing system shall be provided in accordance with Indian Standards IS-3043-1987 and other statutory regulations.

All non-current carrying metal parts forming the Electrical System shall be connected to the Earthing System as per the requirements of Indian Electricity Rules and local statutory requirements. The Earthing system shall be so designed that the resistance of the Earthing network shall be less than 1.0 ohm at any point of the system.

All the cable trays shall be provided with suitable size of 2 Nos. G.I. strip in full length. Separate Earthing shall be provided for Computers/UPS Network and entire Earthing shall be insulated with PVC tape.

Separate Earthing grid shall be provided for the Earthing of Panels, and Earthing of Data/Telephone System. Earthing resistance for LT shall be less than 1 ohm and for LV it shall be less than 0.5 ohm. All earthing conductors shall be sized based on short circuit current calculations for electrical system.

All the earthing pits and other pits near receiving station and main earthing bars are to be connected to each other to make a common equal potential earthing electrode grid & maintain overall resistance less than 1 Ω. Actual calculation to be provided by ETAP latest version including earth resistance testing at multiple point at site and 2 software licence with lifetime validity of ETAP to be provided to verify the same.(one for client and one for consultant) the same software to be used for other electrical calculations like fault level calculation, voltage drop calculation, short circuit calculations, etc.

Type of Earthing (Plate/ Pipe/ Mat/ Grid/ Chemical/ Advance/ Electrolite etc.) can be decided accordingly after approval and no extra payment should be claimed in this regard.

* 1. **Lightning Protection System**

The comprehensive Lightning protection plan - consist both External Lightning Protection and Internal surge protection as per the guideline of IS/IEC 62305 standard and latest NBC. It shall be applied as per the detailed specifications given and as per the approval from owner/consultants.

* 1. **Lifts**

All lifts shall be provided as per design along with civil works required for installation of lift such as scaffolding, grouting, concreting and masonry work including all accessories. The parameters for Lifts are as follows:

**Passenger Lifts**

* Type and capacity: 20 Passenger (1360 kgs) / as per Lift calculations
* Speed Approx.: 3.0 meter/second
* Type of Drive: Variable Voltage Frequency Drive (V3F).
* Location of Machine Room: Machine room less
* Travel in Mtrs: As per building ht
* Serving : All floors including basements/Semi Basement/ podium
* Shaft size required : As per latest NBC norms
* Available shaft size : As per latest NBC norms
* Car Size : As per latest NBC norms
* Car and landing centre door opening : As per latest NBC norms
* Power Supply : 415V 3 Phase 50 cycles AC
* Auxiliary power: Single phase 220 V 50 cycles A.C.
* Control: Selective collective control with simplex.
* Car enclosure: SS Hair line finishes for karkhana units. For commercial building in combination with SS hair line finish with decorative wooden panels
* Car door: SS hair line finish.
* Landing Door : SS Hairline Finish
* Electric light/fan : LED / Suitable fan
* No. of entrances : As per plans - Location – As per plan
* Car entrance : Center opening power doors with SS No. 4
* Landing entrance : Center opening power doors with SS No. 4
* Indicators car & landings: 7 Segment 25mm digital direction and indicators in car and at all landings.
* Special features/other features: Automatic Rescue Device.
* Call register type KDS-50 Micro pushbutton for Car and landing.
* 3-Way Intercom
* Manual Cranking operation
* Integral shaft for gear and motor
* Emergency Stop Button
* CVT/Built Voltage Stabilizer (Constant Voltage Transformer)
* Pit ladder and balustrade
* Specifications Flooring: Provision for Granite flooring with 19mm recess. In commercial block and PVC laminated floor in karkhana units.
* Emergency cabin lighting and alarm.
* FRD/Fire Man Drive (Fire Rescue Device)
* Controls: Resolve Micro Processor based simplex full collective control with or without attendant operation.
* Door Safety: PANA 40-Full ray curtain for car door safety.
* Load weighing device with indicator & bypass function.
* Lift Announcement System (LAS)
* Safety gears & over speed Governor.
* Infra-red door safety device.
* Dismantling of old lift and less towards old materials.
* Civil works: All minor civil works such as scaffolding, making holes, grouting, concreting etc.
* Provision for connectivity of CCTV.

**Goods Lift**—Minimum of two goods lift in each core area.

* Type and capacity: 2500 Kg
* Speed Approx.: 2.0 meter/second
* Type of Drive: Variable Voltage Frequency Drive (V3F).
* Location of Machine Room: Machine room less
* Travel in Mtrs: As per building ht
* Serving : All floors including basements/Semi Basement/ podium
* Shaft size required : As per latest NBC norms
* Available shaft size : As per latest NBC norms
* Car Size : As per latest NBC norms
* Car and landing centre door opening : As per latest NBC norms
* Power Supply : 415V 3 Phase 50 cycles AC
* Auxiliary power: Single phase 220 V 50 cycles A.C.
* Control: Selective collective control with simplex.
* Car enclosure : SS Hair line finish
* Car door: SS hair line finish.
* Landing Door : SS Hairline Finish
* Electric light/fan : LED / Suitable fan
* No. of entrances : As per plans - Location – As per plan
* Door width : Sufficient for entry of 2T fork lift
* Landing entrance : Center opening power doors with SS No. 4
* Indicators car & landings: 7 Segment 25mm digital direction and indicators in car and at all landings.
* Special features/other features: Automatic Rescue Device.
* Call register type KDS-50 Micro pushbutton for Car and landing.
* 3-Way Intercom
* Manual Cranking operation
* Integral shaft for gear and motor
* Emergency Stop Button
* CVT/Built Voltage Stabilizer (Constant Voltage Transformer)
* Pit ladder and balustrade
* Specifications Flooring: Provision for Kota flooring
* Emergency cabin lighting and alarm.
* FRD/Fire Man Drive (Fire Rescue Device)
* Controls: Resolve Micro Processor based simplex full collective control with or without attendant operation.
* Door Safety: PANA 40-Full ray curtain for car door safety.
* Load weighing device with indicator & bypass function.
* Lift Announcement System (LAS)
* Safety gears & over speed Governor.
* Infra-red door safety device.
* Dismantling of old lift and less towards old materials.
* Civil works: All minor civil works such as scaffolding, making holes, grouting, concreting etc.
* Provision for connectivity of CCTV.
  1. **Building skin lighting system**

Building skin lighting design shall be carried out by Contractor as per the Owner requirements and approval from the Owner/Consultant. All light fixtures shall be LED lights and enhance the building façade.

Aviation light shall also be provided as per the requirements of Airport Authority of India and approval from Owner/Consultant. The same should be within the Building height restrictions as per AAI.

* 1. **Associated civil works for electrical system**

The civil works associated with Electrical installation shall be executed in accordance with approved shop drawings and as per civil details given in respective tender specifications for other packages. The same shall include the following, but will not be limited to the same:

1. RCC foundation for Transformer,
2. RCC pedestals for HT and LT panels
3. Transformer soak pit (local to transformer) and remote burnt oil tank, with draining arrangement etc. as per relevant statutory requirements RCC Trenches \ floor cut outs inside Sub-station and wherever required including cable supports for laying of HT/ LT cables.
4. Air-tight fire doors of minimum 2-hour fire rating shall be as per NBC 2016 FIRE norms and requirement of CFO for Sub-Stations, LT panel room, Electrical rooms.
5. Repair of all disturbed surfaces/openings.
6. Chasing, chipping, minor civil works, as required
7. Openings, trenching, refilling, cable protections etc.

**SECTION C 5 – Low Voltage (LV), Networking System**

## **System Description**

The LV system under this tender comprises of all LV works from the source to complete distribution till end user. It includes all active and passive components (except server), Fire alarm system, Public addressable (PA) system, CCTV system, Access control system, Telecommunication system, AV system, Local Data networking system (LAN), Television, Cabling & conduiting, etc.

**Fire alarm system** consisting of (but not limited to) main Fire alarm control panel and repeater panel located in LV room and its further distribution through fire survival cable to all Multicriteria detectors, heat detectors, MCP, Hooters, control, relay, monitor & fault isolator module etc. shall be provided as design and approved from Consultant/Owner/Engineer-in-charge.

**PA System** consists of main PA Panel and amplifier located in main LV room and the further zone wise distribution through flexible copper cable to wall/ ceiling speakers with required rating of amplifier etc. shall be provided as design and approved from Consultant/Owner/Engineer-in-charge.

**CCTV system** consists of main control like core switch, NVR**,** etc. located in main LV room and its further distribution through OFC/ Cat 6 cable to distribution POEP switch, and all IP based cameras etc. The conduiting and wiring shall be provided by the EPC Contractor however supply, installation and commissioning of all equipments shall be provided separately by the specialized agency as per design and approved from Consultant/Owner/Engineer-in-charge.

**Access Control System** consists of main Access control panel located in LV room and its further distribution through flexible copper cable to all E/M lock, push buttons, and card readers, biometric system etc. at the main entry and block entry levels. The conduiting and wiring shall be provided by the EPC Contractor however supply, installation and commissioning of all equipments shall be provided separately by the specialized agency as per design and approved from Consultant/Owner/Engineer-in-charge.

**Telecommunications System** consists of IPBAX, Civil Telephone, DCN, RAX, NCN R&B, PAX and video conferencing system, shall be provided as design and approved from Consultant/Owner/Engineer-in-charge.

The main **IPBAX** shall be located at Telephone Exchange room located at utility area in the complex.

For **Civil Telephone** distribution, main supply shall be received from service provider by multicore cable/ OFC cable to the space provided in utility area for further distribution to individual units. Supply shall be at taken at least from two alternative service provider.

This civil telephone line shall also serve the internet facility as per authorization list and approval from the Consultant/Owner/Engineer-in-charge.

**Local area networking system (LAN)** shall be provided with the help of OFC cable, Ethernet switch, Media converter and Cat 8 cable from server room till common area to be provided inside every block/building on ground floor for service provider to setup network room for LAN

The main incoming from outside to server room shall be provided by service provider in coordination with the EPC contractor. All provisions of incoming cables/ supply etc. shall be the part of scope of work.

Provision for all above network systems shall be provided including raceways, pipes, etc. and assistance and support including rectification to be given the service provider to lay line and installation.

All the above LV System and Networking system shall be provided in Core, i.e. Staircases/Fire Staircases, Lifts, Lift Lobbies, and Corridors, Entrance Lobbies, Common Toilets, Shafts, common service areas etc. in the Large & Medium Karkhana Buildings, Small Karkhana Buildings, Commercial Office building, Gold Refinery facility and Central Vault Facility, B2B Units and allied services, Common amenities such as canteen, cafeterias, shops and recreation area for Karkhana units.

The provision of the same in form of DB/Panel as per design shall be provided in the Units. Further Internal LV and networking works shall be done by the Unit holders.

However, the Fire alarm system shall be provided inside the Units also as per the Fire norms and statutory requirements.

All the complete LV System and Networking system shall be provided in the Parking in basement/Semi Basement/Podium & Services areas along with Amenity buildings - Police chowki, MI Room, Custom Office and Fire station, as per the design.

All product/ equipment shall be in compliance as per the requirement of LEED GOLD rating certification.

The LV installation works shall be carried out in accordance with the Indian standard codes as mentioned latest NBC and in conformity with NFPA72, IEC 60849, EN 55103-1, EN 55103-2 & EN 60065, ROHS compliance, EMC standard, with the latest amendments as per Owners requirement and system design requirements.

## 

## **Scope of Work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from Consultant/Owner/Engineer-in-charge/statutory authorities for LV System comprising of following components:

1. Fire Detection and Alarm System
2. Public Address System
3. IP based CCTV system (conduiting and wiring only)
4. Access Control System(conduiting and wiring only)
5. Telecommunications System & Local area networking (LAN)system for common area
6. Wi-Fi Solutions
7. Web Security Solutions
8. Electric Vehicle Charging Stations

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Consultant/Owner/ Engineer-in-charge up to satisfaction.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and preliminary schematic drawings for complete LV system.

This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

All equipment under the scope shall be fully compatible, communicable, operatable and controlled and monitored through IBMS.

## **DESIGN PARAMETERS**

* 1. Fire Detection and Alarm System

An extensive and carefully planned fire detection and firefighting system both for external areas of the site and internal areas of all buildings and Entry / exit gates shall be provided to ensure fire safety of the complex.

1. Addressable Fire Detection and Alarm System using state of the art Intelligent Control Panel along with PA system in the entire premises shall be provided in the Buildings.
2. Intelligent Fire Detectors shall be provided for the same. These shall include a mix of smoke detectors, Heat detectors and Multi criteria detectors in the entire premises. Various types of Detectors like Photoelectric smoke detectors, Very Intelligent Early Warning detectors, Multi criteria Detectors like Acclimate detectors shall be connected to an Intelligent Addressable Fire Alarm Panel which shall indicate the address of the device connected in each loop. The Common areas, lift lobbies and corridors shall have conventional detectors attached to the loop through a Zone Monitoring Module.
3. The addressable system shall have an ability to pin point fire and each device in the loop shall have a unique address which shall be displayed on the screen in case of fire. The sensitivity of each device can be varied from the Panel. The Panel shall indicate the contamination fault of the devices, in case a particular detector/ device needs cleaning. Thus, any intelligent detector which has ill health/malfunctioning shall be indicated to the IBMS Control so that it can be made fully functional.
4. These detectors shall be installed below and above the false ceiling as per the nature and type of areas.
5. Network Control Station shall be considered to show the complete building highlighting the troubles and alarm activated areas, along with the normal state of the detectors.
6. A large Public-Address System shall be provided for the entire complex. It shall consist of speakers in ceiling and concealed at different points, connected to a set of Amplifiers and console. There shall be gooseneck microphones at different areas to make announcements in case of an emergency.

Main purpose of this system shall be to detect fire at the earliest practicable moment & to give alarm, so that appropriate action can be taken (for evacuation of occupants, triggering of extinguishers etc.).

Fire detection and alarm system shall be designed as per IS 2189, latest version.

1. Main fire alarm panel shall be installed in control room along with voice evacuation system panel. The fire alarm main panel shall be integrated with sprinkler flow switch devices, ventilation cum smoke management system and pressurization fans, AHU, Access doors etc.
2. Microprocessor based analogue addressable fire alarm control panel complete with addressable smoke, heat detectors and multi criteria (smoke & heat combination) detectors, manual call point, input/output devices, sounders and associated cabling shall be provided. Fire alarm control panel shall have facility with printer and graphic display. All main control panel and equipment shall be UL ONLY. The fire alarm control panel shall also monitor water level in tanks, hydrant and sprinkler system pressures, and pump ON/OFF status etc.
3. The spacing between detectors to detector shall be 7.5 M maximum.
4. The spacing between beam detectors to beam detector shall be 15 M.
5. For every 10 to 20 detectors one fault isolation module shall be placed or detector with fault isolation may also be placed.
6. Electronic hooter cum strobe to electronic hooter cum strobe distance shall be 30 m and as per CEFEES requirements.
7. At every exit manual detection system shall be adopted through manual call points.
8. In every loop monitor module shall be used to control and monitor the hooters.
9. The types of detectors used at kitchen, pantry, electrical, AHU and ELV rooms shall be heat detectors.
10. The types of detectors used at below false ceiling shall be multi sensor detectors (photo electric plus thermal).
11. The types of detectors used at above false ceiling shall be smoke detectors.
12. Double layer of detectors shall be provided wherever the depth of the ceiling void exceeds 800mm.
13. If above false ceiling/false flooring is provided with detection system, then response indicators shall be provided.
14. Response indicator shall be placed above the doors or in false ceiling for detectors above false ceiling.

Two-way communication systems shall be envisaged meeting the latest NBC requirements. Fire Fighter/ Talk back system shall be considered for the entire building. Master Control Panel of Talk Back System shall be located in security room. Talk Back Units shall be considered near the staircase in each floor of the Block. Two-way communication fire fighter’s telephone jack with control relay shall be provided along with adequate no. of fire fighters handsets.

* 1. **Public Address System**

1. The Public-address system shall be designed to serve the dual purpose of making general announcement or to transmit the fire tone under fire condition. The 6W wall/celling mounted speakers shall be distributed on all floors of all buildings.
2. For basement/semi basement/podium parking area, AC plant room, Substation, DG room, Plumbing Pump room, STP pump room horn type wall mounted speaker shall be provided.
3. All speakers shall be configured in different addressable zones. The announcement shall be made in zone wise or to all the speakers simultaneously in ALL CALL mode.
4. Fire Alarm shall be announced immediately on receipt of Fire signal from the panel to all zones.
5. All zones shall be activated during emergency.
6. The console, amplifier and microphone shall be installed close to the fire alarm control panel.
7. In the event of actuation of any two detectors or manual call point on a particular floor, the fire marshal or security personnel shall select the public-address speaker on the affected floor by operating the particular floor/zone switch on, in the switching console.
8. Potential free contacts for the main console panel in each block shall be provided so that the same can be connected to the BMS system.
   1. **IP based CCTV system**

The Closed-Circuit Television (CCTV) System shall provide surveillance of unmanned areas and visitors. The primary objective of implementing CCTV system shall be to ensure effective surveillance of an area and also create a record for post event analysis. Cameras with suitable lenses shall be used to view specific areas of interest. The system shall be monitored on-line and also shall be recorded. The following components and accessories shall be considered in CCTV System.

1. Network Video Recorder (NVRVMS BASED)
2. Fixed Dome Cameras (IP Based)
3. Varifocal Lens Cameras (IP Based)
4. Bullet Cameras (IP Based)
5. PTZ Dome Cameras (IP Based)
6. JOY Stick (for PTZ Cameras)
7. 90 days’ storage - One standard storage unit supports up to 8TB HDD
8. 50 inch UHD LED Colour Monitors.
9. CPU, software license for two viewers.
10. Active data points in server rooms.
11. All Cameras shall be high Definition
12. System shall be capable for Face tracking system.
13. System shall read vehicle number plates and capable to authorize vehicle for entry in coordination with boom-barrier/other security systems.
14. System shall be capable for imaging during night operation.

The CCTV system with 24x7 surveillance shall be provided for all common areas like main Entrance/Exit, corridors, Common Toilet entry, Services areas, parking, Ramps, Terrace, staircase, Equipment’s room, server room, security room, etc. within the building with indoor type fixed dome camera, bullet camera, PTZ camera etc. with 180 deg. viewing angle and at Lifts, Lift Lobby, Basements/Semi Basement/Podium etc. with 360 deg. viewing angle cameras as per approval from Consultant/Owner/Engineer-in-charge.

For the whole Site surveillance, CCTVs shall be proposed for all main entry/exits, Gates, Guard rooms, Service/Utility Building area, Surface Car Parking, internal roads, Main Buildings Entry points, etc. with Outdoor type cameras with night vision facility and peripheral walls @ approx. 30-40m distance, with 180 deg/360 deg cameras as per the as per approval from Consultant/Owner/Engineer-in-charge.

All Cameras shall be connected to network Video Recorder (NVR) with the help of POEP (Power over Ethernet Protocol) switches through Cat 6/Cat 6A Optical fiber as required to ensure good connectivity without losing any data and protection of cable. NVR shall be located in server room and monitoring of entire system shall be done at Security room. For clear views of all cameras, video wall shall be provided. Further for close monitoring, 5 monitors of 50” size approx. UHD screens shall be provided as per approval from Consultant/Owner /Engineer-in-charge.

System shall have a storage facility for min. 90 days. Further system shall be capable for backup by all kind media writing facility like blue ray, DVD, CD, portable storage, external hard-disk etc. with the authentication only.

UPS power arrangement for POEP switches shall be provided as per manufacturer standard or as approved by as per approval from Consultant/Owner/Engineer-in-charge. The CCTV shall be installed on separate GI poles at suitable Height as per the manufacture standard and clear visibility requirements. In no case, cameras should be installed on electrical/external lighting poles.

EPC Contractor shall provide conduiting and wiring for the system and supply, installation and commissioning of equipment shall be separately done by another agency.

**Access Control System**

The access control system shall be IP based system, designed to work with proximity card readers or bio metric for both entries as well as exit control doors. The System shall be designed to control door access to restricted areas. This shall be provisioned to combine with time and attendance Management systems for staffs/workers by the Unit holders. The access control shall be linked to fire alarm & detection system, Fire hazard occur in building and fire alarm raised then the access control magnetic locks shall be automatically de-activated of all access control doors.

The following components and accessories shall be considered in Access Control System.

i. Controller

ii. Proximity Readers

iii. Biometric Readers

iv. Proximity Cards

v. Electromagnetic Locks

vi. Magnetic Contacts

Vii. Panic Bars

The Access control system shall be provided for all Entrance/Exits of the premises and buildings.

The access control system shall be controlled and monitored from one location and all access controls shall be connected with central monitoring system by Cat 6 Cable/OFC as required.

UPS Power arrangement for all access control points shall be provided. In case of emergency, IBMS system shall operate all access points and it shall automatically open. All necessary arrangements for the operation and compatibility with IBMS shall be provided.

Access control system shall be provided with access control software for instant issuing of Proximity card from Security room/Reception with the controlled access facility for the visitors and users as well.

EPC Contractor shall provide conduiting and wiring for the system and supply, installation and commissioning of equipment shall be separately done by another agency.

* 1. **Telecommunication system and Local Area Network (LAN)**

Data and Communication Systems shall include Telephone, Data -Network for the common areas. The provisions of the same shall be provided including raceways, pipes, etc. along with assistance and support including rectification to the service provider to lay line and installation as per requirements of Consultant/Owner/Engineer-in-charge.

The main incoming of the LAN system shall be received from the Antenna /Cloud/ LAN service provider by OFC, then it shall pass through the router and connected to the main core/ layer 3 switch which shall be located in main LV control room then further distribution through Layer 2 switch/ Jack panel (24 Port/48port) by Cat 6/6A only cable to information outlet (I/O) which shall be located in each floor of the building.

* 1. **Wi-Fi Solutions**

Wifi solutions shall consists of Access points distributed all over the common areas. The network of Cat 6A/OFC cables coming from Server shall feed into access points director in loop for providing the Wifi facility. The Wifi shall be password protected with 2-layer authentication system. This wifi system shall be capable of the multi-mode operation simultaneously and shall also be used for video conferencing, data networking internet etc. as per the requirements and specifications.

* 1. **Web Security Solutions**

Web Security Solutions software shall be provided for the security of all the systems mentioned above from unauthorized access, restrictions, virus, controlling, monitoring with log management etc. as per requirements of /Owner/PMC and as per the specifications.

The solution shall support for whole populations from day one with life time subscription license /support /updates and should have flexibility to scale up in future without any additional software / subscription license. In case of hardware based solution, scalability needs to be provisioned from day one.

* 1. **Electric Vehicle Charging Station**

Electric vehicle charging stations shall be provided for “Charging Infrastructure of Electric Vehicles”. The number of charging stations will be **2%** of the total car park of the project.

The Electric vehicle charging stations shall meet all technical as well as performance standards and protocols/norms laid down by Ministry of Power, Bureau of Energy Efficiency (BEE), and Central Electricity Authority (CEA) from time to time.

Every charging station shall comply with appropriate cabling and electrical safety works, adequate space for charging and entry/exit of vehicles, appropriate fire protection equipment and facilities.

The Electric vehicle charging stations shall be compatible to all types of vehicles ranging from two wheelers, four wheelers and buses.

The Electric vehicle charging stations shall be so located that it should not congest the traffic movement and distributed in such a way throughout the premises to bring convenience of charging.

The type of charger will be fast type as per the requirements specified in guidelines of Ministry of Power.

**SECTION C 6 – Security System**

## **System Description**

The Security system under this tender comprises of security and surveillance set up for the project, composed of an ideal mix of mechanical, manual, electrical & electronics Security Systems starting right from the perimeter boundary wall and main entry exit gates.

The three level security system shall be provided as follows:

1. The Tier -1 Security zone shall comprise of complete perimeter protection, Security installations at Boundary wall and all Entry / Exit Gates of the Park.
2. The Tier -2 Security zone shall comprise of security checked entries inside the buildings and Basement/Semi Basement/Podium Parking.
3. The Tier -3 Security zone shall comprise of security checked entries at each unit. The provision for the same at Unit entry shall be provided, further, security system shall be installed by Unit holders.

The Security System works shall include conduiting and wiring only as per design, supply, installation, commissioning of complete 3-tier security system including integration with IBMS system of the campus by the specialized agency.

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from Consultant/ Employer/ Engineer-incharge/ statutory authorities for Security System comprising of following components:

* 1. Security and Surveillance System -Tier1,
     1. **Supply , installation and commissioning of following**
* Boom Barriers
* Under Vehicle Scanning System (UVSS)
* Rising Bollards
* Road Blockers
* Turnstiles – With Access Control
  + 1. **Provisions for following including conduiting and wiring only**
* X-Ray Baggage Scanners
* Door Frame Metal Detector
* Hand Held Metal Detectors
  1. Security and Surveillance System -Tier 2
     1. **Supply , installation and commissioning of following**
* Flap Barriers – With Access Control
* Boom barrier
  + 1. **Provisions for following including conduiting and wiring only**
* Hand Held Metal Detectors
* X-Ray Baggage Scanners
* Door Frame Metal Detector
* CCTV for Parking Management System
  1. Security and Surveillance System -Tier 3 –
     1. **Provisions for following including conduiting and wiring only**
* Provision for Access Control for Units
* Access Control for MEP Services rooms, Common rooms, Vault facility, Gold Refinery facility etc.
* Access Control for Internal Building CCTV System.

d) Guard tour system as additional security measure with software to monitor guards and assets , real time interaction, track from everywhere, NFC/QR code compatible and to monitor unlimited locations.

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Engineer in Charge.

The contractor shall furnish all labour, materials and equipment as required by design and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete Security system as described in the document and as per design.

This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Documents as being furnished or installed, but which are necessary and customary to be performed under this contract.

## **Design Parameters**

* 1. Security and Surveillance System -Tier 1

The Tier -1 Security zone comprises of Security installations at Entry / Exit Gates and perimeter Boundary wall as follows:

* 1. Boom Barriers at the Main Entry / Exit Gate points coupled with Under Vehicle Scanning system, and fixed outdoor day/ night cameras. It shall have and automatic Number Plate and Driver face recognition system also. The Vehicles shall pass through these Booms and the entire under belly shall be scanned by the high speed equipment placed underground in the scanning system. The under belly of the vehicles shall be displayed in the monitor placed in the control room. The System shall be easily integrated with any physical access control devices like Bollards etc. for seamless access. The entire system shall have a recording system and shall be automated to allow remote operation of various devices for the entry of vehicles.
  2. BOLLARDs shall be provided on the road leading to the interior area of the project to ensure that no vehicle unless authorized entry/ exit after due security shall be able to pass through the gate. It shall not permit any vehicle to enter the secured area of the complex unless it passes through the Bollard point.
  3. For pedestrian entry the following installations shall be provided at the Entry/Exit Gate to ensure authorized Pedestrians/Visitors Entry-
* X-Ray Baggage Scanners
* Door Frame Metal Detector
* Hand Held Metal Detectors
* Turnstiles – With Access Control
  1. The Boundary wall shall be provided with electrical fencing along with Concertina coil and Razor blade wires going through it.
  2. Security and Surveillance System -Tier 2

The Tier -2 Security zone comprises of Security installations at all Builidng entry points and Basement/Semi Basement/Podium Parking as per design/Masterplan, as follows:

1. Installations at the Entrance Lobbies of all Building Blocks to provide security clearance to the Staff/Workers and Visitors shall be as follows:

* X-Ray Baggage Scanners
* Door Frame Metal Detector
* Hand Held Metal Detectors
* Flap barriers – With Access Control Readers

1. The Basement/Semi Basement/Podium Parking entry points and parking areas shall be secured with following installations-

* Boom Barriers with long range Proximity Readers at the Ramp Entry/Exits with Fixed Cameras to monitor the vehicles entry and exits. The authorized vehicle shall enter the basement parking after the drivers flashes the proximity card being issued to all the barrier at ramp OUT.
* There shall be a fixed Box type High Resolution day/night cameras monitoring the vehicles going in and coming out of the ramp. These cameras shall be able to capture the driver’s pictures and read the number plate of the vehicle if required.
* Complete Basement/Semi Basement/Podium covered PTZ camera shall be provided at various locations as required to completely cover the Parking area.

1. The Main Lift lobby in Basement/Semi Basement/Podium shall be provided with following installations to provide security clearance to the Staff/Workers entering the Buildings from Car parking –

* X-Ray Baggage Scanners
* Door Frame Metal Detector
* Hand Held Metal Detectors
* Flap barriers – With Access Control Readers

1. All other lift lobbies and Staircase entries shall be provided with Access Control Readers and Fixed Dome Cameras.
2. Parking Management System

* Intelligent Parking System is an extension of the Access Control System and Visitor Management – indicating the number of vehicles getting into the basement and number of vehicles exiting. The system shall be provided and shall be able to show the number of parking slots available
* The system shall also be able to show the total number of parking slots designated for visitors.
  1. Security and Surveillance System -Tier 3

The Tier -3 Security comprises of Access Control for Units (provision only), Common facilities rooms, all MEP Services rooms etc. and Internal Building CCTV System. The details of the same are specified in the Access Control in the LV Systems Section.

* 1. Interface and Integration

The Contractor shall ensure that required interfaces and Integration between Security Surveillance works and other services systems such as Electrical, LV, Fire Fighting, IBMS etc. are correctly identified and implemented to ensure the completeness of the overall project functional requirements.

**SECTION C 7 – External Plumbing System**

## **System Description**

External Plumbing system under this tender comprises of External Water Supply system, External Sewerage System, External Drainage System, Rain Water Harvesting System and External Irrigation System.

The whole system shall be integrated with IBMS system and all equipment should be selected for operational, monitoring and control through IBMS.

The EPC contractor shall be responsible for working out the quantities pertaining to total water demand of the project, sewage generation to work out the STP capacity, Effluent generation to work out the ETP capacity, rain water calculations to work out the methodology and quantum of RWH pits etc and all other areas forming part of the external plumbing system.

**External Water Supply system** includes receiving water from the approved source, storage in tanks, Water treatment plant with filtration, water softener system - complete plumbing works including all equipment, pumps, piping, connections, filters, softeners, accessories etc. and further distribution as per design scheme proposed by the contractor and approved from Consultants/Owner/Engineer-in-charge. Storage capacity of Underground tanks shall be planned for 2 days and Overhead tanks for half day.

Main source of water shall be municipal water from MIDC. Fresh water for the total water requirement of the project shall be received upto the valve chamber with water meter at the entry point of site near the Entry/Exit Gate from the state authority.

From valve chamber, water shall be brought to the Underground Water (UG) tank & Pump room located in the Utility services area through underground piping. Water shall be treated through filtration and softening by water treatment plant and further distributed through the pumps to Overhead Water Tank (OHT) through vertical risers for domestic.

Water for drinking purposes shall be treated through RO plant located in the Pump room and shall be fed into receiving Valve/valve chamber at entry points for the buildings. It shall further be supplied directly to individual outlet points inside the buildings through Hydro-pneumatic pumps housed in the RO plant through vertical riser.

**External Sewage system** includes collection of solid waste & waste water in sewer manholes from various exit points of all buildings and further collected in Sewage Treatment Plant (STP) through network of underground sewer lines and manholes, as per design scheme proposed by the contractor and approved from Consultants/Owner/Engineer-in-charge. It also includes further distribution of STP recycled water for flushing & irrigation of the landscaped areas through the pumps.

Soil waste & waste water pipe from the building exit points shall connect to sewer manholes. Sewer shall be taken to the STP proposed at site. The same shall be carried through network of underground sewer lines (Stone Ware Pipe) and manholes. After the treatment of STP, treated water shall be collected in treated water tank and from the treated water tank, it shall pump out treated water to distribute for Irrigation purpose.

**Effluent Treatment Plant**  includes collection of industrial waste water in sewer manholes through appropriate suitable piping works from various exit points of all buildings, all sources and further collected in Effluent Treatment Plant (ETP) through network of underground sewer lines and manholes, as per design scheme proposed by the contractor and approved from Owner/PMC It also includes further distribution of ETP recycled water for flushing & irrigation of the landscaped areas through STP or through the pumps directly as per the approved scheme. The Contractor shall consider Sulphuric acid, nitric acid, hydrofluouric acid , hydrochloric acid and hydrogen peroxide acid in the design and piping system of ETP.The contractor shall provide ETP based on the calculation for Red zone. The Contractor shall engage the Subject Matter Expert (SME) for all specialized works. Separate metering system shall be installed in each unit to measure the ETP waste from the unit level.

**Zero Liquid Discharge (ZLD)** – The EPC contractor shall be responsible for designing the facility in such a way to achieve Zero-liquid discharge (ZLD), wherein to design a water treatment process in which all wastewater is purified and recycled; therefore, leaving zero discharge at the end of the treatment cycle. Additionally provision space for 2 Nos. boilers is to be provided by EPC contractor for ZLD and the boiler shall be charged by the nearest MGL supply for which EPC shall also make suitable provisions.

**Smoke Extraction** - Scrubber System includes collection of all gases at various exit points of all buildings and all types of karkhana units. Designing of efficient scrubber system as per the demand of the project as per national/international codal provisions with main objective to is to neutralize harmful components in industrial air or waste gas streams before being released to the environment. The EPC contractor will be responsible for providing a tap off point for all karkhans units to enable integration of their internal exhaust system. Minimum three shafts shall be provided in each unit

**External Drainage system** includes collection of building roof top rain water at various exit points of all buildings and storm water from roads and landscaped areas through a network of catch basins, storm water manholes and underground pipes and collected into Rain water harvesting pits as per design scheme proposed by the contractor and approved from Owner/Consultants. Rain water harvesting pits at appropriate locations planned for Zero Discharge Scheme.

External storm water from roads and landscaped areas shall be collected through the catch basin with the perforated cover and connect to storm water manholes. Storm water shall be carried out though the underground R.C.C. pipe and manholes connect to rain water harvesting pit for recharge.

The plumbing installation works should be carried out in accordance with the Indian standard codes as mentioned in NBC, SP- 35 plumbing standard, CPWD, IS: 10500, IS: 1239, IS: 15801, etc. with the latest amendments as per Owners requirement and system design requirement.

Requirements of LEED Gold certification rating like relating to Rain water harvesting, water conservation, solar energy use, metering system etc. should be implemented in the whole plumbing works as applicable.

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from owner/consultants/statutory authorities for External Plumbing System comprising of following components:

1. Source of Water & Tap-off
2. Domestic Water Supply System
3. Drinking Water Supply System – RO Plant
4. Soft Water Supply System for HVAC Cooling Towers
5. Under Ground Water Tank and Pump Room Construction and Internal services for Housing complete system.
6. External Sewerage System
7. Sewage Treatment Plant (STP) Construction and Internal services for Housing complete system.
8. Effluent Treatment Plant (ETP) Construction and Internal services for Housing complete system.
9. External Scrubber System
10. External Drainage System
11. External Irrigation System
12. Rain Water Harvesting System
13. Associated Civil works – Drainage & Rain Water Harvesting System

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Owner’s site representative upto his satisfaction.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and preliminary schematic drawings for complete External plumbing system.

This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

The contractor shall ensure that required interfaces between other services systems such as HVAC, Electrical & Fire Fighting etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

All equipment under the scope should be fully compatible, communicable, operatable and controlled and monitored through IBMS.

## **DESIGN PARAMETERS**

* 1. Source of Water & Tap-off

Water supply shall be received from relevant authority near the Entry/Exit Gate for the total Water requirement of the Project. A tap-off shall be taken from the supply with a valve chamber along with water meter. From there, the water shall be brought to the UG tank & Pump room located in the Utility services area through underground piping. The size of the pipe shall be provided for the water requirement.

* 1. **Domestic Water Supply System**

3.2.1 Water Requirement Calculations

|  |  |  |
| --- | --- | --- |
| Description | Domestic usage | Flushing usage |
| Office | 25 lit /person /day | 20 lit /person/day |
| Karkhana staff | 20 lit /person /day | 10 lit /person/day |
| Visitors | 5 lit /person/day | 10 lit /person/day |

Water requirement for per person / day for the project shall be calculated as per latest NBC guidelines and approved by owner/consultant. The calculation to be done as per following parameters

In additions to domestic water requirement, there shall be water requirement for process in Karkhana units and same shall also be considered in the total water requirement for the project.

3.2.2 Domestic Water Supply

The water received from the tap-off shall be brought into underground fire storage tank in UG Tank & pump room. Overflow from fire storage tank shall be taken to raw water storage tank in order to avoid stagnation of water. The water from raw water storage tank shall be treated with filtration & softener and pumped to the underground treated water & flushing water storage tanks.

The water treatment should include bacteriological treatment to keep the quality parameters conforming to IS: 10500 codes latest edition.

After the treatment, domestic and flushed water shall be pumped to Overhead Water Tanks (OHT) of each block terrace through Transfer pumps. Water shall be further supplied from OHT to all floors through gravity system.

3.2.3 Drinking Water Supply System – RO Plant

The Drinking water supply system shall consist of processing of treated water from underground storage tanks through a central R.O. Plant located in the Pump room in Utility services area. The processed water (from RO Plant) shall be stored in a separate tank designed for 1-day storage capacity and shall be pumped through Hydro-pneumatic pumps to the receiving valve/valve chamber at all buildings entry points. It shall be directly distributed through vertical risers to individual all types of karkhana units, pantries, Kitchen/ Cafeteria, Drinking water coolers etc. through separate pipelines.

3.2.4 Soft Water Supply System for HVAC Cooling Towers

Soft Water required for HVAC Cooing Towers make up water shall be passed through Softener and shall be stored in underground soft water storage tank in the Pump room. Soft water shall be supplied through the pumping system to Chillers and Cooling Towers at Utility services area. The load calculation for the soft water requirement for HVAC system shall be calculated as per requirement.

3.2.5 Piping Works

Laying of piping for External Water supply shall be done with main supply to UGT – DI and from UGT to distribution network - PLPE pipes and for RO water with PPR pipes buried in ground for required sizes/diameters as per the preliminary schematic drawings and specifications and approval from Owner/Consultants. Piping works at all road crossings shall be done with RCC Hume pipes NP 3 class as per specifications.

Under Ground Water Tank and Pump Room Construction and Internal services for Housing complete system.

3.2.6 Under Ground Water Tank and Pump Room

The UGT & pump room is proposed in the Utility services area comprising of Fire water tank, Raw water tank, Treated water & Flushing water tank, Soft Water tank, RO Plant room/area and platforms for various pumps, treatment equipment etc. along with additional space all these for the future expansion.

* 1. **External Sewerage System**

3.3.1 STP Capacity Calculations

Sewage calculations shall be done as per latest NBC guidelines and approved by owner/consultant. The calculation to be done as per following parameters:

1. Consider minimum 80% of Domestic & 90 % of Flushing water shall find its way into the proposed sewer
2. The sewer lines shall be designed for three times Av. D.W.F. (Average Dry Weather Flow) in relation to the water supply demand.
3. All sewer pipes upto 400 NB shall be designed to run half (1/2) full and above 400 NB to run at 2/3rd full.

The STP capacity shall be calculated as per final water requirement.

3.3.2 Sewerage System Scheme

The soil and waste from building floors carried down in separate independently vented pipes shall be collected from the building exit points in manholes. Two pipe sewerage systems shall be adopted as per stipulated norms. The sanitary, waste & vent system shall be water tight and gas tight designed to prevent escape of foul gas and odour from various fixtures.

Soil system shall comprise of various Gully Trap/ manholes connected through underground pipes laid to the required slope ensuring self-cleansing velocity of flow (0.75 M/ sec) within the pipes.

The collected soil and water waste shall be connected to STP (MBBR process) of required capacity located as per approved master plan and the recycled water from STP shall be stored in underground tank in the STP building. The treated water shall used for irrigation of the landscaped areas, washing purpose and flushing in toilets by dual plumbing system.

3.3.3 Piping Works

Laying of piping for External Sewerage system shall be done with SW pipes buried in ground for required sizes/diameters as per the preliminary schematic drawings and specifications and approval from Owner/Consultants.

* 1. External Irrigation System

Automated sprinkler system with manual operation for the green areas shall be given along with all necessary piping, fittings, nozzle, heads, pump, etc. Irrigation Technology used shall be such that there is minimum wastage of water.

Recycled water from STP stored in underground tank in the STP building, shall be conveyed to the Garden Hydrant points by booster pumps through a network of underground irrigation piping network.

3.4.1 Piping Works

Laying of piping for Irrigation system distribution shall be with UPVC pipes buried in ground for required sizes/diameters as per the preliminary schematic drawings and specifications and approval from Owner/Consultants. Piping works at all road crossings shall be done with RCC Hume pipes NP3 class as per specifications.

* 1. External Drainage System

Drainage system and Rain water disposal shall be designed as per latest NBC guidelines and approved by owner/consultant. The tentative parameters are as follows:

Average Rainfall data , Rainfall intensity, Storm frequency, Coeff. Of run off, Time of concentration, Catchment area, Existing topography

1. Storm waste drainage system shall be designed based on a rainfall intensity per hour.
2. Rain water disposal shall be designed as per NBC i.e. 150 mm dia covers the area 308.64 sqm. as per NBC, codal provisions based on the rainfall intensity data of the project location.
3. Rain water harvesting pits of required and effective depth with double bore shall be provided as per Environmental clearance norms. In case water table is high, the design shall be designed accordingly.
4. Combined closed circuit of storm water drainage system shall be provided for the building roof drainage and the site drainage.

3.5.1 Piping Works

Laying of piping for External Storm water distribution shall be with RCC NP2 pipes buried in ground for required sizes/diameters as per the preliminary schematic drawings and specifications and approval from Owner/Consultants. Piping works at all road crossings shall be done with RCC Hume pipes NP3 class as per specifications.

* 1. **Rain Water Harvesting System**

Rain Water shall be collected by gravity from the building terraces & site through catch basins, storm water manholes etc. and shall be send to Rain Water Harvesting pits through underground piping. It shall be used for recharge the ground water level and shall be designed for the Zero discharge system.

Water collected from below ground structures like basement/Semi basement, Plumbing Pump room, STP pump room shall also be connected to the external Storm water drainage system through sump-pumps installed inside these spaces.

* 1. **Associated Civil works**

The civil works associated with Water supply, UGT, STP, Drainage, Rain Water Harvesting installations etc. shall be executed in accordance with design and approved shop drawings and as per civil details given in respective tender specifications for other packages. The same shall include:

* RCC foundation, RCC pedestal/ platform for all pumps, equipment etc.
* Sump pit with draining arrangement etc. as per requirements
* Masonry / RCC manholes / Chambers / Trenches, floor cut outs etc. as per required shape and dimensions
* Trench covers, SFRC/RCC covers, Gratings, MS rungs, etc.
* All necessary piping, valves, filters, puddle flanges, level sensors, vent pipes etc. to meet all functional requirements of the system.
* Ramps, Steps, MS staircase, MS Railing, rolling shutters, Doors etc. as shown in preliminary schematic drawings and as per requirement/approval from Owner/consultant.

All the tanks, manholes, sumps, grease traps, etc., should be constructed water tight and coated with water proof lining as per specifications and finished with ceramic tiling. All the tanks should be hydro–tested and witnessed and certified by the Owner/Consultants.

**SECTION C 8 – Internal Plumbing System**

## **System Description**

Internal Plumbing system under this tender comprises of Internal Water Supply system – Domestic & Flushing water, RO Water & Hot Water, Internal Sewerage System, Internal effluent collection system, Internal Drainage System and Rain Water. It includes all pumps, filters, valves, traps, pipes, sanitary fittings, fixtures, heating components, accessories etc. necessary for completion of all Internal Plumbing works.

The whole system is integrated with IBMS system and all equipment shall be selected for operational, monitoring and control through BMS.

Internal Water Supply includes pumping of treated water to Overhead Domestic water tank of each block & Central Lobby by transfer pumps through vertical risers and further distribution to all toilets and other water points on all floors from OHTs. Water meters compatible for BMS integration shall also be provided water consumption recording.

Drinking water supply includes supply of processed water from RO plant to individual pantries, Kitchen and Drinking water coolers etc. through separate pipelines by hydro-pneumatic pumps housed in the RO plant in Pump room building.

Hot Water supply includes heating of water by solar panels mount at terraces and supply of hot water to Cafeteria/ Kitchens & pantries etc. as per the requirement.

Internal Sewerage System includes collection of waste from all floors through soil and waste pipes and convey it down through vertical stacks and connected to the sewer manholes located in the periphery of the building under External Sewerage network.

Internal Drainage System includes collection of rain water from roof top of all buildings, exposed balconies and terraces etc. and conveyed down to basement or ground floor of the building through vertical down take pipes and connected to nearest manhole or catch basin located in the periphery of the building under External Drainage network.

The plumbing installation works should be carried out in accordance with the Indian standard codes as mentioned in NBC 2016, SP- 35 plumbing standard, CPWD, IS:10500, IS: 1239, IS: 15801 and local bylaws etc. with the latest amendments as per Employers requirement and system design requirement.

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from owner/consultants/statutory authorities for Internal Plumbing System comprising of following components:

1. Internal Domestic Water system
2. Internal Drinking water system
3. Dual Plumbing system
4. Internal Hot water supply system
5. Internal Sewerage System
6. Internal Drainage System
7. Piping material
8. Associated civil works for internal plumbing system
9. Interface Building Management System (BMS)

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Owner’s site representative upto his satisfaction.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and approved design, drawings for complete Internal plumbing system.

This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

1. The contractor shall ensure that required interfaces between other services systems such as HVAC, Electrical & Fire Fighting etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.
2. All equipment under the scope should be fully compatible, communicable, operatable and shall be controlled and monitored through IBMS.

## **Design Parameters**

The Design of the Internal Plumbing system shall consider the following parameters for the system:

* 1. Low capital cost - The selection of equipment shall be designed to achieve the lowest capital cost consistent with energy efficient modern technology. The choice of equipment and specifications shall be provided as best possible system at a reasonable price.
  2. Maximum flexibility of operation
  3. Use of highly responsive control system (BMS) to optimize system functioning.
  4. Proposed system, equipment selection and specifications shall be proposed to facilitate fulfilling LEED Gold rating criteria.
  5. **Internal Domestic Water System**

3.1.1 Supply of Water

The Design of the internal domestic water supply system shall be based on latest NBC and as per design parameters already specified in the External Plumbing Section. Treated water from the UG tanks by a series of pumps in the Pump room in the Utility services area shall be received into the receiving Valve/Valve chamber at entry points for the buildings under External Plumbing system.

3.1.2 Overhead Domestic Water Tanks

The water from Valve/Valve chamber shall be pumped to terraces of the building by transfer pumps through vertical risers. It shall be further distributed through horizontal riser network on terraces and fed into Overhead Domestic water tanks located of roof of the building. The overhead water tanks shall be provided with storage for half day capacity.

All these tanks shall be constructed water tight and coated with suitable water proofing material and ceramic tile lining. All the tanks shall be hydro –tested and witnessed and certified by the PMC/client representatives.

3.1.3 OHT Capacity

The overhead water tank capacity shall be calculated by EPC contractor as per water requirement in each building.

3.1.4 Water Distribution

Water distribution to all floors toilets for domestic use i.e. wash basin, health faucet, WC tap, shower, and all water points for Units, Offices, etc. shall be by gravity & by booster pumps (if required) as per design located at terrace level near each overhead tank.

Water meters compatible for IBMS integration shall be proposed in identified areas for water consumption recording for efficient monitoring and assessment. Head losses through water meter shall be accounted for in water distributions calculations. Colour coding for domestic and hot water supply piping shall be ensured for clear identification of the piping.

3.1.5 Overhead Flushing Water Tanks and Distribution

The water from treated water tank shall be pumped to terraces of the building by through vertical risers. It shall be further distributed through horizontal riser network on terraces and fed into Overhead Flushing water tanks located of roof of the building. The overhead water tanks shall be provided with storage for half day capacity.

All these tanks shall be constructed water tight and coated with suitable water proofing material and ceramic tile lining. All the tanks shall be hydro –tested and witnessed and certified by the PMC/client representatives.

Water distribution to all floors toilets for flushing use in WC, urinal etc. shall be by gravity from overhead tanks. Colour coding for flushing water supply piping shall be ensured for clear identification of the piping.

* 1. Internal Drinking Water System

Drinking water supply from RO plant room in Utility area shall be received in Valve/ Valve chamber for the buildings under External Water supply system.

The processed water shall be supplied to individual points provisioned for pantries, Kitchen, Drinking water coolers etc. through separate pipelines (PPR) by hydro-pneumatic pumps housed in the RO plant room in Utility services area. This water shall be chilled by standalone water cooler located at required location by the Unit holders. Water to this system shall be supplied after treating through central R.O. Plant.

* 1. **Internal Sewerage System**
     1. Sewage Collection

The Sewage System are Designed based on the Following Codes and Standards.

CPHEEO Manual for Sewage and Sewage Treatment, NBC-2005, IS-456, IS-458, IS-783, SP-35 (Handbook on Water Supply & Drainage)

The waste from all floors shall be collected through soil and waste pipes and convey it down through vertical stacks in plumbing shafts to join to the sewer manholes located in the periphery of the building under External Sewerage network.

The waste pipe shall be led to the gully trap before joining it into the sewer manhole. The soil and waste shall be carried down in separate independently vented pipes and two pipe drainage system shall be adopted as per stipulated norms. The sanitary, waste & vent system shall be designed as water tight and gas tight to prevent escape of foul gas and odour from various fixtures. Provision of mini & maxi vent shall be made for hygiene, safety considerations, and to avoid entry of foul smell into occupied area.

3.3.2 Sewage Parameters

Vent system shall be designed to facilitate escape of gases and odour from all parts of sanitary and waste system to the atmosphere at a point above the building is shall also be designed to allow admittance of air to all parts of the system, so that, siphonage, aspiration or back pressure conditions do not cause loss of seal at traps.

Provision for cleaning and rodding eyes shall be made at strategic locations to allow the system maintenance. These cleaning & rodding eyes shall be located in BOH areas, in ceiling space and shall be remote from kitchen / pantry and other critical areas. Grease interceptors to be proposed for kitchen waste, located close to the source of grease. The grease traps to be liberally sized to avoid overflows. Also, the incoming line shall be minimum 150mm dia to avoid blockages.

3.3.3 Sanitary fittings and fixtures

1. All sanitary wares shall be as per approval from the Owner/ Architect / Client representative for energy efficient low flow fixtures required to achieve LEED Gold rating.
2. Water closets (European) shall be wall mounted / floor mounted vitreous china, with concealed cisterns / low level PVC cisterns, dual flushing type.
3. Water closets (Indian Orissa pan) shall be of vitreous china, with low level cisterns.
4. Wash basins shall be of vitreous china, Table top type/ self-rimming, counter sunk type, fixed on Granite counter.
5. All Kitchen and Pantry sinks shall be Stainless Steel -single bowl without drain board.
6. Urinals shall be of white vitreous china flat back half stall sensor based with auto flushing system with frosted glass partitions.
7. All fittings and accessories as pillar cocks, bib cocks, valves, traps, gratings, mixer units, shower heads, health faucets, toilet paper holder, towel rails, soap dispenser, tissue paper dispenser, hand drier, mirror, coat hooks etc. shall be provided as per specifications and selection by the Owner/Consultant.
   1. **Internal Drainage System**

3.4.1 Drainage Parameters

Rain water down takes shall be sized in accordance with standard norms i.e. latest NBC and Rain water disposal shall also be designed as per latest NBC norms. All the terraces shall be sloped in a slope of 1:75 or 1:100 slopping towards down vertical pipes.

3.4.2 Roof/Terraces Drainage

Rain water from roof top of all buildings, exposed balconies and terraces etc. shall be conveyed down to ground floor of the building through vertical down take UPVC pies and connected to nearest manhole or catch basins located in the periphery of the building. These vertical down take pipes shall be located at suitable locations in side the rain water shafts at the periphery of the building. No Rain water shaft or pipe shall be given inside the building. The rain water from catch basins/manholes shall be fed into the External drainage and rain water harvesting network system.

3.4.3 Basement/Semi Basement Drainage

Basement and all areas below road levels shall be provided with a separate drainage system delivering the water into pre-designated sumps. Ramp drains shall also be provided at the foot of each ramp. Basements shall be provided with covered drains with gratings.

The drain and sumps shall be located at appropriate locations as per architectural and structural configuration of the building. Drain channels shall be provided with adequate slope to affect self-cleaning velocity and shall terminate in sumps. For each sump, 2 nos. submersible pumps (1 working + 1 standby) shall be provided for disposal of collected run-off. Pumps shall be installed in identified sumps and shall be operated by Hi-Lo level switches with automatic changeover between both pumps

3.4.4 Piping material

The following piping material shall be proposed for the internal plumbing works of the project.

1. Domestic Water – UPVC/PLPE pipes in shaft and terrace. CPVC pipes inside Toilets.
2. Soil waste & Waste pipes - UPVC – 5-layer sound insulated (POLO PLAST), leak proof
3. Waste water - PVC pipes 5-layer sound insulated (POLO PLAST), leak proof
4. Rain water down take pipes – UPVC
   1. Associated Civil Works

The civil works associated with all plumbing installation shall be executed in accordance with approved design and shop drawings and as per civil details given in specifications. The same shall include:

1. All necessary civil works like foundations, platforms, supports as required.
2. Cutting holes, chases & like through all types of walls /floors and finishing for all services crossings, including sealing, frame works, fire proofing, providing sleeve, cover plates, making good structure and finishes to an approved standard.

**SECTION C 9 – External Firefighting System**

## **System Description**

The Coupling jointing shall be provided for firefighting as per seismic Zone requirement for entire piping, pumps, valves etc. The firefighting arrangement shall be designed as per the requirement of local guidelines, latest NBC, NFPA & engineering design standard. External Fire Fighting system under this tender comprises of Fire Water supply, Storage, External Fire Pumping system, External Fire Hydrant System and Distribution.

The entire firefighting system installation shall be compliant with the most stringent codes / standard for the entire Complex to ensure the highest safety standard and uniformity of system. Further, before property is opened to public, the firefighting shall be fully operated and tested under simulated conditions to demonstrate compliance with the most stringent standards, codes and guidelines.

The Fire Fighting System shall consist of Jockey Pump, Electrical Driven Main Fire Pump and Diesel Pump for Sprinkler and fire Hydrant, Air Vessel, Associated Instruments, Cabling, Piping, Valves, and Control Panel etc. which shall be provided as per latest NBC requirement. Jockey Pump shall maintain all water lines for Hydrants and Sprinklers fully charged under pressure for full Automatic operation in case of fire.

Complete System shall be operated by IBMS with pressure sensors located at different points to check and maintain the required pressure at all the times in the line.

Under Ground Water Tank and pump room building with required capacity underground fire water tanks shall be provided as static fire water storage tank for Firefighting System.

The Mode of Operation shall be as follows:

1. In the event of fire, when one or more hydrants valves are opened or the fire sprinklers burst, the pressure fall in the relevant header shall start the AC motor driven fire pump through pressure switches automatically. In case of failure of electricity or failure of pump to start or the pump not meeting the required water demand the standby diesel pump set shall start automatically. However, shutting down of the pumps shall be manual except for the jockey pump which shall start and stop automatically through pressure switches. These systems will override the IBMS system.
2. The setting of the pressure switches would be adjustable so that any desirable sequence of starting may be achieved at site.
3. In addition to auto start arrangements, the main pump shall also have an overriding manual starting facility by push button arrangement in case of an emergency.

External fire hydrant system shall be provided at site and all around the building with single landing valve, rubberized fabric lined hose, complete with instantaneous type outlets, of Gun Metal construction and hose box. Yard Hydrants connected to hydrants ring main shall be provided at every 45 meters C/C, as per latest NBC norms and Fire norms.

The utility services area and buildings shall be protected by non-water based system. The gases shall be supplied from cylinders through a network of manifold & pipeline to the space. Portable fire extinguishers of Carbon-di-oxide, foam type and ABC powder type shall be provided as first aid fire extinguishing appliances. These extinguishers shall be suitably distributed in the entire public as well as service areas. In transformer & LT room, gas flooding system shall be provided.

The firefighting installation works should be carried out in accordance with the Indian standard codes as mentioned in NBC-part IV, NFPA, IS: 903, IS: 15683, IS: 636, etc. with the latest amendments as per Owners requirement and system design requirement and as per recommendations of CEFEES/ local fire authority for approval.

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from owner/consultants/statutory authorities for External Fire Fighting System comprising of following components:

1. System Design
2. Fire Department Connection and Fire Water Storage
3. External Fire Underground Static Storage Tank
4. External Fire Pumping System
5. External Fire Hydrant System
6. Piping Works
7. Fire protection system for all Utility services buildings
8. Associated civil works for external firefighting system

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Owner’s site representative up to his satisfaction.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and preliminary schematic drawings for complete External Fire Fighting system.

This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on documents to furnish or installed, but which are necessary and customary to be performed under this contract.

The contractor shall ensure that required interfaces between other services systems such as HVAC, Electrical & Plumbing etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

All equipment under the scope should be fully compatible, communicable, operable and should be controlled and monitored through IBMS.

EPC to submit firefighting plan/evacuation plan during tender stage, point to be added in RFP

## **DESIGN PARAMETERS**

# System Design

The firefighting system shall be designed as per the recommendations of the National Building Code of India-Part IV, latest version. Since the Site has a mixed occupancy namely – Karkhana Buildings and Office Building, it is imperative that the building firefighting system to be designed for the most stringent of the types out of these and Occupancy wise classification as per the latest NBC.

Considering the purpose of the buildings, as well as the height of the structure and mixed occupancy, shall be necessary to provide a proper and adequate firefighting system based on the requirements of the National Building Code latest version and Fire norms. The firefighting systems considered for the buildings is as follows:

1. Karkhana & Office Blocks - Wet Risers & Complete Sprinklers system.
2. Basement/Semi Basement - Wet Risers & Complete Sprinklers system with water curtain
3. Utility Buildings - Down Comer.
4. Amenity Buildings - Down Comer.

# **Fire Department Connection and Fire Water Storage**

Fire department connection shall be received near the Entry / Exit gate as per the approved masterplan. These shall comprise of 1 no. of 4-way Inlet connection and 1 no. of 2-way outlet connection capable of directly feeding the ring mains through non-return valves or directly filling the static fire storage tanks. These shall be mounted in specially identified boxes.

# **External Fire Underground Static Storage Tank**

The capacity of underground fire tank for the project shall be calculated based on parameters as per latest NBC, /local fire authority norms and recommendations and shall be submitted and got approved from owner/consultants.

All the underground tanks, manholes, etc., shall be constructed water tight and coated with water proof lining as per specifications and finished with ceramic tiling. All the tanks should be hydro –tested and witnessed and certified by the Owners site representatives.

# **External Fire Pumping System**

The external fire pumping system shall comprise of independent electrical pumps for hydrant and sprinkler system, diesel engine driven pump & jockey pump for hydrant & sprinkler system.

The Pump Head calculation shall be calculated based on parameters and as per CEFEES/local fire authority recommendations and shall be submitted and got approve from owner/consultants.

* Electrical pump shall provide adequate flow to cater the requirement of hydrant system.
* Diesel engine driven fire pumps shall be provided for ensuring operation & performance of the system in case of total electrical power failure.
* Jockey pumps shall compensate for pressure drop and line leakage in the hydrant and sprinkler installation.
* Tank suction to be connected to common suction header which shall be connected to independent pump suction. The electric fire pumps, diesel engine driven fire pumps and the jockey pumps shall all draw from this suction header.
* Delivery lines from various pumps shall also be connected to a common header in order to ensure that maximum standby capacity is available. The sprinkler pump shall be isolated from the main discharge header by a non-return valve & isolation valve so that the hydrant pump can also act as standby for the sprinkler system.
* The ring main shall remain pressurized at all times and Jockey pumps shall make up minor line losses.
* Automation required to make the system fully functional shall be provided.
* Only one set of risers each for hydrants & sprinklers systems shall be provided.
* The whole building shall be protected by single stage pumping system.
* All main and jockey fire pumps would start automatically through the pressure switches mounted on the respective pressure vessels.
* The fire pump shall be horizontally mounted. It shall have a capacity to deliver and developing adequate head so as to ensure a required pressure at the highest and the farthest outlet.
* The pump shall be capable of giving a discharge of not less than 150 per cent of the rated discharge, at a head of not less than 65 per cent of the rated head. The shut off head shall be within 120 per cent of the rated head.
* The pump casing shall be of cast iron and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be of stainless steel. Provision of mechanical seal shall also be made.
* Bearings 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 plate 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.
* All types of fire pumps and equipment for firefighting system in the plant in the Utility services area including all necessary piping, valves, puddle flanges, level sensors, vent pipes etc. shall be provided.

# **External Fire Hydrant System**

* External fire hydrant system shall be provided with single landing valve, rubberized fabric lined hose, complete with instantaneous type outlets, of Gun Metal construction.
* For each external fire hydrant, two numbers of 63mm dia. 15 m long controlled percolation hose pipe with Gun Metal male and female instantaneous type couplings machine wound with copper wire, Gun Metal branch pipe with nozzle and hose box shall be provided.
* Yard Hydrants connected to hydrants ring main shall be provided at every 45 meters to serve all the external walls and areas in the complex. External hydrant shall be located within 2 m to 15 m from the building to be protected such that they are accessible and may not be damaged by vehicle movement.
* Each external hydrant hose cabinet shall be provided with a drain in the bottom plate.
* Each hose cabinet shall be conspicuously painted with the letters “**FIRE HOSE”**

# **Piping Works**

MS pipes for hydrant system as per latest IS 1239 & IS: 3589 shall be provided for the external firefighting system for the project. Pipes shall be buried in ground and any road crossings shall be Grooved Victaulic Fittings above 50mm dia. Screwed fittings shall be approved type malleable or cast iron with reinforced ring on all edges of the fittings suitable for screwed joints.

Grooved Victaulic Fittings above 50 mm shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12 (Firelock®), forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9, 53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Forged steel fittings of approved type with "V" groove for welded joints if any.

All distribution pipes for all components of External Firefighting system, for all required diameter and materials as per approved drawings and specifications shall be provided.

All underground piping works shall be with concrete bedding or haunching as per specifications.

Contractor shall provide factory made pipe hangers, supports, brackets, etc. as required and as per approved manufacturer list. Welding of galvanised clamps and supports shall not be permitted.

Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on four straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.

# **Fire protection system for Utility services buildings - Substation, AC plant room, Plumbing plant room, STP, ETP, HT metering room, etc.**

The utility services area and buildings shall be protected by non-water based systems as specified below as per NBC and fire norms:

|  |  |  |
| --- | --- | --- |
| **l. No** | **Area Description** | **Type of Fire protection system / Equipment** |
| 1 | Transformer area/LT Panel Room | GAS flooding system |
| 2 | DG room | CO2 fire extinguisher |
| 3 | HT metering room | CO2 fire extinguisher |
| 4 | HT panel room | CO2 fire extinguisher |
| 5 | AC plant room | CO2 fire extinguisher |
| 6 | Plumbing pump room | CO2 fire extinguisher |
| 7 | RO plant room | CO2 fire extinguisher |
| 8 | STP & ETP pump room | CO2 fire extinguisher |

The gases shall be supplied from cylinders through a network of manifold & pipeline to the space.

Portable fire extinguishers of Carbon-Di-Oxide, Foam type and ABC powder type shall be provided as first aid fire extinguishing appliances. These extinguishers shall be suitably distributed in the entire public as well as service areas. These shall be placed or hanged on wall in a group on several suitable places.

CO2 gas type fire extinguishers shall be provided near all electrical panels. The quantity and size of the various portable fire extinguishers would be determined as per IS: 15683.

# **Associated civil works for external firefighting system**

The civil works associated with firefighting installation shall be executed in accordance with approved design & shop drawings and as per civil details given in respective tender specifications. The same shall include:

* RCC foundation, RCC pedestal/ platform for all pumps, equipment etc.
* Masonry / RCC manholes / Chambers / Trenches, floor cut outs etc. as per required shape and dimensions
* Trench covers, SFRC/RCC covers, Gratings, MS rungs, etc.
* All necessary piping, valves, filters, puddle flanges, level sensors, vent pipes etc. to meet all functional requirements of the system.
* Ramps, Steps, MS staircase, MS Railing, rolling shutters, Doors etc. as shown in preliminary schematic drawings and as per requirement/approval from Owner/consultant.

**SECTION C 10 – Internal Firefighting System**

## **System Description**

Internal Firefighting system under this tender comprises of Internal Fire Hydrant system, Wet Riser system, Sprinkler system, for Karkhana Buildings and Commercial Office buildings, and Sprinkler system with water curtain for Basement/Semi Basement/Podium, and Down comer system for Amenity buildings, Gold Refinery and Vault Facility, including all FHC, extinguishers, pumps, filters, valves, pipes, fittings, fixtures, accessories etc. necessary for completion of all Internal Firefighting works all complete.

Complete System shall be operated by IBMS with sensors located at different points to check and maintain the required pressure at all the times in the line.

The Coupling jointing shall be provided for firefighting as per seismic Zone requirement for entire piping, pumps, valves etc. The firefighting arrangement shall be designed as per the requirement of local guidelines, NBC -part IV, NFPA & engineering design standard, with all latest versions. The entire firefighting system installation shall be compliant with the most stringent codes / standard for the entire Complex to ensure then highest safety standard and uniformity of system. Further, before property is opened to public, the firefighting shall be fully operated and tested under simulated conditions to demonstrate compliance with the most stringent standards, codes and guidelines.

The firefighting system shall be provided in entire Basement/Semi Basement/Podium to connect the fire, sprinkler and curtain pipe at the entry point of basement. The entire Basement/Semi Basement/Podium shall be provided with FHC, Internal hydrant, hose reel, hose pipes and extinguisher. The Water curtain shall be provided in the basement to compartmentation.

Over Head Fire Water Tanks shall be given as static fire water storage tank for Firefighting System. Booster pump shall be provided 900 lpm at the terrace with the required head as per calculations to charge the wet riser in case of failure of main pumps and 450 lpm booster pump at terrace level of Amenity, Utility buildings, etc.

The firefighting installation works should be carried out in accordance with the Indian standard codes as mentioned in NBC -part IV, NFPA, IS: 903, IS: 15683, IS: 636, etc. with the latest amendments as per Owners requirement and system design requirement and as per recommendations from /local fire authority.

## **Scope of Work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from owner/consultants/statutory authorities for Internal Firefighting System comprising of following components:

1. Internal Firefighting system - Wet Riser System
2. Protection system for Services rooms
3. Portable Fire extinguishers
4. Piping works
5. Flow Switch
6. Sprinklers- Automatic system
7. Internal Firefighting System for Basement/Semi Basement/Podium
8. Quartzoid Bulb Automatic Sprinkler
9. Flow Requirements
10. Water Curtain System In Basement
11. Protection system for Basement Services rooms
12. Over Head Storage Tank for Building Internal Fire Fighting.

The Contractor should carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Owner’s site representative up to his satisfaction

The contractor should furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and approved design and drawings for complete Internal firefighting system.

This should also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

The contractor shall ensure that required interfaces between other services systems such as HVAC, Electrical & Plumbing etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

All equipment under the scope should be fully compatible, communicable, operable and should be controlled and monitored through IBMS.

## **Design Parameters**

Considering the purpose of the buildings, as well as the height of the structure and mixed occupancy, it shall be necessary to provide a proper and adequate firefighting system based on the requirements of the National Building Code latest version. The firefighting systems considered for the buildings shall be as follows:

1. Karkhana & Office Blocks - Wet Risers & Complete Sprinklers system.
2. Basement/Semi Basement - Wet Risers & Complete Sprinklers system with water curtain
3. Utility Buildings - Down Comer.
4. Amenity Buildings - Down Comer.

# **Internal Firefighting system for Karkhana & Office Blocks - Wet Riser System**

## **Wet Riser System**

The Karkhana & Office Blocks shall be provided with Wet Riser and Sprinkler system as a part of Internal firefighting installation. The fire hydrant pipe from the external valve chamber shall be received in the basement/Ground (as per approved design) and shall form a fire hydrant ring in the basement roof. All basement hydrants and upper floors fire hydrant riser mains shall be connected to the fire hydrant ring.

Hose boxes containing 2 hoses (each 15 M long) and one branch pipe shall be provided near each hydrant. Likewise, hose reels (containing 30.0M long first aid hose) shall be provided near each internal hydrant.

Internal hydrant shall be provided on each landing and other locations as required by NBC with single headed Gun Metal landing valve with 80mmdia inlet, with shut off valves having cast iron wheels.

Landing valve shall have flanged inlet and instantaneous type outlets. Instantaneous outlets for fire hydrants shall be standard pattern and suitable for fire hoses. For each internal fire hydrant station, two numbers of 63 mm dia. 15 m long rubberized fabric lined hose pipes with Gun Metal male and female instantaneous type coupling machine with copper wire, fire hose reel, Gun Metal branch pipe with nozzle shall be provided. The hydrant shall have nominal size of the orifice for Light hazard where the pressure exceeds the limit.

Standard fire hose reels of 20mm dia. high pressure rubber hose 30 m long with Gun Metal nozzle (non-chrome plated), all mounted on a circular hose reel of heavy duty mild steel construction having cast iron brackets shall be provided.

Hose reel shall be connected directly to the wet riser with an isolating valve and Hose reel shall be mounted vertically. Each shutter shall be conspicuously painted with the letters **“FIRE HOSE”.**

Hose Reel. - Hose reel shall be heavy duty, 20 mm dia length shall be 30metre long fitted with gun metal chromium plated nozzle, mild steel pressed reel drum which can swing up to 180 degrees with wall brackets of cast iron finished with red and black enamel Complete.

# **Protection system for Services rooms**

The services rooms in the basement/Semi Basement/Podium and upper floors of the Office & Karkhana Buildings shall be protected by non-water based systems as specified below:

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Area Description** | **Type of Fire protection system / Equipment** |
| 1 | Floor Electrical / LV rooms | 1 no. 5 kg ABC type dry chemical fire extinguisher |
| 2 | UPS room | 1 no. 5 kg ABC type dry chemical fire extinguisher |
| 3 | Main Server room | CO2 flooding system |

# **Portable Fire extinguishers**

Portable Fire Extinguisher shall be provided near each internal hose box. Co2 gas type fire extinguishers shall be provided near all electrical panels. The quantity and size of the various portable fire extinguishers shall be determined as per IS: 15683.

Portable fire extinguishers of Carbon-Di-Oxide, foam type and ABC powder type shall be provided as first aid fire extinguishing appliances. These extinguishers shall be suitably distributed in the all types of karkhana units , entire public as well as service areas. These shall be placed or hanged on wall in a group on several suitable places. The quantity will be as per the NBC, local fire authorities and building topology requirements.

# **Piping works**

MS pipes for hydrant system as per IS 1239 & IS:3589 shall be provided for the internal firefighting system for the project. Pipes joints shall be Grooved Victaulic Fittings above 50mm dia and pipe shall be threaded below 50mm dia. Screwed fittings shall be approved type malleable or cast iron with reinforced ring on all edges of the fittings suitable for screwed joints.

Grooved Victaulic Fittings above 50 mm shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12 (FireLock®), forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153

Forged steel fittings of approved type with "V" groove for welded joints if any.

# **Flow Switch**

Flow switch shall have a paddle made of flexible and sturdy material of the width to fit within the pipe bore. The terminal box shall be mounted over the paddle/ pipe through a connecting socket. The Switch shall be potential free in either NO or NC position as required. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head.

The terminal box shall have connections for wiring to the Annunciation Panel. The flow switch shall have connections for wiring the seat shall be of S.S to the Annunciation Panel.

The flow switch shall have IP: 55 protections. The flow switches work at a triggering threshold band with (flow rate) of 4 to 10 GPM. Further, it shall have a “Retard‟ to compensate for line leakage or intermittent flows.

# **Sprinklers - Automatic system**

All blocks shall be designed as fully sprinklered building as a part of Internal firefighting installation. The Fire Sprinklers set to burst at rated temperature shall be provided on all floors of the entire office buildings. The sprinklers system shall be designed for moderate hazard occupancy as per IS: 15105.

# **Quartzoid Bulb Automatic Sprinkler**

Sprinkler heads shall be made of SS (316 Grade) quartzoid bulb sufficiently strong, in Compression to withstand any pressure, surge or hammer likely to occur in the System. The yoke & body shall be made of high quality SS (316 Grade) duly chrome Plated with arms streamlined to ensure minimum interference with the spread of Water. The deflector of suitable design shall be fitted to give even distribution of Water over the area commanded by the sprinkler.

The bulb shall contain a liquid having a freezing point below any natural climatic figure and a high coefficient of expansion. The temperature rating of the sprinkler shall be stamped on the deflector & the colour of the liquid filled in the bulb shall be according to the temperature rating as per NFPA standard. The sprinkler heads shall be of type & quality approved by the local fire brigade authority and **UL/FM** approved. The inlet shall be screwed.

The sprinklers shall have 15 mm nominal size of the orifice for ordinary hazard. The orifice size shall be marked on the body or the deflector of the sprinkler. Metal guards for protection of sprinkler against accidental or mechanical damage shall be provided.

# **Sprinkler Installation**

Sprinkler heads (fully recessed or semi-recessed or surface mounted) shall be quick response type, located in positions as per approved design and drawings. The maximum spacing between sprinkler heads and coverage area shall not exceed those stipulated in the NFPA 13 Rules. The Fire Fighting Services Trade shall co-ordinate with the ceiling Trade to set out the sprinkler locations to suit the site location of the unit grid. Chrome plated wire mesh guards shall be used to protect the sprinkler heads which are liable to accidental or mechanical damage. In case of loft or mezzanine floor within the karkhana unit, the positioning of the sprinkler shall be designed accordingly and EPC contractor to prepare a SOPfor karkhana units for adherence to firefighting norms.

# **Internal Firefighting System for Basement/Semi Basement/Podium**

## **Wet Riser System**

The Basement/Semi Basement/Podium shall be provided with Wet Riser and Sprinkler system as a part of firefighting installation. Hose boxes containing 2 hoses (each 15 M long) and one branch pipe shall be provided near each hydrant. Likewise hose reels (containing 30.0M long first aid hose) shall be provided near each internal hydrant. The all wet riser and sprinkler riser shall be connecting in the basement for upper floors.

Internal hydrant shall be provided on each landing and other locations as required by latest NBC with single headed Gun Metal landing valve with 80mmdia inlet, with shut off valves having cast iron wheels. Landing valve shall have flanged inlet and instantaneous type outlets. Instantaneous outlets for fire hydrants shall be standard pattern and suitable for fire hoses.

For each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric lined hose pipes with Gun Metal male and female instantaneous type coupling machine with copper wire, fire hose reel, Gun Metal branch pipe with nozzle shall be provided. The hydrant shall have nominal size of the orifice for Light hazard where the pressure exceeds the limit.

Standard fire hose reels of 20mm dia high pressure rubber hose 30 m long with Gun Metal nozzle (non-chrome plated), all mounted on a circular hose reel of heavy duty mild steel construction having cast iron brackets shall be provided. Hose reel shall be connected directly to the wet riser with an isolating valve. Hose reel shall be mounted vertically. Each shutter shall be conspicuously painted with the letters “FIRE HOSE”.

Hose reel shall be heavy duty, 20 mm dia length shall be 30metre long fitted with gun metal chromium plated nozzle, mild steel pressed reel drum which can swing up to 180 degrees with wall brackets of cast iron finished with red and black enamel Complete.

# **Quartzoid Bulb Automatic Sprinkler**

In the Basement/Semi Basement/Podium, Sprinkler heads shall be made of SS (316 Grade) quartzoid bulb sufficiently strong, in Compression to withstand any pressure, surge or hammer likely to occur in the System. The yoke & body shall be made of high quality SS (316 Grade) duly chrome Plated with arms streamlined to ensure minimum interference with the spread of Water. The deflector of suitable design shall be fitted to give even distribution of Water over the area commanded by the sprinkler.

The bulb shall contain a liquid having a freezing point below any natural climatic figure and a high coefficient of expansion. The temperature rating of the sprinkler shall be stamped on the deflector & the colour of the liquid filled in the bulb shall be according to the temperature rating as per NFPA standard. The sprinkler heads shall be of type & quality approved by the local fire brigade authority and **UL/FM** approved. The inlet shall be screwed.

The sprinklers shall have 15 mm nominal size of the orifice for ordinary hazard. The orifice size shall be marked on the body or the deflector of the sprinkler. Metal guards for protection of sprinkler against accidental or mechanical damage shall be provided.

# **Flow Requirements**

The flow requirement for sprinkler heads shall be specifically approved for the designated area of installation to ensure compliance to AMAO based upon hazard Classification.

Each installation shall be provided with a set of installation control valves comprising An Alarm Valve. A Water Motor Alarm & Gong. Installation valves shall be installed on the sprinkler circuits as per approved design and drawings. Installation valve shall comprise of a cast iron body with gunmetal trim, and double seated clapper check valves, pressure gauges, test valve and orifice assembly and drain valve with pressure gauges, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system. A cast iron isolation valve with lock and chain at the inlet of the installation valve shall be provided.

# **Water Curtain System in Basement/Semi Basement/Podium**

For Basement/Semi Basement/Podium car parking, compartmentation shall be required as per NBC, and hence a separate longitudinal pipe fixed with Spray Nozzle at interval of 2.5m spacing or less as per design shall be given. It shall be auto controlled by Deluge valve installed in an accessible place with instructions.

* As per NBC the Basement/Semi Basement/Podium area to be compartmented by means of water spray curtains of each 3000 Sqm. area.
* K value of water curtain nozzle should be **’K- 23’**.
* Minimum 60 min. additional fire water storage required in underground fire water tank for this system considering the largest compartment’s perimeter out of all compartments of basement.

# **Protection system for Basement Services rooms**

The services rooms if provided in the basement, shall be protected by non-water based systems as specified below:

|  |  |  |
| --- | --- | --- |
| **S. No** | **Area Description** | **Type of Fire protection system / Equipment** |
| 1 | 11 KV Transformer room & RMU in Basement | CO2 flooding system |
| 2 | Main LT panel room in Basement | CO2 flooding system |
| 3 | Electrical / LV rooms | 1 no. 5 kg ABC type dry chemical fire extinguisher |

# **Over Head Storage Tank for Building Internal Fire Fighting.**

The capacity of overhead fire tank of the project shall be calculated as per requirement of latest National Building Code and as per CEFEES /local fire authority recommendations and shall be submitted and got approve from owner/consultants.

The Overhead Fire water tanks shall be RCC tanks and should be constructed water tight and coated with water proof lining as per specifications and finished with ceramic tiling. All the tanks should be hydro –tested and witnessed and certified by the Owners site representatives.

# **Gas Suppression System**

Fire suppression system is fire detection and quenching system. This shall be provided for flooding system in LT panel, Transformer & server room etc. with Novec 1230/latest. The Cylinder Valve Assembly must be UL/FM approved with Seamless CCOE approved cylinder and an undertaking from manufacturer must be submitted with the tender to comply the same.

**SECTION C 11 – Ventilation and Air Conditioning System**

## **System Description**

The HVAC system under this tender comprises of Centralized Air-conditioning system, Centralized Heating system, Split Air-Conditioning system, Precision Air-Conditioning system and Mechanical Ventilation system. It consists of all high side and Low side HVAC works from HVAC Plant room in Utility Service area to main building, ceiling suspended AHU, Directorates etc. The contractor will submit best utilization of air cooled chiller, water cooled chillier or hybrid system based on total water requirement and effective utilization of space and recycled water.

It includes Chillers, Pumps, Variable Frequency Drives (VFD), Heat Pumps, Cooling tower, Piping, Underground piping, insulation, Valves accessories, fittings, controllers, Air Handling units (AHU), AHU air filters, Ducts, Expansion tank, air separator, chemical dosing system for chillers tube cleaning, AHUs, Fan Coil Units (FCU), Heat Recovery Wheel (HRW), Variable Air Volume (VAV) box, Volume Control Damper (VCD), Fire dampers, Grill, & diffuser, Ventilation Fans, Pressurization Fans, Smoke Extraction, Precision AC and plant manager with PID, Exhaust system etc.

All Chillers and high side equipment shall be placed in utility building area (plant Room). Chilled water from chillers shall be supplied to main building from HVAC Plant room by underground insulated piping at two entry points at basement of main building. Further distribution shall be done to all AHU tap off in Main Building with insulated supply & return piping system.

From all AHU rooms, air distribution shall be done as per heat load requirements by supply and return GI ducting, Grill/Diffusers, motorized dampers, VAV Box & VCD’s etc. In case of fire, the same supply air duct shall act as makeup air duct and return duct shall become smoke exhaust duct. The velocity shall be increased to achieve required air changes as per NBC/ CEEFES requirements in fire condition.

All AHU shall be provided with fresh air as per the ASHERAE/GRIHA requirement. TFAs with Energy Recovery Ventilator (ERV) shall be provided to take care of fresh air requirement. The same shall be located on the terrace of building also with bypass system for cooling Tower maintenance and further supply and return air to Energy Recovery Wheel (ERW) should be feed by GI Ducting.

All floor Exhaust fan shall be located at terrace and ERW duct shall be used for smoke extraction as per the approved scheme.

Basement, toilets, pantry, Kitchen & Battery room etc. shall be ventilated as per air change requirement by axial flow fans, Inline fans, Propeller fans, and Scrubber, Air washers, etc. integrated with BMS and monitored though RH and Co2 sensors should compile with MERV-9 or MERV-14.

The Basements shall be mechanically ventilated with axial flow fans/ jet fans as per NBC/CEEFES requirement with the help of ducts/ dampers/ grills etc. The same shall be coupled with the Fire Alarm system/ CO sensors. The Central Courtyard of the Building shall also be mechanically ventilated.

All Lift wells, staircase, Lift Lobbies etc. shall be pressurized as per NBC/ CEEFES requirements.

Advance air filtration system shall be provided to make the building a healthy building for eliminating all kind of infection bacteria, PM 2.5 value etc. The same shall be provided with the help of impingement, polarization & Agglomeration and shall have ability to capture particles up to 0.3 microns.

The HVAC Design and installation works should be carried out in accordance with the Indian standard codes as mentioned in NBC 2016 and conformity with ECBC 2017, ASHRAE 2009, ISHRAE 2007, WHO & Environment Protection Agency (EPA) and all latest amendments as per Owner’s requirement and design requirement.

Indoor units and all electrical work shall be done by the owner of Karkhana unit. The space for keeping outdoor units of air conditioning system shall be provided with proper screen. All air conditioning, electrical work shall be done by the owner of unit

For kitchens hood system separate wet & dry scrubber should be provided to maintain the Air change and oil free atmosphere.

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from Consultants/Owner /Engineer-in-charge /statutory authorities for HVAC System comprising of following provisions:

1. Air-conditioning space and load provision for Karkhana units
2. Centralized Air-conditioning provision for Commercial Office units
3. Ventilation system for Karkhana Units and office Units and their corridors
4. Air-conditioning for Entrance Lobby and Lift Lobby in all buildings
5. Mechanical ventilation system for Basement/Semi- Basement/Podium car park, common toilets and plant rooms.
6. Kitchen/pantry ventilation system in common area
7. Exhaust system -- hoods for fume collection and further treated in MERW unit
8. Fresh Air & exhaust unit in STP/ETP/WTP to maintain the Air change for required process

Which shall further comprise of following components:

1. Water Cooled Centrifugal Chilling Units
2. Air Cooled Heat Pump
3. Pumping system
4. Cooling towers
5. Air handling units (AHUs)
6. Central Air-Purification System
7. Treated Fresh Air Unit (TFA) with ERV
8. Precision Air-Conditioning Unit (PAC)
9. Split Air-Conditioning Unit (Hi-Wall Type)
10. Cassette Units (chilled Water based)
11. Heat Recovery Wheel (HRW)
12. Scrubber Unit
13. Air washer Unit
14. Axial/Centrifugal/Propeller/Inline/Roof mounted Fans
15. Piping Works
16. Ducting Works, Supply and Return Air Diffusers
17. Insulation Works
18. Mechanical Ventilation System for Basement/Car Park & Central Courtyard/ Equipment rooms
19. HVAC Plant Room Construction and internal services for housing complete system
20. Electrical Installations for HVAC System
21. Painting & finishes of all HVAC Equipment, Identification of services
22. Noise Control
23. Chemical water treatment
24. Ozone System

The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Consultants/Owner/ Engineer-in-charge upto the satisfaction level.

The contractor shall furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and preliminary schematic drawings for complete HVAC system.

This shall also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

The contractor to ensure that required interfaces between HVAC works and other services systems such as Electrical, Plumbing, Fire Fighting etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

All equipment under the scope shall be fully compatible, communicable, operatable and shall be controlled and monitored through IBMS.

## **Design Parameters**

* 1. **Site Information**

Site Location : Mahape Mumbai

Geographic location : Longitude - 19° 6'10.32"N : Latitudes -73° 1'47.42"E

* 1. **Outdoor Design Conditions (As Guideline):**

Outdoor Design Conditions for the site shall be based on the relevant data from Indian Metrological Department, ISHRAE and ASHRAE (latest edition):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cooling DB/ MCWB** | | | | | | **Cooling WB / MCDB** | | | | | | **Heating DB/ MCWB** | | | |
| 0.4% | | 1.0% | | 2.0% | | 0.4% | | 1.0% | | 2.0% | | 99.6% | | 99.0% | |
| DB | MCWB | DB | MCWB | DB | MCWB | WB | MCDB | WB | MCDB | WB | MCDB | DB | MCWB | DB | MCWB |
| 41.8 | 23.6 | 40.6 | 23.8 | 39.3 | 23.5 | 28.4 | 33.3 | 28 | 33.3 | 27.6 | 32.7 | 6 | 5.2 | 7.1 | 6.3 |

\*For heat load calculations, values to be considered of 1.0%

* 1. **Indoor Design Conditions:**

Indoor Design Conditions for the site shall be based on the relevant data from the standards:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Summer** | **Monsoon** | **Winter** |
| Office Area | 23.0 OC ±2OC | 23.0 OC ± 2OC | 21.0 OC ± 2OC |
| RH ≤55% | RH ≤55% |  |
| Enclosed Corridors, Passages & Lift Lobbies | 25.0 OC ±2OC | 25.0 OC ± 2OC | 21.0 OC ± 2OC |
| RH ≤55% | RH ≤55% |  |
| Server Room/LV Room/Telecom or Electronic Equipment | 18.0 OC ± 2OC | 18.0 OC ± 1OC | 18.0 OC ± 1OC |
| RH ≤50% | RH ≤50% | RH =50 + 5% |

|  |  |
| --- | --- |
| Fresh Air  (As per ASHRAE Std. 62.1-2010) | 5 cfm x person + 0.06 cfm x sqft for Office, Lobby etc. |
| 7.5 cfm x person + 0.18 cfm x sqft for Cafeteria + 30% Extra (as per GRIHA) |
| Lighting Load | 5.0 W/Sq.m for Office Areas (As per Super ECBC code)  6.0 W/Sq.m for Karkhana Areas (As per Super ECBC code) |
| 4.6 W/Sq.m for Lift Lobbies (As per ECBC code) |
| Equipment Load | 10.8 W/Sq.m for Office Areas |
| Roof Insulation | Overdeck insulation to achieve overall ‘U’ Value of 0.4 W / m2.K (As per ECBC Code) |
| Glazing | All facade glazing in office building will have heat reflective double-glazed units (DGU) with specified thermal properties |

|  |  |
| --- | --- |
| Occupancy level |  |
| Office Area | 10 sqm Person as per NBC 2016 (with all latest amendments) or actual whichever is higher |
| Karkhana Units | 10 sqm./Person as per NBC 2016 (with all latest amendments) or actual whichever is higher |

* 1. **Safety Limits**

The safe concentration of various gases should be as follows as per Ashrae:

a) VoC Below 100 PPM

b) Ozone Below 50 PPB

c) CO2 Below 1000 PPM

* 1. **Central Air-Purification System**

The Central Air Cleaner shall be a hybrid air purification system that improves the indoor air quality through reducing harmful pollutants like particulate matter (PMx), PM 2.5, allergens, pollen, smoke, bacteria and pathogens, based on trap & kill technology. It shall be a monobloc structured unit specifically designed for integration in Return Air paths to AHUs, to centrally capture and kill germs.

* 1. **AQM (Air quality monitor) Device**

Air quality monitor (AQM) shall be installed for Supply air monitoring near Air conditioning space is a professional grade monitor which provides the most credible way of real time air quality monitoring which monitors the PM 2.5, VOCs, CO2, Temperature, Humidity of the indoor air.

1. The air quality monitor should monitor 08 parameters of air. Indoor as well as outdoor air.
2. It should monitor 05 parameters (PM 2.5, VOCs, CO2, Temperature and Humidity) of the indoor air in a real time basis.
3. The sensors must be able to provide data in line with NAAQS, India standards with a further possibility of information display
4. The sensor should be capable of getting connected with wifi to provide the data. It should be RS485 enabled with IOT ready.
5. It should be capable of controlling the HVAC systems, air purification systems installed in the facility through interloop with BMS.
   1. **Design parameters for selection of AHUs & its components:**

1. Maximum face velocity across pre-filter = 500 Ft/Min. (150M/Min.)
2. Maximum face velocity across Cooling Coil = 500 Ft/Min. (150M/Min.)
3. Maximum fan outlet velocity = 2200 Ft/Min. (700M/Min.)

a) Fans above 300 mm dia. = 900 RPM

b) Fans upto& including 300 mm dia = 1440 RPM

1. Maximum Fan Motor Speed = 1440 RPM
   1. **Design parameters for Piping:**
2. Maximum Velocity : 8 Ft/Sec. (2.5 M/Sec.)
3. Maximum Friction : 5 Ft/100 Ft Run (5 M/100 M Run)
   1. **Design parameters for duct design shall be:**
4. Maximum flow velocity = 1500 Ft./Min (450 M/Min)
5. Maximum Friction = 0.08inch WG/100ft. Run (1cm WG/100M Run)
6. Maximum Velocity at Supply Air Outlet = 500 Ft./Min. (150 M/Min.)
   1. **Design parameters for Water Chilling Machine:**

Performance rating of the water chilling machine shall be based on following design parameters:

1. Temperature of chilled water leaving chiller = 44degF (6.7deg C)
2. Temperature of chilled water entering chiller = 54deg F (12.2 degC)
3. Fouling factor for chiller in FPS unit = 0.0001
4. Temperature of condenser water entering = 90deg F (32.2degC)
5. Temperature of condenser water leaving = 100degF (37.7degC)

condenser

1. Fouling factor for condenser FPS unit = 0.0005
2. Refrigerant = R-134a
3. COP & IPLV: 6.5 kW/kW & 0.32 kW/ TR respectively
   1. **Design parameters for Grilles/Diffusers - As per ISHRAE:**

Maximum face velocity = 500 fp m

Sound level = 30 dB

Maximum pressure drop = 4 mmwg

Throw as per interior layout

* 1. **Air Filtration System**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Filter Type** | **Dust particle absorption property** | **Efficiency** | **Installed Location** | **Using Purpose** |
| 1 | HEPA Filter | 0.03 micron | 99.9 % | AHU | Air Cleaning |
| 2 | Pre.Filter | 5-10 micron | 95 % | AHU | Air Cleaning |
| 3 | Central Air Cleaner | 0.3 micron | 99 % | AHU | pollen, smoke, bacteria & pathogens, PM 2.5 |

* 1. **Building Thermal Properties**

The thermal properties to be considered for Building components as follows:

| **Description** | **Thermal properties** |
| --- | --- |
| Glass façade | U value Based on the building skin designed proposed by EPC contractor and approved by Owner. |
| Wall | AAC Blocks = U value = 2.1486sqm k/m |
| Roof | Polystrene Boards =U-value == 0.028 W/m2K),  R value = 15  Concrete roof= 2.5-3.0 W/m2K)  Heat resistant tiles SRI value > 78, Solar Reflection >0.70,  initial emittance >0.75 |

**Notes: -**

* The above values shall be finalised based on the actual U Values based on the , type & thickness of thermal insulation shall be finalised based on the wall & roof construction details (to be submitted by contractor) as per U-value mentioned above and ECBC norms whichever is lower.
  1. **Mechanical Ventilation System:**

The following areas shall be provided with dedicated ventilation system with the number air changes, or CFM per Sq. ft. for each space as identified herewith:

1. Relative Pressure = Slight positive pressure (for air conditioned areas) as per NBC
2. Basement Ventilation = @ 6+6 ACPH (normal/ Fire) as per NBC
3. Toilet Ventilation = @ 10 ACPH (normal) as per NBC
4. Kitchen = @ 30 ACPH (normal) as per NBC
5. S.T.P. plant room = @ 30 ACPH Ventilation (normal)
6. AC plant room and = @ 20 ACPH (normal)
   1. Pump room Ventilation
7. Substation = @ 20 ACPH (normal)
8. HT metering room = @ 18 ACPH (normal)
9. Lift Lobby Pressurization = @ 30 Pascal Differential pressure as per NBC 5mm positive pressure in case of fire
10. Staircase Pressurization = @ 50 Pascal Differential pressure as per NBC 5mm positive pressure In case of fire
11. Lift well Pressurization = @ 50 Pascal Differential pressure as per NBC 5mm positive pressure In case of fire
12. Above Floor Smoke Extraction = @ 12ACPH (Fire)
13. Central Courtyard Ventilation = @ 6+6 ACPH (normal/ Fire)
    1. **Load Calculations**

The load shall be calculated based on above parameters by HAP software latest version (hourly analysis programme) and shall be vetted from the Owner/PMC.

* 1. **Water Cooled Centrifugal Chilling Units**

Magnetic Centrifugal Water cooled Chilling units shall be placed inside the HVAC Plant room in the utility area. It shall have all air conditioning high -side equipment housed in the plant room. Water shall be chilled in the plant room and shall be supplied to Block C for further distribution.

The Centrifugal chilling unit shall be complete with centrifugal compressor, flooded chiller, water Cooled condenser, Microprocessor controlled panel and Controls etc. The chilling unit shall be suitable for an environment friendly refrigerant as per the Montréal Protocol on CFC. The most suitable refrigerant recommended is R-134a, as it is a stable gas, has no phase-out date and is readily available.

System provided shall be of sufficient capacity to meet peak cooling loads but must be capable of operating efficiently at part-load conditions without excessive amounts of spare capacity.

The compressor shall be provided with an automatic capacity control for infinite steps of capacity control between 20%-100%.

The Chilling machine shall have a Microprocessor panel and it shall have the following capabilities:

1. Self-diagnostic facility.
2. Alpha-numeric display of operating parameters.
3. Chilled water reset.
4. Power demand limit and its reset.
5. Capacity control with overload limit control point adjustment.
6. Suction, oil and discharge pressure indications.
7. Built in air Separator
8. Safety cut-outs.
9. Economizer
10. The chilling unit would be certified as per ARI 550 for performance.

Chillers shall be provided with a Chiller Plant Management System for the control/ Automatic control and Monitoring of the chilling units, secondary chilled water pumps, primary chilled water pumps and hot water pumps etc. The system shall consist of control station, DDC, Sensors, Motorized valves etc. The plant manager shall restrict the starting current of the chilling units by unloading the running units during start-up of the next unit, this reduction in starting current would result in reduction of the capacity of the D.G. sets. This system shall be integrated with the BMS to provide access to various input/output points of the plant room equipment.

Pressurized Expansion tank, air separator along with accessories shall have full acceptance Factor and shall be ASME rated/ European standard code no. 97/23/EC pre-charged bladder-type pressure vessels. The tank shall be designed to absorb the expansion forces of cooling system water while maintaining proper system pressurization under varying operating conditions. The heavy duty bladder should contain system water thereby eliminating tank corrosion and water logging problems.

* 1. **Air Cooled Screw Heat Pump with VFD**

The heat pump shall have two or more mono or twin type screw compressors in two or more refrigeration circuits.

The Heat Pump shall be complete with full charge of Zero ODP Environmental friendly refrigerant R134a and oil, vibration isolation pads and accessories, factory assembled and tested for rated capacity.

For Cooling Mode Minimum COP at AHRI conditions should be 2.6, min IPLV shall be 4.6 at AHRI conditions (both COP & IPLV shall be including condenser fan power). Full load IKW/TR at design conditions shall be 1.7 max (including condenser fan power)

* 1. **Pumping System**

The Primary Pumping and Secondary Pumping shall be provided with VFD system. The primary pumps shall circulate the water between the chilling/hot water units and secondary pumps. The secondary pumps shall further distribute the chilled water to the Air Handling Units (AHU)s /FCU’s/ Cassettes of Block C . All Pumps shall be of Vertical Type. Sizing and capacity shall be calculated and shall be verified from the client.

The secondary pumps shall be controlled automatically by a variable frequency drive (VFD) and the pump speed shall increase or decrease as per the demand of chilled water from thermal units. The AHU’s shall be provided with dynamic balancing valves to regulate the Chilled Water supply as per the load. When the pump speed shall be reduced, the power consumption shall also be reduced by the cube of speed, resulting in substantial saving in the power consumption of the pumps. The pumps shall be imported type capable of operating satisfactorily over a speed range of 30% to 100%.

All the equipment shall be provided with butterfly valves for shut off and isolation. The chiller and pumps shall also be provided with balancing valves on the outlet for balancing and flow measurement of the water.

The pumps shall be provided with inlet suction guide with strainer for laminar flow of water and with pressure gauges on the suction and discharge connections. The chiller, Heat Pumps and AHU’s shall also be provided with pressure gauges and thermometers on the inlet and outlet.

* 1. **Cooling Towers**

Cooling towers for air conditioning system shall be installed as per service layout plan. They shall be induced draft type, counter flow type shall be selected for minimum drift losses and minimum noise. Cooling tower shall be of fibre reinforced plastic construction in circular/square/bottle shape, complete with fan, motor, surface, spray sections, eliminators, automatic controls and sound attenuation equipment etc. Cooling Towers should be CTI certified.

* 1. **Air Handling Units (AHU)**

The chilled water from the chilling unit shall be circulated to several Air Handling Units located in AHU rooms on all floors through insulated supply and return piping system. Floors shall have multiple AHUs with ducted air distribution depending upon the requirement with VFD Panels to save energy during fewer loads.

The installation of multiple AHU’s shall result in easy sub-division and subsequent saving in operating cost. If some areas are not in use, the respective AHU shall be switched off.

The AHU shall be sectional type with double skin construction and frame work of extruded aluminium, G.I. sandwiched panels with PUF insulation, forward/backward curved plug fan with motor, cooling coil, drain pan and pre-filters of 90% efficiency upto 10 microns etc. For better air purification, Fine Filter of 5 microns in size with at least 99% efficiency shall be provided. Each section shall be provided with access panel with rubber gaskets for proper sealing.

The air handling units shall also be provided with the following accessories:

1. Fresh air Grill with filter actuator operated damper.
2. Temperature and pressure gauges.
3. Butterfly valve at inlet/outlet and dynamic balancing valve at outlet.
4. UV Tubes to improve air quality.
5. Motorized valves & thermostats for AHUs
6. VAV Terminal Boxes
   1. **Central Air Purification System**

The Central Air Cleaner shall be a hybrid air purification system that shall improves the indoor air quality through reducing harmful pollutants like particulate matter (PMx), PM 2.5, allergens, pollen, smoke, bacteria and pathogens, based on trap & kill technology. It shall be a monobloc structured unit specifically designed for integration in Return Air paths to AHUs, to centrally capture and kill germs.

1. The Central Air Cleaner units shall be designed to reduce 99.97% of the airborne particles down to 0.3 microns in a recirculating system, equivalent to H13 efficiency.
2. The pressure drop across the Central Air Cleaner should not exceed 0.20” wg @ 2.5 m/s.
3. Each individual unit should be of a honeycomb structure, operating at a low resistance, and should not have any pads which create resistance or any consumable media.
4. It should be a hybrid system: a combination of passive and active technology working together, with x3 working principles of impingement, polarization and agglomeration.
5. The active air purification effect of the product must be designed to be greater than 1 million ions/cc at a sampling rate of 400 cc/sec
   1. **Treated Fresh Air Units (TFA) with ERV**

The Treated Fresh Air Units shall be two stream units in double skin construction, comprising of supply air section, return air section and Energy Recovery Ventilator Section. The supply air section shall include Cooling/Heating Section, Microvee filter section, Mixing Box Section, Sound Attenuator Section, Damper Section, Humidifier Section, Inspection Section etc.

* 1. **Precision Air-Conditioning Unit (PAC)**

Precision air-conditioning system shall be a floor discharge unit designed specifically for high sensible heat ratio applications shall be provided in **Server, Control and Command center rooms** in 1 Working + 1 Standby.

Each unit shall be capable of providing sensible cooling capacities at rated ambient temperatures with adequate airflow. Each unit shall be capable of required tonnage of cooling capacity and quantity of air flow as per the requirement when the room air-condition is 18±1 Degree Celsius and relative humidity is 50 ± 5% R/H. The system shall contain Scroll compressor, Evaporator, Humidifier, Condenser and an Electronic Expansion Valve etc. which shall be contained within the cabinet of the unit.

* 1. **Split Air-Conditioning Unit (Hi-Wall Type)**

Hi-Wall units shall be provided as per the requirements in common areas, etc. It shall comprise of hermetic scroll or hermetic reciprocating type Compressor using refrigerant R-22 complete with safety controls oil heater and other accessories, main bearings shall be of generous size and self-aligning type with lining of anti-friction bearing metal complete with forced feed type lubrication system, filters with by-pass relief valves, pressure and control valves as required. Compressor shall be installed in outdoor condenser housing.

* 1. **Cassette Units (Chilled Water Based)**

The Chilled Water (CHW) Cassette Units shall be provided in cafeteria and other amenities area for Karkhana blocks etc. as per the preliminary schematic drawings and approval from Consultants/Owner/Engineer-in-charge. It shall be ceiling suspended, concealed type, complete with fan, fan casing, fan motor, cooling coil made of copper tube and aluminium fins, filter, built-in condensate water pump, casing, insulated drain pan etc.

The unit shall be 4-way Cassette type and shall comprise of coil section, 3-speed motor, 4 -dimension screw fan, circuit box, decorative panel, thermostatic controls, drain pump assembly etc. and galvanized sheet steel casing with GI coated finish.

* 1. **Heat Recovery Wheel (HRW)**

The Heat Recovery Wheel section shall include enthalpy wheels and shall have minimum recovery of 75 %-85 % of total heat, i.e. both sensible and latent (each being 75 %). The recovery of sensible and latent shall be equal. Necessary computerized selection of the wheel should be provided along with the bid to justify the same. The wheel shall be made of pure aluminium foil coated with molecular sieve desiccant with pore diameter of 30 Althea, cross contamination between the two air streams shall be nil and leakage less than 0.04%. The vertical and radial run of the wheel shall be less than 1 mm per meter of diameter. The wheels shall have non-contact labyrinth seals for effective sealing between the two air streams.

* 1. **Scrubber Unit**

Dry Type scrubbers comprising of electrostatic sections with auto wash module shall be used in kitchen exhaust / grease / exhaust air treatment etc

* 1. **Air Washer Unit**

The air-washer section shall consist of imported cellulose paper pads of intersecting angle of 45/15 Degree or 60/30 Degree. The fill shall be cross fluted configuration, assembled in self-supporting pads in light weight construction. The pads shall be able to redistribute the water & shall be impregnated with insoluble antiriot salts rigidifying saturants & wetting agents with built in eliminators.

The velocity across the fill shall not exceed 152 MPM & shall not allow carryover water. A FRP distributor should evenly distribute water on the fill. The efficiency of fill should be able to perform with an efficiency of minimum 90% & thickness of fill should be minimum 200 mm.

* 1. **Axial/Centrifugal/Propeller/Inline Fans**

Fans shall be provided for mechanical ventilation systems - Motor control centres complete with motor, motor mount, belt driven/direct driven/plug fan and vibration isolation type and for 120-minute fire resistivity suspension arrangement as per approved for construction shop drawings.

Axial/Centrifugal Fan shall be used for Ventilation in case of normal and fire both shall be UL Listed. For fire ventilation, Fan should be fire rated for 250 deg. Upto 2 hours and UL listed in accordance with “Power Ventilators for Smoke Control Systems”. Propeller/Inline Fan shall be used for normal ventilation of toilets, stores etc. Axial flow fan shall also be used for pressurization fresh air/exhaust air requirements etc.

* 1. **Piping Work**

Piping works shall be provided for Chilled water, condensing water, condensate drain piping and condensers inclusive of all valves and fittings, pipe, channel, braided wire supports and vibration isolators etc. complete

The chilled water from the AC plant room shall be fed to the AHU’s in the building blocks, through underground chilled water piping system upto the basement of Block-I, Block-II and Central Entrance Lobby block. Distribution pipes shall travel at ceiling of basement floor. These pipes shall be then routed to vertical shafts of building to individual AHU’s at upper floors.

The chilled water and condenser water shall be circulated through mild steel, heavy duty ‘C’ class pipes as per I.S. 1239 upto 150 mm dia. Pipes in sizes 200 mm dia. and above shall be as per IS 3589 with wall thickness of 6 mm. The bends, fittings etc. upto 150 mm shall be ready made as per IS 1239. Larger bends and fittings shall be fabricated from pipes of same dia

* 1. **Ducting Work with Insulation, Grills, Diffuser, Dampers etc.**

Ducting works shall be factory fabricated and consist of Sheet metal ducts, external insulation, acoustic lining, canvas connections, silencers, VAV, volume control dampers, smoke dampers and braided wire supports etc. as required. It also includes fire sealant around ducts / pipes and cables when passing through wall / floor and other openings.

The conditioned air from the AHU shall be distributed through G.I. ducts minimum 22 gauge, duly insulated. The ducts shall be factory fabricated from G.I. material (120 microns GSM) in coil form to reduce the number of longitudinal joints and shall be fabricated generally as per SMACNA standards, as applicable. The duct connectors shall be of preformed G.I. C&S cleats, 4-bolt slip on flange or TDC flange with built in sealant.

The main duct and branches shall be provided with motorized fire dampers & opposed blade volume control dampers to adjust the flow rate during operation. The supply and return air shall be distributed through extruded aluminium grilles and diffusers. The supply air outlets shall be provided with motorised volume control dampers to adjust the air quantity and temp with the help of local controller as per the requirement.

The ducts shall be completely insulated with open cell elastomeric insulation of 13/19 mm and as per required thickness. The material shall be in the form of rolls and shall be fixed to the ducts using synthetic adhesive. The insulation material shall be in the form of semi-rigid sheets and the adhesive provided should ensure that there is no sagging or peeling of the insulation. The Material shall be of class “O” and global FM Approved.

The starting ducts shall be provided with High performance acoustic insulation, Open Cell processed elastomeric foam ensures the ideal acoustic insulation for HVAC Noise Control Applications, Air-Conditioning Duct Lining, AHU Rooms etc.

The lining shall be supplied in a frame work of G.I. sheets to provide a smooth and uniform surface inside the duct.

* 1. **Pipe & Equipment Insulation**

All pipes shall be insulated and cladded with aluminium sheet. It consists of Insulation of pipes with protective coating and of pumps and tanks.

The chilled water pipes shall be insulated with preformed sections of insulation. THERMAL INSULATION PROTECTIVE COATING shall be provided in conjunction with 7 mil woven fiber glass cloth to offset the impact of mechanical injury and scratch resistance and to provider protection against fire.

The insulation for chilled water and drain piping, chillers, pump, etc. shall be done with Microcellular Closed Cell Nitrile Rubber Insulation. The thickness of the insulation for chilled water pipes shall be 50 MM. Preformed pipe sections shall be used for pipes upto and including 350 mm dia. Pipes above 350 mm dia. shall be insulated with insulation slabs cut in mitred sections.

The material for insulation of drain pipes shall be pipe section of closed cell elastomeric insulation/nitrite rubber having a ‘K’ valve of 0.027 W/mK at a mean temperature of 10°C and a minimum density of 55 Kg./cubm. The thickness of insulation shall be a section of 6 mm thick.

The insulation in AHU rooms shall be covered with Open Cell processed elastomeric foam sheets and perforated aluminium cladding to avoid damage to the insulation and to provide acoustic effect and smooth and uniform finish.

* 1. **Mechanical Ventilation System for Basement**

Mechanical Ventilation system shall be provided for entire basement area, toilets, services rooms, Equipment rooms in Utility building, STP, WTP, all Lift well and Lift Lobby pressurization, all critical areas etc. with the help of Centrifugal fans/axial flow fans/propeller fans/inline fans/Jet Fans etc. as per mentioned parameters /NBC /NFPA /CEFEES etc. The higher of the recommended air changes, as required, to get all approvals, proper functioning, equipment requirements and manufacturer’s recommendation etc. shall be provided.

Basement shall be divided in Zones and dedicated fresh air/exhaust provisions with the help of fire Axial flow fan and ducting system as per NBC and all approvals from Consultants/ Owner/Engineer-in-charge/Relevant Authorities. The fresh air for each individual heat recovery wheel shall have efficiency greater than 70%.

System shall be so designed that Fresh air shall be supplied at the bottom and air shall be exhausted from the top. CFD analysis of the same shall be submitted for approval.

* 1. **Associated Civil/Services Works**

The civil/services works associated with HVAC installation shall be executed in accordance with approved shop drawings and as per civil details given in respective tender specifications for other packages. The same shall include:

1. RCC foundation, RCC pedestal/ platform for all pumps, Chillers, Cooling Towers, other equipment etc.
2. Cutting holes, chases etc. through all types of non-structural walls, and finishing for all services crossings, including sealing, frame work, fire proofing, providing sleeves, cover plates, making good structure and finishes to an approved standard
3. Electrical Installations for HVAC system - Wiring and earthing from MCC panels to various refrigeration, air conditioning and mechanical ventilation equipment, control wiring and interlocking, Vibration isolators, all components, accessories etc.
4. Ramps, Steps, MS staircase, MS Railing, rolling shutters, Doors etc. as shown in preliminary schematic drawings and as per requirement/approval from Consultants/Owner/Engineer-in-charge.
5. Painting, Finishing of all Equipment, Accessories, identification of Services etc. as per technical specifications.
   1. **Noise Control**

It consists of noise and vibration control of all HVAC equipment and accessories as per detailed technical specifications.

* 1. **Chemical (Water) Treatment**

It consists of basic mechanical materials, chemical treatment of HVAC equipment as required for the proper operation of the MEP systems as per technical specifications.

For chilled water system, water treatment system shall be installed incorporating a manual feed dosing pot for chemicals (rust inhibitors and biocides) necessary for testing, commissioning and operation. A specialized professional company, shall be appointed by the Contractor for the water treatment system.

For Cooling Towers, the Treatment shall be done by applying chemicals, adjusting bleed/blown down equipment and furnishing laboratory analysis etc. as per technical specifications.

**Condenser Water Systems (Cooling Towers)**

Automatic condenser water control systems shall be provided for corrosion inhibitor feed, blowdown and biocide feeds. Inhibitor application shall be for make-up water meter activated, blowdown shall be for conductivity activated, and biocide shall be for make-up water meter fed with blowdown locked out to ensure biocide retention time.

**Chemical Feed Systems and Metering Pumps**

Completely pre-assemble packaged chemical feed system shall be provided. Package shall be hydraulically and electrically tested at the factory and shall be furnished with all required lubricants, special tools, and installation instructions etc. as per technical specifications.

* 1. **OZONE SYSTEM**

Air Ozone System shall be provided for Business Center and Cooling Towers and as per requirement and approval of Owner/PMC

Ozone Generators shall be provided with the primary aim of achieving reduction in Volatile Organic Compounds (VOC), hydro carbon gases, and organic odours, in Indoor Environment. They shall also serve purpose of depleting and inhibiting growth and propagation of microbial organisms and microflora, commonly found in indoor environments, HVAC ducts, cooling coils and on air filters. VOC reduction shall be achieved by oxidation of VOC by ozone. Depletion of microbial colonies shall be achieved by inhibiting their growth and propagation.

**SECTION C 12 – IBMS System**

## **System Description**

This is a very large project spread out across a land area of 21.3 acres. The monitoring checking & control of such projects particularly of its services & utility system has to be through Central Control room where all services & utilities can be checked, monitored and immediate required prompt action taken in event of any deficiencies or faults.

Thus, an Integrated Building Automation System is essential for this project and shall be provided. This system shall not only ensure functioning of the various systems but lead to substantial Energy Saving and reduce Recurring cost leading to overall economy.

**METERING:** Metering shall be provided for the following parameters:

* 1. **Electrical:** Grid power, DG Power, Power Factor. (V/A/KW/kWh/Hz/KVAR).
  2. All outgoing feeder of MLTP shall be metered.
  3. **Water Consumption:** Raw water consumption, Treated water consumption, soft water consumption, RO water consumption Steam, Diesel Consumption.

**Equipment detail monitored & control through IBMS:** The following equipment shall be controlled and monitored through IBMS.

1. **Cooling Towers**: - To control the motors with ON/OFF, to monitor the water temperature of inlet & outlet, to ensure that the circulating water is achieving the required temperature for equipment’s & optimizing so that the energy is saved, to check cooling tower running status.
2. **Chiller:** - To control the running of chiller by increasing & decreasing the capacity according to the requirement, to monitor the chiller trip/fault & take necessary action, to monitor the common header chilled water supply temp. & to monitor the common header chilled water return temp.
3. **Primary, Secondary & Condenser Pumps**: - To monitor the water temperature of inlet & outlet.
4. **AHU’s**: - To monitor the chilled water temperature, outlet air temperature & to check the air flow so that the running of AHU can be controlled according to requirement.
5. **Ventilation Fans**: - To ON/OFF the fans in case of excess level of CO, for through the fresh air according to the requirement & in case of fire to start & stop all exhaust air fans as required.
6. **Butterfly & Motorized Valves**: - To control the flow of water supply, chilled air supply according to the requirement.
7. To ON/OFF the DG set, to check DG Battery status, day tank level, DG running status, to generate the life cycle report.
8. **Transformers**: - To check voltage, current, frequency, maximum demand, winding temperature, oil temperature, loading of transformer, ON load losses, off load losses etc.
9. **Lifts**: - To monitor and control the run status, fault status & in case of emergency to know the floor level where the lift is stuck.
10. **Monitoring of HT Breaker**: - Monitoring of phase voltage, phase current, frequency, KW & status of breaker ON/OFF so that in case of failure of grid supply to inform the respective department for resuming the supply. Monitoring & Controlling of all incomer & outgoing breaker in the main LT Panel so that breaker can be ON/OFF in case of emergency.
11. **Monitoring & Controlling of UPS. -** To monitor the loading of UPS & to utilize the single or both UPS in parallel if required, to check the battery status, UPS running status.
12. **Monitoring & Controlling of LV** Service: - To monitor the fire zone, zone wise control of voice, to restrict the entry from any specific entry position by controlling through access control panel.
13. **Monitoring & controlling of water level**: - To ON/OFF the pumps for filling the tanks.
    * **Water supply pumps**: - To ON/OFF the pumps.
    * **Firefighting pumps**: - To monitor the hydrant pressure, sprinkler pressure,

jockey pump run status, diesel fire pump run status, electric fire pump run status etc.

* + **Flow switches**: - To control the flow of water
  + **STP & STP Tanks**: - To check the outlet water, tank level.
  + **Rain water storage tank & filtration**: - To check tank level.

1. **Irrigation system**: - To check the pressure of line used for irrigation.
2. Control system components shall be new and in conformance with the following applicable standards for products specified:

* ANSI\EIA 709.1 (LonTalk Protocol)
* LonMark Certified (Version 3.1 Guidelines)
* UL 916 (Energy Management Equipment)

## **Scope of work**

The brief scope of work shall comprise of (but not limited to) design, supply, installation, testing and commissioning, approval from Consultants/Employer/Engineering-charge/statutory Authorities for IBMS System comprising of following components:

1. System Details (Building Management System)
2. Building Automation System
3. Access & Energy Conservation
4. Intrusion Detection Systems
5. Security System (Access Control System, Closed Circuit TV System)
6. Automatic Fire Detection System
7. Electrical System Section
8. Water Supply and Fire Fighting System Section
9. Ventilation & Air Conditioning System Monitoring & Control
10. **IBMS - System Description & Input Output Summary**
11. Central Stations Hardware
12. Central Station Software
13. Direct Digital Controller
14. Portable Operators Terminal (POT)
15. Data Communication
16. Field Devices
17. Electronic Metering
18. Enclosures for Controllers and Electrical Panels
19. Conduits and Wiring
20. Signal Cabling & Communication Cabling

The Contractor should carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of Owner’s site representative upto his satisfaction.

The contractor should furnish all labour, materials, equipment, transportation and incidental necessary for supply, installation, testing and commissioning per the scope of works and specified otherwise in the document and design and approved drawings for complete BMS system.

This should also include any material, equipment, appliances and incidental work, not specifically mentioned or noted on preliminary schematic drawings/documents to furnish or installed, but which are necessary and customary to be performed under this contract.

The contractor shall ensure that required interfaces between IBMS and other services systems such as HVAC, Electrical & Fire Fighting etc. are correctly identified and implemented to ensure the completeness of the overall project requirements.

## **Design Parameters**

The Contractor shall include the following for the interface to Building Management System:

1. Stop/Manual/ Auto switches along with potential free contacts for monitoring the manual operation status (wherever applicable), to be provided for those equipment whose start / stop is controlled by Building Automation System.
2. Potential free “NO‟ contacts for monitoring “Run‟ status of equipment wherever required.
3. Sockets /Nipples including shut-off valve for mounting sensors/transmitters on pipe lines.
4. All necessary Hardware/ Software shall be made available by the Plumbing / Sanitary Contractor on the Microprocessor based panel for the integration of such panel to Building Management System for remote monitoring / controlling of marking / equipment thru BMS.
5. All Energy and water meters are to be integrated with the BMS system

**SECTION C 13 – Solid Waste Management System**

The contractor shall provide space for solid waste / Bio medical waste/ hazardous waste storage and provision for garbage chute at each floor level. These facilities shall be built, operate and maintained by the service provider. All interface facilities shall be provided by the park/EPC

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**SECTION C 14 – Gases System**

# **PIPED NATURAL GAS LINES**

The PNG shall be supplied by the service provider. The contractor shall provide space for providing gas station as per service provider in the layout plan in open/ covered area. Service shafts shall be provided in each block for laying pipes to provided supply to individual Karkhana units.

# **COMPRESSED AIR SUPPLY LINES**

The compressed air shall be supplied by the service provider. The contractor shall provide space for providing compressed air plant as per service provider in the layout plan in open/ covered area. Service shafts shall be provided in each block for laying pipes to provided supply to individual Karkhana units.

**SECTION –D**

**APPROVED MAKE**

The specifications indicated below are minimum requirement only. The Contractor should design, supply, erect and commission the equipments / system according to latest editions of IEC and EI/IS Standards

The contractor shall produce samples before procurement of the material for approval of Owner/PMC. The material of the makes out of the above as approved by the Owner/PMC shall be used on the work. Final choice of the makes in any category shall rest with the Owner/PMC.

In case of any materials for which approved makes are not specified below, the contractor will submit the Technical Submittal of the product meeting the tender conditions and got it approved by Owner/PMC before incorporating in the works.

The contractor to ensure that the selected make of material shall be in compliance to Energy Conservation Building Code (ECBC) norms and meet the LEED Gold certification.

The contractor shall submit samples of all materials as per pert chart before procurement for approval and shall procure directly from the manufacturer/authorized dealers only.

The contractor shall make a sample room to install all the items/products till the completion of project.

**ARCHITECTURE AND INTERIOR**

| Sl. No | Materials | Approved make |
| --- | --- | --- |
| 1. | PPC / OPC CEMENT | ACC/ Ultratech / Ambuja |
| 2. | WHITE CEMENT | J.K. White / Birla White / Travancore |
| 3. | REIN FORCEMENT STEEL | SAIL/TATA/RINL/JSW |
| 4. | STRUCTURAL STEEL SECTIONS | Sail / Tata Steel Ltd. /RINL/ Jindal Steel & Power Ltd |
| 5. | SUPER PLASTICIZERS | Mc Bauchemie / Fosroc / Sika |
| 6. | WATER PROOFING COMPOUND (LIQUID) | Fosroc / CICO / Laticrete |
| 7. | AAC BLOCK | Builtech / Magicrete Building Solution / Aerocon/Indo Bhutan |
| 8. | AAC BLOCK ADHESIVE | Ultratech / Ferrouscrete / Bal Endura |
| 9. | POLYMER MODIFIED CEMENTITIOUS GROUT | Bal Endura / Webber / Myk Laticrete |
| 10. | STAINLESS STEEL | Jindal Stainless Steel/ Kich / Dorma / Geze / Ozone |
| 11. | EPOXY MORTAR | Fosroc / Sika / Cico / Laticrete |
| 12. | CEMENTOUS GROUT | Xypex / Fosroc/Krytone |
| 13. | CRYSTALINE CEMENTIOUS WATERPROOFING COMPOUND | Xypex Consruction Chemicals / Krytone / Sunanda/Penetron |
| 14. | POLYMERIC CEMENTIOUS COATING | BASF / CICO / Fosroc |
| 15. | NON-MODIFIED / NON BITUMENOUS HIGH SOLID / LIQUID APPLIED POLYURETHANE  MEMBRANE | BASF / Fosroc / Sika |
| 16. | ELASTOMERIC ACRYLIC U.V. RESISTANT LIQUID APPLIED COATING | BASF / Fosroc / Sika |
| 17. | APP WATERPROOFING MEMBRANE | STP / Texsa / Bitumat Co. Ltd / Tikitar / Bengal Bitumen / Dermabit / Pidilite |
| 18. | EXPANSION JOINT- Modular | Hercules / Bizzar/Ztech/Devin/ |
| 19. | LIST OF RMC PRODUCER | Ultratech / Ready Mix India Pvt. Ltd./ ACC / Lafarge |
| 20. | FLUSH DOORS | Green / Duro / Merino / Century/ Mayur |
| 21. | UPVC WINDOWS/ DOORS / VENTILATORS | Encraft / Aluplast / Rehau / Wintech |
| 22. | WOODEN / METAL / GLAZE- FIRE RATED DOOR SHUTTERS | Navair / Sukri / Promat / Kutty / Bhawani |
| 23. | NATURAL WOOD VENEERS | Sonear / Green Ply / Truwood / Mayur /Century/ Archid |
| 24. | ANTI STATIC HIGH PRESSURE  LAMINATE | Formica / Bakelite Hylam / Decolam Merino/Century |
| 25. | ALUMINIUM EXTRUSIONS | Hindalco / Nalco / Jindal |
| 26. | HINGES & BRASSWARE | Shalimar/ Indo-Brass / Amarbhoy Dossaji / Earl Bihari / Magnum/Kich |
| 27. | ALL TYPES OF GLASS | Asahi / Modiguard / Pilkington / Glaverbel / Saint Gobbin |
| 28. | FIRE-RATED  GLASS (TWO HOUR FIRE RATING) TRANSPARENT CLEAR GLASS | Glaverbel / Saint Gobbin / Pyroguard / Shott |
| 29. | GYPSUM BOARD | St. Gobain Gyproc Gypsum / USG Boral  / Amf |
| 30. | CALCIUM SILICATE BOARD FOR FIRE RATED DOOR SHUTTERS | Promatect-H Of Promat / Promina  / Supalux / Master Board / Starpan |
| 31. | INTUMESCENT STRIP FOR FRD SHUTTERS | Promat / Pemko / Intumex / Astoflame |
| 32. | ALL HARDWARE AND FITTINGS FOR ALL TYPES OF  GLAZING / DOORS / WINDOWS ETC. | Dorma / Hafele / Gezei / Kich / Godrej / Assa-Abloy |
| 33. | STEEL FIRE RATED DOOR SHUTTER | Sukri / Shakti-Met / Godrej / Navair / Adhunik |
| 34. | DASH / STUD / ANCHOR FASTENERS | Hilti / Fischer / Bosch |
| 35. | LOCKS IN CABINETS | Dorma / Hafele / Gezei / Kich / Godrej / Assa-Abloy |
| 36. | MDF BOARD | Nuwood / Duratuff/Century/Kitply/Greenply |
| 37. | ADHESIVES | Anchor / Dunlop / Pidilite-Fevicol |
| 39. | EPDM GASKET | Hanu / Anand |
| 40. | STAINLESS STEEL DOOR HANDELS / LOCKS AND FITTINGS | Dorma / Hafele / Geze / Godrej / Kich / Ipsa / Assa-Abloy |
| 41. | MOISTURE RESISTANT BOARDS | St. Gobain Gyproc / Boral |
| 42. | SS MESH | Gkd / Wmw |
| 43. | COMMERCIAL PLY / BOARD | Duro / Century / Archid / Durian/ Merino |
| 44. | HARDWARE ACCESSORIES  FOR FIRE DOORS / PANIC BAR / PANIC TRIM / DOOR CLOSER / HINGES / MORTISE LOCK | Indersoll Rond / Dorma/ Geze / Hafele / Assa-Abloy / Kich |
| 44. | CPVC PIPES & FITTINGS | Astral / Supreme / Finolex |
| 45. | STAINLESS STEEL PIPES & FITTINGS | Tata / Jindal / Viega |
| 46. | VITREOUS CHINA WARE | Hindware / Parryware / Cera / Johnson / Kerovit |
| 47. | RCC PIPES | Pragati / Lakshmi / Sood & Sood / Jain & Co |
| 48. | UPVC PIPES & FITTINGS | Supreme / Prince / Astral / Finolex |
| 49. | STAINLESS STEEL SINKS | Neelkanth / Nirali / Cera/Anupam |
| 50. | SPUN CAST IRON PIPES & FITTINGS (IS:3989) | Jaiswal Neco/ RIF / SKF / BIC |
| 51. | STONEWARE PIPES AND GULLY TRAPS | Perfect / Burn / Anand / Parry |
| 52. | GUNMETAL  VALVES (FULL WAY VALVE) CLASS-I | Zoloto / Castle/ Kartar |
| 53. | CI DOUBLE FLANGED SLUICE VALVE | Kirloskar / Ivc / Sondhi / Kejriwal |
| 54. | CI MANHOLE FRAME & COVERS AND CI GRATING | Neco / RIF / SKF / BIC |
| 55. | SANITARY CP FITTINGS & ACCESSORIES | Orintal Series Of Marc Or Equivalent Series Of Jaquar / Parryware / Grohe |
| 56. | FLOOR TRAPS | Jayna / Chilly / Nirali |
| 57. | LOOKING MIRROR | AIS / Atul/ Saint Gobain/ Modiguard |
| 58. | PVC WATER TANK | Sintex / Polycon / Spl. |
| 59. | CERAMIC TILES | H & R Johnson / Nitco / Somany / Kajaria / Asian (Agl)/Orient |
| 60. | VITRIFIED TILES | H & R Johnson / Nitco / Somany / Kajaria / Asian (Agl)/Orient |
| 61. | ADHESIVE FOR FLOOR VITRIFIED TILES / MARBLE STONE / GRANITE STONE ETC.I | Laticrete / Ferrouscrete / Ballendura |
| 62. | LAMINATED FLOOR | Action Tesa / Pergo/------ |
| 63. | COMPOSIT  MARBLE / GRANITE  / ENGINEERED STONE | Asian / Johnson / Kalinga |
| 64. | WATER BASED MELAMINE POLISH | Premium Quality- Asian Paints / Pidilite Industries/ ICI Dulux / Berger |
| 65. | EPOXY PRIMER AND PAINTS | Premium Quality- : ICI Dulux/Nerolac / Asian Paints/ Berger |
| 66. | FIRE RETARDANT PAINTS | 1st Quality Products Of: Asian Paints / Berger Paints / Shalimar |
| 67. | SYTHETIC ENAMEL PAINT / PRIMER /  DISTEMPER / EXTERIOR | Premium Quality- : Asian / Berger / ICI(Dulux) / Nerolac |
| 68. | TEXTURE PAINT | Premium Quality- : Spectrum / Asian / Heritage / Berger / Dulux |
| 69. | WALL PUTTY / COURSE PUTTY | Premium Quality- : Birla White / J.K White / Ferrous Crete / Berger |
| 70. | CLAMP SYSTEM FOR DRY STONE CLADDING | Hilti / Fischer / Bosch |
| 71. | TILE ADHESIVE / EPOXY GROUTS | Ferrous Crete / Balll Endura / Pidilite / Lati Crete |
| 72. | FLOOR HARDNERS | Piditop 333 By Pidilite / Fosroc / Sika / Firmae / Ironite / Ferrok / Haronate |
| 73. | ALUMINIUM COMPOSITE PANELS | Alucobond / Aludecor / Renobond / Alpulic |
| 74. | METAL FALSE CEILING | Armstrong / Saingobin / Hunter Douglas / Aura -Asipl |
| 75. | CALCIUM SILICATE FALSE CEILING | Everest / NCL / Aerolite |
| 76. | CALSIUM SILICATE CEILING  TILE/BOARD | Gyproc / Boral / Hilux / Aerolite / Armstong (Mylar) |
| 77. | GYPSUM PLASTER | Ferrouscrete / Gyproc / Ultratech |
| 78. | READY MIX PLASTER | Ferrouscrete / Ultratech / Saintgobin |
| 79. | FALSE CEILING GRID SYSTEM | Gyproc / Armstrong/USG Boral |
| 80. | POLYSULPHIDE SEALANT | Fosroc / Pidilite / Tuffseal / Sikka |
| 81. | PAVERS / GRASS PAVERS / KERB STONE | Ovilite / Victoria / Kjs / Unistone / Pinacalle / Chellsia |
| 82. | BUILDING SIGNAGE | Hindustan Signage Pvt.Ltd / Pr Graphics / Motivatte Solution / Galaxy Signage, Signsutra |
| 83 | Toilet Cubicles | Merino/Greenlam/T-line |

A.2 STRUCTURE SYSTEM

|  |  |  |
| --- | --- | --- |
| Sl. No | Materials | Approved make |
| 1. | PPC / OPC CEMENT | ACC / Ultratech / Ambuja |
| 2. | WHITE CEMENT | J.K. White / Birla White / Travancore |
| 3. | REIN FORCEMENT STEEL | SAIL/TATA/RINL/JSW |
| 4. | STRUCTURAL STEEL SECTIONS | SAIL/TATA /RINL/JSPL |
| 5 | EPOXY MORTAR | Fosroc / Sika / Cico / Laticrete |
| 6 | CEMENTOUS GROUT | Xypex / Fosroc/Krytone |
| 7 | EXPANSION JOINT | Construction Specialities / Hercules / Bizzar |
| 8 | LIST OF RMC PRODUCER | Ultratech / Ready Mix India Pvt. Ltd./ ACC / Lafarge |
| 9 | PT STEEL | USHA MARTIN, TATA |

A.3 ELECTRIFICATION & LV SYSTEM

| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 33/11 KV Transfomer | Crompton | Schneider | Siemens |  |  |
| 2 | Engine | Cummins | Caterpillar | MTU |  |  |
| 3 | Alternators | Stamford | Leroy Somer | Mitsubishi |  |  |
| 4 | Syncronization Panel& DG Aux. Panel | Advance | Adlec | Swati | Briltech |  |
| 5 | NIS/NGR Panel | Advance | Adlec | Swati |  |  |
| 6 | Air Circuit Breaker (ACB) | Legrand | Schneider Electric | ABB (E-Max) (TR122) | L&T |  |
| 7 | Moulded Case Circuit Breaker | Legrand (DMX) | Schneider Electric (NSX) | L&T (D-SYN) | ABB (T-MAX) |  |
| 8 | MPCB/ MCB/Isolator/Contactor/Timer | Legrand | Schneider Electric | ABB | L&T |  |
| 9 | Meters (Digital Type) | Legrand | Schneider Electric | ABB | L&T |  |
| 10 | Indicating Lights (LED) Push Buttons | Legrand | Schneider Electric | ABB | L&T |  |
| 11 | CT/PT (Cast Resin) | AE | Kappa | Matrix | Pragati |  |
| 12 | Protection Relay/Aux. Relay | Siemens | Schneider Electric | ABB |  |  |
| 13 | Control Cables | Siemens | Schneider Electric | ABB |  |  |
| 14 | Valves | Audco | Advance | Keytone | Sant |  |
| 15 | Exhaust Pipe | Jindal Hissar | Tata Steel |  |  |  |
| 16 | LRB Insulation | Llyod | UKP -Twiga | Kimmco | Owing Corning |  |
| 17 | Cable Gland/Lug | Commet | Dowels | Jainson |  |  |
| 19 | Motor/Pumps | Kirloskar | Crompton Greaves | ABB |  |  |
| 21 | Oil Flow Meter | Crown | Kent | Schlumberger |  |  |
| 22 | Level Indicator (oil) | Forbes Marshall |  |  |  |  |
| 23 | Welding Rod | Advani |  |  |  |  |
| 24 | Fastener | Fisher | Hilti |  |  |  |
| 25 | PLC | Siemens | Schneider Electric | ABB | Allen Bradley |  |
| 26 | Anti Vibration Mounting | Gerb | Resistoflex | Mupro | EBR |  |
| 27 | Fire Sealent | Birla 3M | Hilti | Promat |  |  |
| 28 | Pot Strainer/Y-Strainer | Emerald | Sant | Audco | Advance | Leader |
| 29 | HSD Fuel Transfer Pump (Flame Proof) | Rotodel |  |  |  |  |
| 30 | Pressure Gauge | Fiebig | Forbes Marshall | H Guru |  |  |
| 31 | Temperature Gauge | Fiebig | Forbes Marshall | H Guru |  |  |
| 32 | Expansion Bellows | Restiflex | Cari |  |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 33 | Flexible Coupling | Resistoflex | Kanwal |  |  |  |
| 34 | Steel Supports | Tata | Sail | Jindal Hissar |  |  |
| 35 | Enamel Paint Primer | Burger | Asian Paint |  |  |  |
| 36 | Bus Bar | Hindalco | Jindal |  |  |  |
| 37 | Ventilation Fans | Nicotra | Humidin | Airflow |  |  |
| 38 | HSD Tank | As approved from CCO, Nagpur |  |  |  |  |
| 39 | Ceiling Fan & Exhaust Fan | Bajaj | Usha | Havells |  |  |
| 40 | MS Conduit | BEC | AKG | RMCON |  |  |
| 41 | PVC Conduit | BEC | AKG | Persision |  |  |
| 42 | Telephone & TV Wire | Finolex | RR Kabel | KEI | Delton |  |
| 43 | Telephone Tag Block | Krone | Pauyet |  |  |  |
| 44 | CAT-6 Cable/Cat - 6A | Legrand | Penduit | AMP |  |  |
| 45 | Telephone Socket (RJ - 11) & Data Socket (RJ -45) | Legrand | Penduit | Siemen |  |  |
| 46 | Safety Equipment | As Approved |  |  |  |  |
| 47 | Suspended Support System | Grippal | Hilti | Duct Mate |  |  |
| 48 | CAT 6A I/O | Legrand | Panduit | Siemon |  |  |
| 49 | Jack Panel | Legrand | Panduit | Siemon |  |  |
| 50 | UTP Patch Cords | Legrand | Panduit | Siemon |  |  |
| 51 | Face Plate | Legrand | Panduit | Siemon |  |  |
| 52 | 15U Wall Mount Rack | APW | Legrand | Rittal |  |  |
| 53 | 42U Rack | APW | Legrand | Rittal |  |  |
| 54 | EPBX and IP Phones | Toshiba | Polycom | Tadiran |  |  |
| 55 | CCTV Camers | Bosch | Pelco | CBZ |  |  |
| 56 | Workstations | DELL | Lenovo | HP |  |  |
| 57 | LED Monitor | Panasonic | LG | Samsung |  |  |
| 58 | 24 Port Distribution Switch for Data and Voice | Cisco | Juniper | Aruba | Brocade |  |
| 59 | Access Control Systems | Honeywell | Impulse | HID | Smart I |  |
| 60 | Fire Alarm Systems | Notifier | Edwarb | Tyco (Ansul) |  |  |
| 61 | Video Conferencing device | Cisco | LifeSize | Polycom |  |  |
| 62 | Audio Conferencing device | Brahler | Clock Audio | Bosch |  |  |
| 63 | Switching and control System | Extron | Crestron | AMX |  |  |
| 64 | Amplifier | Biamp | Bose | Crestron |  |  |
| 65 | Speakers | Bose | Electrovoice | Crestron |  |  |
| 66 | Wireless Handled/head Set Microphone | Revolab | Clock Audio | Bosch |  |  |
| 67 | DSP | Biamp | Clearone | Crestron |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 68 | BMS | Delta | Azbil | Siemen |  |  |
| 69 | Capacitor | Legrand (DMX) | Schneider Electric (NSX) | L&T (D-SYN) | ABB (T-MAX) |  |
| 70 | Control | Legrand (DMX) | Schneider Electric (NSX) | L&T (D-SYN) | ABB (T-MAX) |  |
| 71 | 33kV Cable | Finolex | KEI | Universal (Satna) |  |  |
| 72 | 11kV Cable | Finolex | KEI | Universal (Satna) |  |  |
| 73 | MS Pipe/GI Pipe | Jindal Hissar | Tata Steel |  |  |  |
| 74 | Battery Charger | Amararaja | HBL Nife | Exide |  |  |
| 76 | Cable Trays | Slotco | Needo | Pilco | OBO | RMCON |
| 78 | External Lighting Fixture | Philips | Wipro |  |  |  |
| 82 | Internal Lighting Fixture | Philips | Wipro |  |  |  |
| 83 | Decoration Light | Orange | Trilux | Philips |  |  |
| 84 | FRLS, Cu Conductor Wire | Finolex | RR Kabel | KEI |  |  |
| 85 | Modular Switch & Socket | Legrand (Artiar) | Clipsal Neo (C-Metra) | MK(Aspect) | ABB (Concept BS) |  |
| 86 | Distribution Board | Schneider | ABB | Legrand |  |  |
| 87 | Fire Extinguisher | Life Guard | Minimax | Safex | Ceasefire |  |
| 88 | Wire Mess Cable Tray/Cable Management | Legrand | OBO | MK |  |  |
| 89 | Lighting Protection System | DEHN | JMV | LPS | ABB |  |
| 90 | Raceway/Junction Box/Floor Box | Legrand | MK | Gewiss |  |  |
| 91 | LT Panel | Advance | Adlec | Swati | Briltech |  |
| 92 | Battery | Exide | AMCO |  |  |  |
| 93 | Heat Shrinkable Jointing Kits | Raychem | Denson | CCI | 3M |  |
| 94 | 33kV Panel (GIS) | Siemens | Schneider | ABB | L&T |  |
| 95 | HT (11kV Breaker) | Siemens | Schneider | ABB | L&T |  |
| 96 | CTs | AE | Kappa | Electromac |  |  |
| 97 | Battery Charger | Advance |  |  |  |  |
| 98 | Support System for Duct/Pipes/Cable Tray /Light Fitting/Sinages/Sign Board/ Other suspended items | Gripple | Hilti | Ductmate |  |  |

A. 4 HVAC & BMS SYSTEM

| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | High Side Equipment |  |  |  |  |  |
| 1.1 | Water cooled Scroll chilling unit /Heat Pump | Carrier | Mcqway-daikin | York |  |  |
| 1.2 | Pumps Coupled/Vertical Inline | Armstrong | Luby | Willo | Grundfoss |  |
| 1.3 | Air Handling Units | Zeco | Crystal Air | Edgetech | VTS |  |
| 1.4 | Axial Fan | Humidin | Airflow | Nicotra |  |  |
| 1.5 | Inline Fan | Humidin | Airflow | Nicotra |  |  |
| 1.6 | Hi-Wall/Cassette (DX Type) | Daikin | Samsung | Panasonic |  |  |
| 2 | Ducting & Grilles |  |  |  |  |  |
| 2.1 | Factory Fabricated Duct | Zeco | Dustech | Ecoduct |  |  |
| 2.2 | Fire Dampers Motors | Belimo | Siemens | Airflow |  |  |
| 2.3 | G.I. Sheet Metal Duct | Jindal Hisar | Natational | Tata |  |  |
| 2.4 | Grilles/Fire Dampers/Diffusers | Caryaire | Airflow | Systemair |  |  |
| 2.5 | G.I. Sheets | Jindal Hisar | Sail | Tata |  |  |
| 2.6 | Gaskets | Primaseal | Neoprene Rubber |  |  |  |
| 2.7 | Adhesives | Resistoflex | Dunlop |  |  |  |
| 2.8 | Stick Pins | Primaseal | Airflow |  |  |  |
| 3 | Pipes |  |  |  |  |  |
| 3.1 | G.I. | Jindal Hissar | Sail | Tata |  |  |
| 3.2 | MS Upto 150mm | BST | H.S.T. | Jindal Hissar | Tata |  |
| 3.3 | MS 200 to 300 | BST | H.S.T. | Jindal Hissar | Tata |  |
| 4 | Valves |  |  |  |  |  |
| 4.1 | Butterfly Valves | Advance | Sant | Zoloto |  |  |
| 4.2 | Non Return Valve | Advance | Zoloto | Sant |  |  |
| 4.3 | Balancing Valve | Advance | Aduco | Honeywell | AIP |  |
| 4.4 | Gate/Globe Valves | Advance | Zoloto | Sant |  |  |
| 5 | Accessories |  |  |  |  |  |
| 5.1 | Y-Strainer | Flowell | Sant | Zoloto |  |  |
| 5.2 | Pressure Gauge | H.Guru | Fiebig |  |  |  |
| 5.3 | Thermometer | Flowell | H.Guru | Taylor |  |  |
| 5.4 | Flow Switch | Danfoss | Siemens | Belimo |  |  |
| 5.5 | Automatic Air Vent | Rapid Control | Anergy | AIP |  |  |
| 5.6 | Pot Strainer | Flowell | AIP |  |  |  |
| 5.7 | Suction Guide' | Anergy | Rapit Control |  |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 6 | Air Filters/Air Purifications |  |  |  |  |  |
| 6.1 | Filters | Magneto | Dr. Air |  |  |  |
| 6.2 | Air Curtains | Mitzwah | Tristar | Conaire |  |  |
| 7 | Insulation |  |  |  |  |  |
| 7.1 | Insulation Nitrile | Vido Flex | K-Flex | Eurobatex | K Form |  |
| 7.2 | Glass Wool | Kimmco | UP Twiga |  |  |  |
| 7.3 | Polyurethene Foam | Malanpur | Superurethane |  |  |  |
| 7.4 | Crossed Linked Polyethylene Foam | Trocellene | Thermobreak | Themoflex | K-Flex |  |
| 7.5 | Closed Cell Elastomeric Insulation | K-Flex | Vedoflex | Eurobatex |  |  |
| 7.6 | Non-Woven Fibre Material | Mikron | Du Pont |  |  |  |
| 7.7 | Premoulded PUF Section For Pipe & Pipe Supports | Malanpur | Lloyd |  |  |  |
| 7.8 | Aluminium Tape | Johnson | Birla 3M | Garware |  |  |
| 8 | Controls |  |  |  |  |  |
| 8.1 | 2/3 Way Motorized Valve for AHU | Honeywell | Belimo | AIP |  |  |
| 8.2 | Thermostats | Belimo | Honeywell | Siemens |  |  |
| 8.4 | Microprocessor Based System | Siemens | Johnson Controls | Honeywell | Belimo |  |
| 9 | Paint |  |  |  |  |  |
| 9.1 | Enamel | Asian | Nerolac | Berger | Berger |  |
| 9.2 | Bituminus | Shalimar |  |  |  |  |
| 9.3 | Tarfelt (for Underground Chilled Water Pipe Insulation) | Shalimar |  |  |  |  |
| 10 | Support System for Duct/Pipes/Cable Tray /Light Fitting/Sinages/Sign Board/ Other suspended items | Gripple | Hilti | Ductmate |  |  |
| 11 | BMS | Delta | Azbil | Atmos |  |  |

A.5 PLUMBING SYSTEM

| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | EWS / IWC | Hindware | Jaquar | Kohlar |  |  |
| 2 | W.C. seat cover | Hindware | Jaquar | Kohlar |  |  |
| 3 | Flushing Cistern | Hindware | Jaquar | Kohlar |  |  |
| 4 | Urinal / Sensor type urinal | Hindware | Jaquar | Kohlar |  |  |
| 5 | Urinal partitions | Hindware | Jaquar | Kohlar |  |  |
| 6 | C.P. brass flush valve for WC and Urinals | Hindware | Jaquar | Kohlar |  |  |
| 7 | Automatic flushing system for Urinals | Hindware | Jaquar | Kohlar |  |  |
| 8 | Wash basin | Hindware | Jaquar | Kohlar |  |  |
| 9 | Toilet paper holder | Hindware | Jaquar | Kohlar |  |  |
| 10 | C.P. brass fittings such as bib cock, two way bib cock, pillar cocks, stop cocks, angular stop cocks, C.P. flexible pipes / hose connection, C.P. brass waste, C.P. brass cast bottle trap, C.P. brass shower rose / shower assembly, long body bib taps, C.P. brass health faucets, single lever mixing fittings, sink mixture etc | Acquaviva | Jaquar |  |  |  |
| 11 | Automatic hand drier | UTEC |  |  |  |  |
| 12 | Stainless Steel Kitchen Sink | Nirali, | Anupam | Cera |  |  |
| 13 | Soap dish | Cera | Hindware | Jaquar | Parryware |  |
| 14 | Liquid soap dispenser | Cera | Hindware | Jaquar | Parryware |  |
| 15 | Towel ring / Towel rail | Cera | Acquaviva | Jaquar |  |  |
| 16 | Air Purifier | UTEC |  |  |  |  |
| 17 | Coat hook / Robe hook | Cera | Hindware | Jaquar | Parryware |  |
| 18 | Glass Mirror | Modi Guard | Century |  |  |  |
| 19 | P- Trap (Floor Trap) | Supreme | Appolo | AKG pipes |  |  |
| 20 | Floor Drain | Modi Guard | Century |  |  |  |
| 21 | Stainless Steel Grating for P- Trap / Cockroach Trap | Sanjay Chily |  |  |  |  |
| 22 | C.P. Grating for Floor P - Trap | Cera | Acquaviva | Jaquar |  |  |
| 23 | Rain Water Outlets Gratings |  |  |  |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 24 | GI Pipes (IS : 1239 and IS : 3589) | Astral | APL Apollo | Tata Steel | Jindal (Hissar) |  |
| 25 | GI pipes fittings | Unik | Zoloto M |  |  |  |
| 26 | PVC / uPVC Pipe & Fittings | Supreme | Appolo | AKG pipes |  |  |
| 27 | Cast Iron Pipes & Fittings |  |  |  |  |  |
| 28 | RCC Pipe | Pragati | Super wire |  |  |  |
| 29 | Stoneware Pipes | Anand | Rota | Jindal |  |  |
| 30 | CI Manhole covers and frames | Neco | SKF | SRIF |  |  |
| 31 | SFRC Manhole covers and frames | SFMC | Jindal | Supreme |  |  |
| 32 | FRP Manhole covers and frames | Products Unlimited | Supreme | Jain |  |  |
| 33 | Gully Traps | Supreme |  |  |  |  |
| 34 | GM / Forged Brass Ball Valves | AIP | C & R | Zoloto |  |  |
| 35 | Sluice Valves | AIP | C & R | Zoloto |  |  |
| 36 | Butterfly Valve | AIP | C & R | Zoloto |  |  |
| 37 | Non Return Valve / Check Valve | AIP | C & R | Zoloto |  |  |
| 38 | Motorised Butterfly Valve | AIP | C & R | Zoloto |  |  |
| 39 | Air Release Valve | AIP | C & R | Zoloto |  |  |
| 40 | Y Strainer | Zoloto | Emaral | Venus |  |  |
| 41 | Hydro pneumatic Pumps and other pumps | Luby | Grundfoss | Wilo |  |  |
| 42 | Variable Frequency Drives | Honeywell | Siemens | Schneider |  |  |
| 43 | Drinking Water Cooler | Blue star | Carrier |  |  |  |
| 44 | Anti Vibration Mounting | Dunlop | Resistoflex |  |  |  |
| 45 | Pressure Gauge | FIEBIG | Guru |  |  |  |
| 46 | Water Meter (Mechanical Type) | C & R | Lahri |  |  |  |
| 47 | Level Controller (Water) | Sant | Active Controls | Technika |  |  |
| 48 | Level Indicator (Water) | Sant | Active Controls | Technika |  |  |
| 49 | Paints | nerolac | Asian | Burger |  |  |
| 50 | MH / Water Tank Plastic Steps | KGM |  |  |  |  |
| 51 | Water Treatment Plant / RO Plant / Sewage Treatment Plant | Enky water | Ion Exchange | Thermax |  |  |
| 52 | Ultra Violet Water Purifier | Enky water | Ion Exchange | Thermax |  |  |
| 53 | Dosing Pumps |  |  |  |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 54 | Insulation for Hot Water Pipes | Armacel – Armaflex (UK) | Eurobatex – Union Foam (Italy) | K-Flex |  |  |
| 55 | Electric Water Heater / Gyser | Venus | AO Smith | KEPL |  |  |
| 56 | Flanges | To be on site |  |  |  |  |
| 57 | Pypcoat for Burried Piping | IWL | Coaltek |  |  |  |
| 58 | Welding Rods | Advani |  |  |  |  |
| 59 | Garden Irrigation system | Jain, Harvel | Harvel |  |  |  |
| 60 | CPVC Pipes & Fittings | Astral | Ashirwad | Flow Guard Plus | SFMC |  |
| 61 | PP-R Pipes & Fittings | SFMC | Supreme | Fusion |  |  |
| 62 | Stainless Steel Pipes & Fittings | Tata, Jindal Hisar | Jindal Hisar |  |  |  |
| 63 | CI (LA) Pipes and fittings | Electrosteel | Kesoram |  |  |  |
| 64 | Solar Heating System | Solpower | Solarhat | Photon |  |  |
| 65 | 3 layer pipe made of PP-C + PP-MV + PP-C & Fittings | Poloplast | Pestan |  |  |  |
| 66 | PP white Trap, Push fit cap plug, Clean out pipe (door piece), Floor drain | McAlpine | Pestan |  |  |  |
| 67 | Air Admittance valves | McAlpine | Studor |  |  |  |
| 68 | GI Pipes (IS : 1239 and IS : 3589) | Astral | APL Apollo | Tata Steel | Jindal (Hissar) |  |
| 69 | GI pipes fittings | Unik | Zoloto M |  |  |  |
| 70 | PVC / uPVC Pipe & Fittings | Supreme | Finolex | Prince | AKG |  |
| 71 | Cast Iron Pipes & Fittings |  |  |  |  |  |
| 72 | RCC Pipe | Pragati | Super WIre |  |  |  |
| 73 | Stoneware Pipes | Anand | Rota | Jindal |  |  |
| 74 | CI Manhole covers and frames | Neco | SKF | SRIF |  |  |
| 75 | SFRC Manhole covers and frames | SFMC | Jindal WIeme |  |  |  |
| 76 | FRP Manhole covers and frames | Products Unlimited | Supreme | Jain |  |  |
| 77 | Gully Traps | Supreme |  |  |  |  |
| 78 | GM / Forged Brass Ball Valves | Zoloto | AIP | Leader |  |  |
| 79 | Sluice Valves | Zoloto | AIP | Leader |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 80 | Butterfly Valve | Zoloto | AIP | Leader |  |  |
| 81 | Non Return Valve / Check Valve | Zoloto | AIP | Leader |  |  |
| 82 | Motorised Butterfly Valve | Zoloto | AIP | Leader |  |  |
| 83 | Air Release Valve | Zoloto | AIP | Leader |  |  |
| 84 | Y Strainer | Zoloto | AIP | Leader |  |  |
| 85 | Hydropneumatic Pumps and other pumps | Luby | GrundFoss | Wilo |  |  |
| 86 | Variable Frequency Drives | Honeywell | Siemens | Schneider |  |  |
| 87 | Anti Vibration Mounting | Dunlop | Resistoflex |  |  |  |
| 88 | Pressure Gauge | FIEBIG | Guru |  |  |  |
| 89 | Water Meter (Mechanical Type) | C & R | Lahri |  |  |  |
| 90 | Level Controller (Water) | Sant | Active Controls | Technika |  |  |
| 91 | Level Indicator (Water) | Sant | Active Controls | Technika |  |  |
| 92 | Paints | Nerolac | asian | Burger |  |  |
| 93 | MH / Water Tank Plastic Steps | KGM |  |  |  |  |
| 94 | Water Treatment Plant / RO Plant / Sewage Treatment Plant | Anky Water | Ion Exchange | Thermax |  |  |
| 95 | Ultra Violet Water Purifier | Anky Water | Ion Exchange | Thermax |  |  |
| 96 | Dosing Pumps |  |  |  |  |  |
| 97 | Insulation for Hot Water Pipes | Armacel – Armaflex (UK) / | Eurobatex – Union Foam (Italy) | K-Flex |  |  |
| 98 | Flanges | To be on site | on WIte |  |  |  |
| 99 | Pypcoat for Burried Piping | IWL | Coaltek |  |  |  |
| 100 | Welding Rods | Advani |  |  |  |  |
| 101 | Garden Irrigation system | Jain | Harvel |  |  |  |
| 102 | CPVC Pipes & Fittings | Astral | Ashirwad | SFMC | AKG |  |
| 103 | PP-R Pipes & Fittings | SFMC | Supreme | Fusion |  |  |
| 104 | Stainless Steel Pipes & Fittings | Tata | Jindal Hisar |  |  |  |
| 105 | CI (LA) Pipes and fittings | Electrosteel | Kesoram |  |  |  |
| 106 | Polymar modular RWH | Cross – Wave | Poly Pipe | Rehau |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 107 | G.I. Pipes (heavy duty) Unless specified | Astral | APL Apollo | Tata Steel | Jindal (Hissar) |  |
| 108 | Gunmetal valve (full way valve) Class-I | AIP | C&R | Zoloto |  |  |
| 109 | C.I. double flanged sluice valve | AIP | C&R | Zoloto |  |  |
| 110 | Butterfly valve | AIP | C&R | Zoloto |  |  |
| 111 | Gate Valve | AIP | C&R | Zoloto |  |  |
| 112 | Non return Valve (GM) up to 65mm | AIP | C&R | Zoloto |  |  |
| 113 | Ball Valve | AIP | C&R | Zoloto |  |  |
| 114 | Dosing Pump | ASIA LMI |  |  |  |  |
| 115 | Dosing Tank | Sintex | Roto Plast |  |  |  |
| 116 | Pressure Gauges | H GURU | FEIBIG |  |  |  |
| 117 | Dash Fasteners | HILTI | Chilli |  |  |  |
| 118 | Automatic Air Vent | TBS | IBP | CIM |  |  |
| 119 | Pipe Clamps / Hangers / Support | HILTI | CHILLI |  |  |  |
| 120 | Paint | Shalimar | Berger | Asian |  |  |
| 121 | Conduit | AKG ATUL | BEC |  |  |  |
| 122 | Rotameter / Flow Indicator | Heinrick | Alpha | Flow |  |  |
| 123 | Diaphram Valve | As approved by CONSULTANT |  |  |  |  |
| 124 | Water Supply Pumps | MATHER PLATT | GRUNDFOSS | Wilo |  |  |
| 125 | Hydro-pneumatic System | MATHER PLATT | GRUNDFOSS | Wilo |  |  |
| 126 | Filter/Softener | Thermax | Ion Exchange | Enweco |  |  |
| 127 | Activated Carbon Filter | Thermax | Ion Exchange | Enweco |  |  |
| 128 | CPVC Pipes & Fittings | ASTRAL | Ashirwad | SFMC |  |  |
| 129 | Water level indicator | Sant | Active Controls | Technika | Minilec |  |
| 130 | Level Controller | Sant | Active Controls | Technika | Minilec |  |
| 131 | PH Meter | VATS | Hanna (Italy) |  |  |  |
| 132 | Pressure Switch | DANFOSS | Porter |  |  |  |
| 133 | Controls | HONEYWELL | Steafa | Penn |  |  |
| 134 | Vibration Eliminator | DUNLOP | Resistoflex | Kanwal |  |  |
| 135 | Foot Valve | DANFOSS | C&R |  |  |  |
| 136 | Water Meter | C & R | Lahri |  |  |  |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 | Make - 5 |
| 137 | PH Controller | FORBES MARSHALL | YOKOGAWA |  |  |  |
| 138 | PVC Pipe | SUPREME | FINOLEX | AKG |  |  |
| 139 | HDPE Pipe | EMCO | Ori - Plast |  |  |  |
| 140 | C.I Pipe | KESORAM | IISCO | Electrosteel Casting |  |  |
| 141 | VFD | HONEYWELL | Schneider | Danfoss | Siemens |  |
| 142 | TDS Meter | HACH | Hauch | Eutech |  |  |
| 143 | Water Treatment Plant / RO Plant / Sewage Treatment Plant | Grey water solutions Pvt Ltd | Ion exchange | Thermax |  |  |
| 144 | Support System for Duct/Pipes/Cable Tray /Light Fitting/Sinages/Sign Board/ Other suspended items | Gripple | Hilti | Ductmate |  |  |

A.6 FIRE FIGHTING SYSTEM

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| S.No. | Particular | Make - 1 | Make - 2 | Make - 3 | Make - 4 |
| 1 | M.S PIPE | APL Apollo | Jindal Hisar | Tata |  |
| 2 | Fire aid hose reel | Minimax | Deepak | Newage | Lifeguard |
| 3 | RRL hose | Lifegurard | Safeguard | Newage |  |
| 4 | Hose drum | Lifegurard | Safeguard | Newage |  |
| 5 | Branch pipe | Lifegurard | Safeguard | Newage |  |
| 6 | Fire man axe | Lifegurard | Safeguard | Newage |  |
| 7 | Fire brigade connection | Lifegurard |  |  |  |
| 8 | Air valve | Lifegurard | Safeguard | Newage |  |
| 9 | Hydrant landing valve | Lifegurard | Safeguard | Newage |  |
| 10 | Fire cabinet | Lifegurard | Safeguard | Newage |  |
| 11 | Enamel paint | Nerolac | Asian | Burger |  |
| 12 | Corrosion protection tape | Pupkote | Makpolykote |  |  |
| 13 | Butterfly valve(Groved) | Zoloto | Leader | Victaulic |  |
| 14 | Non return valve | Zoloto | Victaulic |  |  |
| 15 | Pressure switch | Indfoss | Switzer |  |  |
| 16 | Pressure gauge | Fiebig | H Guru | Zoloto |  |
| 17 | Vibration eliminators | Resistoflex | Dunlop |  |  |
| 18 | Fire extinguisher | Lifegurad | Ceasefire | Minimax | Newage |
| 19 | Fire pumps | Wilo | Newage Pumps | Grundfoss |  |
| 20 | Air vessel | Minimax | Safeguard | Ceasefire |  |
| 21 | Automatic alarm | HD | Spraysafe | AIP |  |
| 22 | Y-STRAINER | Zoloto | Leader | Emarlad |  |
| 23 | Pudlle flange | Site Fabricated |  |  |  |
| 24 | Sprinkler | Astrul | Tyco | Newage | Lifeguard |
| 25 | Fasteners | Hilti | Fischer | Bosch |  |
| 26 | Rubber gaskets | CIC | Varuna |  |  |
| 27 | Mechanical seal | Durametallic | Burgmann |  |  |
| 28 | Flow switch | System Sensor | Potter |  |  |
| 29 | Installation control valve | Newage | Guru | Sant |  |
| 30 | Mechanical seal | Durametallic | Burgmann |  |  |
| 31 | Support System for Duct/Pipes/Cable Tray /Light Fitting/Sinages/Sign Board/ Other suspended items | Gripple | Hilti | Ductmate |  |