THE URBAN DEVELOPMENT CORPORATION OF TRINIDAD AND TOBAGO LIMITED (UDeCOTT)

REQUEST FOR PROPOSALS
ARIMA ADMINISTRATIVE COMPLEX – PHASE 1 BASE BUILDING WORKS

The Urban Development Corporation of Trinidad and Tobago Limited (UDeCOTT) invites suitably qualified and experienced entities to submit proposals for the **Arima Administrative Complex – Phase 1 Base Building Works.**

In accordance with the Public Procurement and Disposal of Public Property Act, 2015 (as amended), suppliers of goods, works and services, interested in conducting business with UDeCOTT must be registered on the OPR Procurement Depository. The relevant guidelines for registration can be found on the OPR website via https://oprtt.org/procurement-depository/. Therefore, UDeCOTT is inviting suitably qualified suppliers to register and apply for pre-qualification in the OPR's Procurement Depository for the following:

Line of Business Code: 72121101 - Commercial and Office Building New Construction Service.

A request for the RFP package can be made via email to tenders@udecott.com from **Friday November 17, 2023 (excluding weekends and public holidays)**, between the hours of **9:00 a.m. to 4:00 p.m. (AST)**.

The successful contractor shall be chosen using competitive selection process as set out in the Request for Proposals (RFP). Proponents are informed that submissions must include ALL the documents as set forth in the RFP. Failure to do so may result in disqualification.

INFORMATION SESSION

An Online Information Session will be held **via Microsoft Teams** on **Friday November 24, 2023 at 9:00 a.m.** This will be followed by a **Site Visit** on **Friday November 24, 2023 at 2:30 p.m.** Interested parties are kindly asked to confirm their availability, together with the **names and preferred email addresses** of their representatives who will be in attendance, via email to tenders@udecott.com.

SUBMISSION

Proponents are advised that submissions must include ALL the documents as set forth in the RFP and must be in accordance with the terms therein.

Failure to do so may result in disqualification.

The deadline date for submissions is **December 15, 2023 (AST)**.

Additional information may be requested through email forwarded to the attention of **The Office of the Chief Procurement Officer** at tenders@udecott.com.

UDeCOTT reserves the right to reject any or all proposals for failure to comply with any mandatory requirements stated in the RFP.

THE OFFICE OF THE CHIEF PROCUREMENT OFFICER

FREQUENTLY ASKED QUESTIONS (FAQs)
ARIMA ADMINISTRATIVE COMPLEX – PHASE 1 BASE BUILDING WORKS

What is the purpose of this Request for Proposal?
The purpose of this Request for Proposal is to identify and contract a suitably qualified and experienced Contractor to undertake the Project.

What is the Location of the site?
The Project Site is the Arima Administrative Complex, located on Robinson Street and Railway Road, Arima.

When will the RFP be available?
A request for the RFP package can be made via email to tenders@udecott.com from Friday November 17, 2023 (excluding weekends and public holidays), between the hours of 9:00 a.m. to 4:00 p.m. (AST).

Is it mandatory to attend the site visit and online information session?
Attendance to the site visit and online information session is **not** mandatory. It does however, provide a greater understanding of the requirements of the RFP.

Are there any eligibility requirements for this Procurement Process?
In order to be eligible for evaluation and/or consideration to provide the Works, Proponents must be able to demonstrate the following:

- Incorporation or otherwise registered to do business in Trinidad and Tobago as evidenced by the Certificate of Incorporation or Registration (as applicable);
- Submission of Statutory Clearance/Compliance Certificates, (for companies incorporated/registered in Trinidad and Tobago) valid as at the tender submission deadline, namely;
    - VAT Clearance Certificate
    - BIR Clearance Certificate
    - NIS Certificate of Compliance
- Submission of a Bid Bond to the value of One Million Dollars ($1,000,000.00).

Are interested parties required to register with the Office of the Procurement Regulator?
Proponents are advised that in light of the proclamation of the Public Procurement and Disposal of Public Property Act, 2015, all proponent interested in conducting business with UDeCOTT must be registered on the OPR Procurement Depository. The relevant guidelines for registration can be found on the OPR website via https://oprtt.org/procurement-depository/. Proponents are required to apply for pre-qualification in the OPR's Procurement Depository for the following:

Line of Business Code: 72121101 - Commercial and Office Building New Construction Service.

Are Proponents required to purchase the RFP package?
There will be no cost for the RFP package.

Are Proponents required to submit a Bid Bond with their Proposals?
Yes. A Bid Bond to the value of One Million Dollars ($1,000,000.00) is required for this RFP.

Proponents are to note that the responses provided as guidance to these Frequently Asked Questions does not relieve the Proponent of its obligation and responsibility to fulfil and comply with all requirements of the Request for Proposals.

SCOPE OF WORKS

ARIMA ADMINISTRATIVE COMPLEX – PHASE 1 BASE BUILDING WORKS

The total area of the site to be developed for the construction of the Arima Administrative Complex is ten thousand, nine hundred and eighty three (10,983) square meters. The Scope of Works for the Arima Administrative Complex consists of the construction of facilities at the project site inclusive of the following:

- Construction of a six-storey Main Building (gross area: 8400 square meters) housing Government Offices and agencies providing services to the public
- Construction of a one main building to house all offices and conferencing facilities together with the inclusion of commercial spaces.
- Construction of a parking structure and parking on grade to accommodate 180 parking spaces (This will be done at a later phase upon completion of this scope of works)
- Development of green Spaces
- Development of site works

udecott
Urban Development Corporation
Of Trinidad And Tobago Limited

PERFORMANCE SPECIFICATIONS FOR THE PROPOSED ARIMA ADMINISTRATIVE COMPLEX

ARCHITECTURAL UNIT, THE URBAN DEVELOPMENT CORPORATION OF TRINIDAD & TOBAGO (UDECOTT)

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SECTION 101 - PRELIMINARIES

1.0 PRELIMINARY PARTICULARS

1.1 Names of parties

The Employer is:	The Urban Development Corporation of Trinidad and Tobago 38-40 Sackville Street Port of Spain Phone 225-4004
The Project Manager is:	The Urban Development Corporation of Trinidad and Tobago 38-40 Sackville Street Port of Spain Phone 225-4004
The Client is:	Ministry of Public Administration Levels 5-7 National Library Building Corner Hart and Abercromby Streets Port-of-Spain Phone 623-4724

1.2 Description of the Works

The Ministry of Public Administration is desirous of consolidating various government agencies and services into a new facility to be constructed at Robinson Circular Road in Arima. Phase 1 of this project consists of the construction of a six storey office building with commercial spaces to serve the public, recreational and childcare services for staff at the Ground Floor; and offices on the remaining floors.

The New Administrative Complex is to have a gross floor area of 8400 sqm, with 180 no. parking spots provided on grade.

1.3 Location of the site

Bounded between Robinson Circular and Railway Roads Arima, on the former BK Hardware Site

2.0 CONTRACT PARTICULARS

2.01 Form of Contract

The Articles of Agreement and Conditions of Contract will be those of:

Contract for Plant and Design-Build First Edition 1999 published by the *Fédération Internationale des Ingénieurs-Conseils* (FIDIC)

3.0 DESIGN REQUIREMENTS

An office building must have flexible and technologically-advanced working environments that are safe, healthy, comfortable, durable, aesthetically-pleasing, and accessible. It must be able to accommodate the specific space and equipment needs of the User. As such the Contractor shall prepare and submit a Design which meets the following Employer's requirements:

3.01 Roles and Responsibilities of the Designer

- The Contractor shall assume full responsibility for the professional quality, completeness, accuracy and co-ordination of all design documents and its conformance with all applicable laws, rules, regulations and orders governing said work.
- The Designers shall consider the scale and character of the surrounding urban fabric in designing above ground structures.
- The Designers shall consider sustainable initiatives including but not limited to the following:

  Water Efficiency: Water Greywater system (recycled rainwater) for flushing fixtures

  Energy Efficiency: Computerized building management system optimizes energy use by mechanical and electrical systems., Solar Energy use within the building to cut energy costs, Use of natural daylighting to reduces lighting energy cost

Material Selection: Regional materials used throughout design: concrete, landscape materials, finishes, etc. Use of interior finishes made from recycled materials

Indoor Environmental /Air Quality: Low-emission materials—paints, coatings, adhesives, sealants and floorings are used throughout to maximize indoor air quality.

- All design documents (including drawings, plans, schedules, equipment manuals etc.) shall describe with specificity all elements, details, components, materials, and other information necessary for the complete construction of the Works and the delivery of the Works fully functional and operational for its intended purposes, including compliance/satisfaction of all testing, permitting, qualifications, certifications, validations, and obtaining regulatory certification and approvals by all applicable regulatory authorities required to render the Project and all its components operational and functionally and legally usable for their intended purpose.

- The Contractor shall perform all Design Services described in, contemplated by, inferable from, or necessary or desirable to achieve the objectives specifically stated in the Scope of Works and in the Employer's requirements and the Contract, including all Design Services necessary for the Project to be properly constructed by the Contractor in accordance with all applicable guidelines, requirements and standards. In development of the designs, the Contractor must give careful and adequate consideration to ensure that the designs which are prepared are efficient, cost effective, safe, functional, constructible and that the final product is easily maintained and at minimal cost.

- The Contractor shall prepare, as necessary, surveys and topographic information including photographs needed to establish line and grade of services lines, location of property lines and easements and to determine the necessary earthworks (cut and fill) to design and construct all structures.

- All design and construction documents shall be prepared using the English (metric) system, unless otherwise specified in the Contract.

- Design services shall be performed by licensed design professionals. The standard of care for architectural and engineering services performed shall be the highest degree of care and skill used by design professionals practicing under the same time and locality conditions.

3.02 Design Review Process

The Contractor shall provide for all quality control design reviews required by sound professional architectural and engineering practices.

The Employer's final review and approval of design documents will be carried out at the following sequential stages of design development:

Stage 1 – (25%) Completion of Preliminary Architectural and Engineering designs and drawings including outline Technical Specifications (Materials and Workmanship)

Stage 2 – (35%) Completion of Final Architectural and Engineering designs and drawings

Stage 3 – (75%) Completion of Design Development Architectural and Engineering designs, drawings, details and schedules (Floor Finishes, Wall Finishes, Paint Colour/Scheme, Ironmongery,

Doors, Windows, etc.), including Bar Bending Schedules for all reinforced concrete design; fabrication/shop drawings for structural steel work; equipment cut-sheets, fittings and fixtures cut-sheets.

Stage 4 – (95%) Completion of "For Construction" Drawings and Detailed Technical Specifications

Stage 5 – (100%) Completion of "As-built drawings"

The documents for the above stages shall be submitted to the Employer for approval only after completion of design reviews by the Contractor and completion of the design quality checks and certifications by the Contractor's Quality Team. Any review or approval by the Employer shall not relieve the Contractor of or otherwise diminish its obligations under the Contract.

The Contractor shall conduct presentations (Microsoft PowerPoint or approved) on the Conceptual architectural design options, recommended preferred options and design criteria. The presentations are to be delivered to Employer representatives and other stakeholders to provide precise and clear understanding/appreciation of the conceptual designs and also to solicit comments from the audience. The Contractor may also be requested to conduct similar presentations at the various design review stages

3.03 Design Review Notices

The Contractor shall give written notice of scheduled Design Reviews to the Employer in accordance with the terms and conditions of the Contract.

The purpose of Design Reviews is to examine different aspects of the design, but not limited to:

- Ensure technical integrity by verifying that the design complies with all contract requirements; design standards, codes of practice and governmental regulations
- Ensure maintainability of the designs
- Ensure the constructability of the designs
- Ensure that the designs are consistent with the Contractors Price Proposal with respect to the cost of construction works
- Ensure that there is compatibility amongst all designs
- In the case of reviews of "For Construction Drawings", to enable construction to commence and/or continue
- The Employer's Approval will be required prior to proceeding to each succeeding Stage.
- The design notes and computation sheets shall be fully titled, numbered, dated, indexed, and signed by the lead designer and the checker.
- All drawings shall be dated and initialled by the lead designer and checker
- All Engineering drawings shall be stamped and signed by a Board of Engineering of Trinidad and Tobago (BOETT) registered Engineer of Record.
- All Architectural drawings shall be stamped and signed by a Board of Architecture of Trinidad and Tobago (BOATT) registered Architect of Record.

4.0 Proposed Code and Standards

The proposed codes and standards to be used in the designs include the following:

4.01 Architectural Designs

PLANNING	• Town and Country Planning Regulations
	• Regional Corporation Regulations
BUILDINGS/ STRUCTURES	• International Building Code (IBC) 2018.
	• Caribbean Uniform Building Code (CUBIC)
	• AWPA U1 – User Specification for Treated Wood: 2012
	• American Society of Civil Engineers code ASCE-7-05
	• International Building Code (IBC) for earthquake loading using equivalent static analysis and compared to CUBIC. A peak ground acceleration of 0.4g shall be used.
	• American National Standards Institute (ANSI)
	• American Concrete Institute ACI 318
	• American Institute of Steel Construction (AISC manuals)
	• ASHRAE Standard 189.1
LIFE SAFETY	• NFPA 101-2015 – Life Safety Code
	• NFPA 1-2015 – Fire Code
UNIVERSAL ACCESSIBILITY	• Accessible and Usable Buildings and Facilities ANSI A177.1:2014
SUSTAINABILITY	• LEED v4 Guidelines
LOCAL REGULATIONS	• GORTT Office Outfitting Policy
	• The Occupational Safety and Health Act 1, 2004 as amended 2006

4.02 Structural Designs

VERTICAL LOADS	• American Society of Civil Engineers (ASCE): ASCE 7-05 Minimum Design Loads for Buildings and Other Structure
EARTHQUAKE LOADS	• ASCE 7-05 and International Building Code (IBC) 2009 - (Refer to Seismic Research Unit website http://www.uwiseismic.com/Maps.aspx for Hazard Maps of Trinidad and Tobago -2475 year Return Period)

WIND LOADS	• ASCE 7-05 (Trinidad 117mph, Tobago 130mph – 3 sec. Gust for Trinidad and Tobago)
REINFORCED CONCRETE	• American Concrete Institute (ACI): ACI 318-08 or latest Building Code Requirements for Structural Concrete
STRUCTURAL STEEL	• American Institute of Steel Construction (AISC): Manual of Steel Construction (Load & Resistance Factor Design), Specification for Structural Steel Buildings (AISC 360-10), • AISC 341 – 10 including Supplement No. 1 dated 2006 (Seismic Provisions for Structural Steel Buildings • AISC 358 - 10 including Supplement No. 1 dated 2009 (Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications
STRUCTURAL MASONRY	• ACI 530-05 / ASCE 5-05 / TMS 402-02
STEEL REINFORCEMENT	• ASTM A615 GR 60 – Fy = 60 ksi, Fu = 75 ksi
STRUCTURAL STEEL MATERIAL:	• ASTM A992 – Fy = 50 ksi (Wide Flange and Hot Rolled Sections) • ASTM A36 – Fy = 36 ksi (Plates)
OTHER STANDARDS	• ASTM – American Society for Testing and Materials

IMPORTANT NOTE:	• The structural designs should comply to the Ministry of Works and Infrastructure Latest Structural Design Guidelines for Trinidad & Tobago
	• All structural drawings should be stamped and signed with a registered
	• Civil / Structural Engineer's Board of Engineers' stamp of T&T.
	• All designs must be accompanied by structural design calculations which must include the following:
	  ○ Design Data Sheet
	  ○ Design Methodology Sheet with assumptions made in the modelling of the structure.
	  ○ Drawing of the complete mathematical model used in the structural (manual or computer) analysis.
	  ○ Clear input and output data.
	  ○ An electronic copy of the computer structural model.

LOCAL REGULATIONS	• Trinidad and Tobago Standard - Recommendations for the Design of Building – TTS 16 90 400 (1978) • National Building Code of Trinidad & Tobago • BAPE WIND CODE (1981) • Wind Speed Maps for the Caribbean for Application with the Wind Load Provisions of ASCE 7 shall be used to determine reference velocities as defined in ASCE 7.

4.03 Roadway, Road Pavement Designs

AASHTO Codes (American Association of State Highway and Transportation Officials

4.04 Mechanical, Electrical & Plumbing Engineering Design Requirements

The planned service life of the Design shall be 30 years. The planned service life of all mechanical, electrical and electronic equipment shall be 15 years. The planned service lives shall take into account the maintenance requirements of the relevant materials and equipment. Equipment that is sourced must have local providers to supply replacements when the need arises. All designs for Mechanical, Electrical and Plumbing Systems must conform with the following proposed codes and standards:

ELECTRICAL	• ANSI C37.13 – 2015 Standard for Low-Voltage AC Power Circuit Breakers Used In Enclosures • ANSI C37.14 - 2015 Standard for DC (3200 V and below) Power Circuit Breakers Used in Enclosures • ANSI C57.12.00 – 2010 Standard for General Requirements For Liquid-Immersed Distribution, Power, And Regulating Transformers • ANSI C57.12.01 – 2015 Standard for General Requirements For Dry-Type Distribution And Power Transformers • ANSI C63.12 – 2015 Standard Recommended Practice For Electromagnetic Compatibility Limits And Test Levels • ANSI C80.1 - 2015 Electrical Rigid Steel Conduit • ANSI C80.3 - 2015 Electrical Metallic Tubing - Steel (EMT-S)

	• ANSI C80.6 - 2018 Electrical Intermediate Metal Conduit
HVAC	• ASHRAE Handbook—HVAC Applications, 2019 • ASHRAE Handbook—HVAC Systems and Equipment, 2020 • ASHRAE 55 – 2017 Thermal Environmental Conditions for Human Occupancy • ASHRAE 62.1 - 2019 Ventilation for Acceptable Indoor Air Quality • ASHRAE 90.1 - 2019 Energy Standard for Buildings except Low-Rise Residential Buildings • ASHRAE Standard 90.4 - 2019 Energy Standard for Data Centers • ASHRAE Standard 185.1 - 2020 Method of Testing UV-C Lights for Use in Air-Handling Units or Air Ducts to Inactivate Airborne Microorganisms • ASHRAE Standard 202-2018 Commissioning Process for Buildings and Systems • ASHRAE 2020 Smart Grid Application Guide: Integrating Facilities With The Electric Grid • ASME A17.1 / CSA B44 – 2019 Safety Code for Elevators and Escalators
PLUMBING	• ASME B31 – Standards of Pressure Piping • ASME B31.3 – 2020 Process Piping • ASME B31.8 - 2018 Gas Transmission and Distribution Piping Systems • ASME B31.9 – 20120 Building Services Piping • ASME B31.12 - 2019 Standard on Hydrogen Piping and Pipelines • ICC IFC 2021 International Fire Code • ICC IPC 2021 International Plumbing Code • ICC IMC 2021 International Mechanical Code • ICC IFGC 2021 International Fuel Gas Code

- ICC IECC 2021 International Energy Conservation Code
- ICC IPSDC 2021 International Private Sewerage Disposal Code
- ICC ISPSC 2021 International Swimming Pool and Spa Code
- ASME B16 – Standards of Pipes and Fittings
- ICEA Class H Flexible Cables
- IEEE 730 Software QA Plans
- IEEE 830 Recommended Practice for Software Requirements Specifications
- NFPA 10 – 2018 Standards on Portable Fire Extinguishers
- NFPA 13 – 2019 Standard for the Installation of Sprinkler System
- NFPA 14 - 2019 Standard for the Installation of Standpipes and Hose Systems
- NFPA 15 – 2022 Standard water spray fixed systems for fire protection
- NFPA 17 – 2021 Standard for Dry Chemical Extinguishing Systems
- NFPA 17A – 2021 Standard for Wet Chemical Extinguishing Systems
- NFPA 20 – 2019 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 22 – 2018 Standard for Water Tanks for Private Fire Protection
- NFPA 24 – 2022 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- NFPA 45 – 2019 Standard on Fire Protection for Laboratories Using Chemicals

LIFE SAFETY

- NFPA 54 – 2021 National Fuel Gas Code
- NFPA 58 – 2020 Liquefied Petroleum Gas Code
- NFPA 59 – 2021 Utility LP-Gas Plant Code

- NFPA 59A – 2019 Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)
- NFPA 70 – 2020 National Electric Code
- NFPA 72 – 2019 National Fire Alarm and Signalling Code
- NFPA 75 – 2020 Standard for the Fire Protection of Information Technology Equipment
- NFPA 88A – 2019 Standard for Parking Structures
- NFPA 90A – 2021 Standard for the Installation of Air-Conditioning and Ventilating Systems
- NFPA 91 – 2020 Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids
- NFPA 92 – 2021 Standard for Smoke Control Systems
- NFPA 101 - 2021 Life Safety Code
- NFPA 110 – 2022 Standard for Emergency and Standby Power Systems
- NFPA 111 – 2022 Standard on Stored Electrical Energy Emergency and Standby Power Systems
- NFPA 418 – 2021 Standard for Heliports
- NFPA 780 – 2020 Standard for the Installation of Lightning Protection Systems
- NFPA 820 – 2020 Standard for Fire Protection in Wastewater Treatment and Collection Facilities
- NFPA 900 – 2019 Building Energy Code

LOCAL REGULATIONS

- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the EMA of Trinidad and Tobago & Water Pollution Rules 2019
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago
- Requirements of the Electrical Inspectorate Division, Ministry of Public Utilities of Trinidad and Tobago

- SMACNA HVAC Duct Construction Standards
- The National Plumbing Code of Trinidad and Tobago
- Trinidad & Tobago Electricity Commission Wiring for Light & Power 8th Edition
- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Trinidad & Tobago Electrical Wiring Code Part 2 - High Voltage Installations (TTS 171: Part 2: 2002)
- Trinidad & Tobago Electrical Wiring Code Part 3 – Renewable Energy Systems and Interconnection Requirements (TTS 171: Part 3: 2011)
- Workplace Design – Lighting of Indoor work places – Specification (TTS 611-2008)
- Water and Sewerage Authority Guidelines for Design and Construction of Water and Wastewater Systems in Trinidad and Tobago

4.05 Statutory Requirements

All designs shall be prepared in accordance with and in compliance with the guidelines, regulations and statutory and legal requirements of all Governmental Statutory and Regulatory Agencies and other service providers which include:

1. Town & Country Planning Division (TCPD)
2. Water and Sewerage Authority (WASA)
3. Trinidad and Tobago Electricity Commission (T&TEC)
4. Local Health Authorities
5. Ministry of Works and Transport (Drainage Division, Highways Division)
6. Division, Traffic Management Branch and other applicable Divisions
7. Regional Corporations
8. Trinidad and Tobago Fire Services
9. Environmental Management Authority (EMA)
10. Telecommunications Services of Trinidad and Tobago (TSTT)

SECTION 102 – DESIGN PROCEDURES & VALIDATION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for design of the facility, based on the design criteria specified.

B. Validation requirements.

1.02 DEFINITIONS

A. Validation: All forms of evidence that are used to predict whether the design will comply with the requirements or to verify that the construction based on the design actually does comply. During Preliminary Design, Design Development, and Construction Documents, requirements to submit Validation are primarily intended to forestall use of designs or constructions that will not comply. At any time before completion of construction, Validation is presumed to be only a prediction and may subsequently be invalidated by actual results. The term Validation is used to distinguish these forms of evidence from traditional submittals commonly required during the construction phase.

B. Proven-In-Use: Proven to comply by having actually been built to the same or very similar design with the same materials as proposed and functioning as specified.

C. Proven-by-Mock-Up: Compliance reasonably predictable by having been tested in full-scale mock-up using the same materials and design as proposed and functioning as specified. Testing need not have been accomplished specifically for this project; when published listings of independent agencies include details of testing and results, citation of test by listing number is sufficient (submittal of all test details is not required).

1.03 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2013c.

1.04 SUBMITTALS

A. Validation Submittal Procedures:

1. Time Frames: As specified. If there is a conflict between the degree of detail or completion specified and the progress of the design or construction, obtain a clarification before submitting.

2. Recipient: Employer's Engineer.

3. Number of Copies: 2 copies for Employer's use and records; Employer will return not more than one additional copy.

4. For time periods that constitute Milestones, all Validation submittals required during that period must be complete and accepted before the Milestone can be considered achieved.

5. Resubmissions: Clearly identified as such, with all changes made since the original submittal clearly marked.

1.05 QUALITY ASSURANCE

A. Qualifications of Testing/Inspection Agencies Performing Validation:

1. Qualified and equipped to perform applicable tests/inspection.
2. Regularly engaged in testing and inspection activities on a commercial basis.
3. Authorized to operate in the State in which the project is located.
4. Validation: Submittal of qualifications, based on ASTM E329.

PART 2 PRODUCTS

2.01 DESIGN-BUILDER FURNISHED PRODUCTS

A. In addition to requirements specified in other sections, provide products and elements that comply with the following.

B. Elements Made Up of More Than One Product:

1. Where an element is specified by performance criteria, use construction either proven in use or proven-by-mock-up, unless otherwise indicated.

   a. The Design-Builder may choose whether to use elements proven-in-use or proven- by-mock-up, unless either option is indicated as specifically required.

   b. Where test methods accompany performance requirements, use those test methods to test the mock-up.

2. Where a type of product is specified, without performance criteria specifically applicable to the element, use the type of product specified.

1. Where more than one type of product is specified, without performance criteria specifically applicable to the element, use one of the types of products specified.
2. Where a type of product is specified, with applicable performance criteria, use either the type of product specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.
3. Where more than one type of product is specified, with applicable performance criteria, use either one of the types of products specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.
4. Where neither types of products nor performance criteria are specified, use products that will perform well within the specified life span of the building.

C. Products:

1. Where a product is specified only by a manufacturer name and model number/brand name, use only that model/brand product.

2. Where the properties of a product are specified by description and/or with performance criteria, use products that comply with the description and/or performance criteria.

3. Where manufacturers are listed for a particular product, use a product made by one of those manufacturers that also complies with other requirements.

D. Reference Standards: Where products or workmanship is specified by reference to a document not included in the Contract Documents, comply with the requirements of the document, except where more stringent requirements are specified.

1. Date of Issue: As indicated in each instance except where a specific date is established by code.

PART 3 EXECUTION

3.01 DESIGN

A. During Preliminary Design, the design criteria and the design itself must be refined, finalized, and documented.

B. Employer will appoint representatives of the following departments to provide details of functional needs:

1. User groups.

2. Operations staff.

3. Maintenance staff.

C. Design Documentation: Record all design and performance criteria that will be of use during occupancy and operation of the project, including all items specified for maintenance manuals, below.

1. Design Criteria Documentation Included in Construction Documents: Organized logically (from the point of view of operations staff) and placed in a prominent location in drawing sets.

2. If desired, documentation may consist of annotated modifications to and amplification of the Conceptual Documents, with changes that affect Contract Times or Contract Price documented as required for modifications.

3. If required, shop drawings may be used to accomplish design documentation.

4. Employer will maintain the project program document, modified to reflect changes made during refinement of the design.

5. Drawings: Prepared using AutoCAD R14, using Employer's specified drawing and layering conventions.

6. Shop Drawings: Prepared using same CAD software.

7. Mock-Ups: Where necessary to clarify design intent and obtain approvals, construct full scale mock-ups.

3.02 PROGRESS DOCUMENTATION

A. Progress Schedule: As specified in the Conditions of the Contract.

3.03 PERFORMANCE OF VALIDATION

A. In addition to the requirements stated in other sections, provide the following Validation of compliance at each stage of the project:

1. If a Validation requirement is specified without an indication of when it is to be submitted, submit or execute it before the end of Construction Documents.

B. Proven-In-Use: Where elements proven-in-use are used to comply with performance requirements:

1. In the Proposal, identify which elements will be accomplished using proven-in-use elements.

2. During Design Development, identify proven-in-use elements proposed for use, including building name, location, date of construction, owner contact, and description of design and materials in sufficient detail to enable reproduction in this project.

C. Proven-By-Mock-Up: Where elements proven-by-mock-up are used to comply with performance requirements:

1. In the Proposal, identify which elements will be accomplished using proven-by-mock-up elements.

2. During Design Development, identify proven-by-mock-up elements proposed for use, with test report including date and location of test, name of testing agency, and description of test and mock-up.

3. Mock-up testing need not have been performed specifically for this project, provided the mock-up is substantially similar in design and construction to the element proposed.

D. Design Analyses (including Engineering Calculations):

1. Where a design analysis or calculation is specified without identifying a particular method, perform analysis in accordance with accepted engineering or scientific principles to show compliance with specified requirements, and submit report that includes analysis methods used and the name and qualifications of the designer.

2. Where engineering design is allowed to be completed after commencement of construction, Validation may be in the form of shop drawings or other data.

3. Submit design analyses at the end of Design Development unless otherwise indicated.

4. Where design analysis is specified to be performed by licensed design professional, use a design professional licensed in Trinidad and Tobago.

E. Validation for Products:

1. Where actual brand name products are not identified by either the Employer or the Design-Builder, identify the products to be used.

2. In the Proposal:

    a. Identify one or more product types for each system, assembly, or element.

    b. For each product type, provide brief descriptive or performance specifications.

    c. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, identify at least one manufacturer that will be used.

3. During Preliminary Design or Design Development:

a. Where more than one product type is identified for a particular system, assembly, or element, identify exactly which type will be used.

b. For each product type, provide descriptive or performance specifications; early submittals may be brief specifications, but complete specifications are required prior to completion of construction documents.

c. For each product type, identify at least one manufacturer that will be used.

d. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, provide manufacturer's product literature on at least one actual brand name product that meets the specifications, including performance data and sample warranty.

4. During Construction:

    a. Identify actual brand name products used for every product, except commodity products specified by performance or description.

    b. Where a product is specified by performance requirements with test methods, and if so specified, provide test reports showing compliance.

    c. Provide manufacturer's product literature for each brand name product.

    d. Provide the manufacturer's certification that the product used on the project complies with the contract documents.

5. Before End of Closeout:

    a. Provide copies of all manufacturer warranties that extend for more than one year after completion.

F. Regardless of whether Validation is specified or not, the actual construction must comply with the specified requirements and may, at the Employer's discretion, be examined, inspected, or tested to determine compliance.

    1. Validation submittals will not be approved or accepted, except to the extent that they are part of documents required to be approved or accepted in order to proceed to the next stage of design or construction. However, approval or acceptance of Validation will not constitute approval or acceptance of deviations from the specified requirements unless those deviations are specifically identified as such on the submittal.

    2. The Employer accepts the responsibility to review Validation submittals in a timely

manner and to respond if they are unacceptable.

3.04 FIELD TESTING AND INSPECTION AS VALIDATION

A. Perform all testing, observation, and inspection required by code and as specified.

B. Reports: Written report of each test/inspection; including complete details of conditions, methods, and results, signed by responsible individual.

SECTION 103 – TRAINING

PART 1 GENERAL

1.01 SUMMARY

1.01 SUBMITTALS

A. See RFP Documentation and FIDIC Contract for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Team.

2. Submit one copy to the Commissioning Team, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Team.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Team in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

5. When the following are specified in individual sections, submit them at project closeout:

- Project record documents.
- Operation and maintenance data
- Warranties
- Bonds
- Other types as indicated

1.02 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those Design Build Contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

3. All training sessions are to be video recorded in a professional manner with the edited recordings submitted.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

SECTION 104 – HANDOVER DOCUMENTATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. RFP Documentation and FIDIC Contract - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 2370 – Handover Documentation

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to FIDIC Engineer __.

B. Operation and Maintenance Data:

1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. FIDIC Engineer will review draft and return one copy with comments.

2. For equipment, or component parts of equipment put into service during construction and operated by Employer, submit completed documents within ten days after acceptance.

3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with FIDIC Engineer comments. Revise content of all document sets as required prior to final submission.

4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Employer's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Addenda.
3. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by Employer.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Record Drawings: Legibly mark each item to record actual construction including:

1. Field changes of dimension and detail.
2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Sub-Design Build Contractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.

3. Include performance curves, with engineering data and tests.

4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants where required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Employer's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 216 by 280 mm three D side ring binders with durable plastic covers; 50 mm maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Engineer, Consultants, Design Build Contractor and subDesign Build Contractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible SubDesign Build Contractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Employer's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

SECTION 105 – COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Design Build Contractor's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Pre-functional Checklists executed by Design Build Contractor are utilized to achieve this.

2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Design Build Contractor and witnessed by the Commissioning Team/Team are utilized to achieve this.

3. Verify that operation and maintenance manuals submitted to Employer are complete: Detailed operation and maintenance (O&M) data submittals by Design Build Contractor are utilized to achieve this.

4. Verify that the Employer's operating personnel are adequately trained: Formal training conducted by Design Build Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Handover

C. The Commissioning Team directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Team's responsibilities.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:

C. HVAC System, including:

1. Piping systems and equipment.

2. Ductwork and accessories.

3. AHU, VAV and Terminal units.

4. Control system.

5. Sound control devices.

D. Exhaust and Ventilation:

1. Exhaust, Ventilation and Specialty fans.

E. Electrical Systems:

1. Uninterruptible power systems.

2. Emergency Generator and associated systems.

3. Grounding Systems

F. Electronic Safety and Security:

1. Security system, including doors and hardware.

2. Fire and smoke alarms.

G. Communications:

1. Voice and data systems.

2. Public address/paging.

H. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

I. Indoor Air Quality Procedures: The Commissioning Team/Team will coordinate; Design Build Contractor will plan and execute.

1.03 RELATED REQUIREMENTS

A. RFP Documents and FIDIC Contract Requirements

B. Section 2360 – Training

C. Section 2370 – Handover Documentation

1.04 REFERENCE STANDARDS

A. ASHRAE & CISBE- Sample Forms for Pre-functional Checklists and Functional Performance Tests;

B. Equipment Manufacturer's Forms for Pre-functional Checklists and Functional Performance Tests.

1.05 SUBMITTALS

A. See RFP Documentation and FIDIC Contract for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Team, unless they require review by FIDC Engineer; in that case, submit to Engineer first.

3. Submit one copy to the Commissioning Team/Team, not to be returned.

4. Make commissioning submittals on time schedule specified by Commissioning Team.

5. Submittals indicated as "Draft" are intended for the use of the Commissioning Team in preparation of Pre-functional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word preferred.

6. As soon as possible after submittals made to Engineer are approved, submit copy of approved submittal to the Commissioning Team.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to Engineer do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.

2. Manufacturer's installation instructions.

3. Startup, operating, and troubleshooting procedures.

4. Fan and pump curves.

5. Factory test reports.

6. Warranty information, including details of Employer's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Pre-functional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Employer.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.3 degree C and resolution of plus/minus 0.05 degree C.

2. Pressure Sensors: Accuracy of plus/minus two percent of the value range being measured (not full range of meter), calibrated within the last year.

3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Employer; such equipment, tools, and instruments are to become the property of Employer.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.

1. Dataloggers required to for Functional Tests will be provided by the Design Build Contractor and will not become the property of Employer.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Team has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Team Lead for purposes of completing the commissioning plan.

2. Require attendance and participation of relevant subDesign Build Contractors, installers, suppliers, and manufacturer representatives.

B. Design Build Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Basis of Design Documentation (BOD): Detailed documentation of the functional requirements of the project; descriptions of the systems, components, and methods chosen to meet the design

intent; assumptions underlying the design intent.

1. Basis of Design Documentation is to be prepared by the Design Build Contractor.

E. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Team within 60 days after award of Contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

3. Pre-functional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to Commissioning Team for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Team.

3.03 PRE-FUNCTIONAL CHECKLISTS

A. A Pre-functional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.

2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.

3. Pre-functional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:

a. Certification by installing Design Build Contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.

b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."

d. Serial number of installed unit.

e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.

f. Sensor and actuator calibration information.

4. ____ preliminary Pre-functional Checklists are included in the contract documents; the Commissioning Team has the authority to modify these and will furnish final versions as applicable.

B. Design Build Contractor is responsible for creating and filling out Pre-functional Checklists, after completion of installation and before startup; witnessing by the Commissioning Team is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Design Build Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Design Build Contractor shall assign responsibility to appropriate installers or subcontractors, Design Build Contractors, with identification recorded on the form.

4. If any Checklist line item is not relevant, record reasons on the form.

5. Design Build Contractor may independently perform startup inspections and/or tests, at his option.

6. Regardless of these reporting requirements, Design Build Contractor is responsible for correct startup and operation.

7. Submit completed Checklists to Commissioning Team within two days of completion.

C. The Design Build Contractor is responsible for furnishing the Pre-functional Checklists to Commissioning Team

1. Initial Drafts: Design Build Contractor is responsible for initial draft of Pre-functional Checklist where so indicated in the Contract Documents.

2. Provide all additional information requested by Commissioning Team to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.

3. Commissioning Team may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.

4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Team Witnessing: Required for:

1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.

2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Employer.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Team immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Design Build Contractor is responsible for execution of required Functional Tests, after completion of Pre-functional Checklist and before closeout.

C. Commissioning Team is responsible for witnessing and verifying results of Functional Tests. The Design Build Contractor is responsible for the preparation and completion of forms for that purpose.

D. Design Build Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Employer; if a deficiency is not corrected and re-tested immediately, the Commissioning Team will document the deficiency and the Design Build Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.

2. When the deficiency has been corrected, the Design Build Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Team; the Commissioning Team will reschedule the test and the Design Build Contractor shall re-test.

3. Identical or Near-Identical Items: If ten percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within two weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. Design Build Contractor shall bear the cost of Employer and Commissioning Team personnel time witnessing re-testing.

5. Design Build Contractor shall bear the cost of Employer and Commissioning Team personnel time witnessing re-testing if the test failed due to failure to execute the relevant Pre-

functional Checklist correctly; if the test failed for reasons that would not have been identified in the Pre-functional Checklist process, Design Build Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures maybe included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Team with input by and coordination with Design Build Contractor.

2. Examples of Functional Testing:

a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.

c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.

d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Team is Functional Testing.

3. Some preliminary Functional Test procedures maybe included in the contract documents; the Commissioning Team has the authority to modify these and will furnish final versions as applicable.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Design Build Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Employer beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Pre-functional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.1 degree C of each other, and for pressure, within tolerance equal to two percent of the reading, of each other.

4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 150 mm of the site sensor.

2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.

3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.

1. Disconnect sensor.

2. Connect a signal generator in place of sensor.

3. Connect ammeter in series between transmitter and building automation system control panel.

4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.

5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.

6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.

7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.

8. Reconnect sensor.

9. Make a reading with a calibrated test instrument within 150 mm of the site sensor.

10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.

11. If not, replace sensor and repeat.

12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: one percent of design.

2. Pressure, Air, Water, Gas: three percent of design.

3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.2 degree C.

4. Relative Humidity: four percent of design.

5. Barometric Pressure: 340 Pa.

6. Flow Rate, Air: ten percent of design.

7. Flow Rate, Water: four percent of design.

8. AHU Wet Bulb and Dew Point: 1.1 degrees C.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.

4. Command valve/damper to open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.

6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.

1. With full pressure in the system, command valve closed.

2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.

2. Sampling is not allowed for:

a. Major equipment.

b. Life-safety-critical equipment.

c. Pre-functional Checklist execution.

3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.

4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.

5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."

6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.

7. If YY percent of the units in the second sample fail, test all remaining identical units.

8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Team may stop the testing and require Design Build Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by Design Build Contractor; at the Commissioning Team's request, Design Build Contractor shall trend up to 20 percent more points than specified at no extra charge.

2. Other points will be monitored by the Commissioning Team using dataloggers.

3. At the option of the Commissioning Team, some control system monitoring may be replaced with datalogger monitoring.

4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.

5. Graphical output is desirable and is required for all output if the system can produce it.

6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 2370 Handover Documentation for additional requirements.

B. Add design intent documentation furnished by Engineer to manuals prior to submission to Employer.

C. Submit manuals related to items that were commissioned to Commissioning Team for review; make changes recommended by Commissioning Team.

D. Commissioning Team will add commissioning records to manuals after submission to Employer.

SECTION 204 – LANDSCAPING

1.0 GENERAL

1.01 DESCRIPTION

Work covers, in general terms: demolition, removals, site preparation and complete construction of the Project.

1.02 SCOPE

Landscape planting is inclusive but not limited to finished grading, supplying and spreading of soil, layout of plants and areas, seeding and sprigging of new lawns, ground cover plantings, shrub planting, tree planting, landscape edges.

1.03 PRODUCTS

All plants and turf material will conform to the varieties specified or shown in the Project Documentation and be true to the botanical name as listed in publications. 2) Substitutions shall only be made when a plant (or alternative as specified) is not obtainable and the Engineer authorizes a change order providing for use of the nearest equivalent obtainable.

1. **Plants:** shall be supplied from localities similar to the climatic conditions of the Project.

a) Plants to be used in the Works shall be well branched and formed planting stock. They shall be sound, vigorous and free from disease, sunscald, windburn, abrasions, harmful insects or eggs, and have a normal healthy and non-broken root system.
b) Symmetrically developed trees and shrubs shall be provided with uniform habit and shall be free from objectionable disfigurement.
c) Groundcover and vines shall be provided with the number and length of runners for the size specified.
d) Trees shall be earth balled and burlapped covered or pot grown.
e) Shrubs, vines and ground cover plants shall be provided in well established in removable containers or formed homogenous soil sections.
f) Palms shall have straight parallel sides and healthy stems that are not rotted, infected or eaten by pests or with root systems extending above the level which the palm was originally planted. Palms should have vigorous root system, a crown of new leaves, leaves the color of an adult palm and proper hardiness. Palms shall be balled and burlapped unless container grown palms are available. Off shoots are not acceptable.
g) The minimum acceptable sizes of all plants measured before pruning in normal position shall conform to the measurements specified in the Project Documentation. Plants larger in size than specified may be used with the approval of the Engineer, at no extra cost.
h) Container grown trees, shrubs, groundcover and vines shall have sufficient root growth to hold the earth intact when removed from the containers, but shall not be root bound. Containers shall be sufficiently rigid to hold ball shape and protect root mass during transporting.
i) A plant schedule is to be provided listing the designated plants and following information:
    - Botanical name
    - Common name
    - Size
    - Condition
    - Additional pertinent data

2. **Soil** :
Soil shall be free of foreign matter, toxic substances, weeds and any material or substance that may be harmful to plant growth. Material shall be stored in piles less than 1 meter high. Piles shall be protected from undue compaction and maintained free of contamination and construction debris. The soil shall comply with the following chemical criteria:
    a) PH value: between 5.5 and 7.2 for growing of grasses

3. **Soil Conditioners:**
    a. Peat shall be free from sticks, stones, roots, and other objectionable matter. It shall have a pH value of not less than 4 and nor more than 7.5. The minimum organic content shall be 85% on a dry weight basis. Peat shall be delivered in undamaged commercial bales in air dry condition.
    b. Manure shall be the decomposed animal manure of fully manure with minimum nitrogen, phosphoric acid and potassium percentage of 2-2-2 and a pH value of 6.0 to 7.5. Sludge waste product may be used as a substitute subject to approval of the Engineer. Manure and sludge shall be free of stones, sticks and non-bio-degradable material.
    c. Vermiculite shall be horticultural grade and free of any toxic material and conform to ASTM C516.
    d. Perlite shall conform to ASTM C 549.

4. **Planting Soil Mixture:** shall consist of approved soil, peat, manure and other soil conditioners as specified in the Project Documentation. The mixture shall be placed in accordance with the requirements of the trees, shrubs or grass to be planted and as per soil lab recommendation.

5. **Dry Plant Fertilizer**: shall be commercial grade and uniform in composition. Packets of slow release fertilizer shall bear the manufacturer's guaranteed statement of analysis. Control released fertilizer may be in packet or tablet form.

6. **Mulch**: shall be free of weeds, sticks and other deleterious material. Inert mulch material shall be crusher run rock, granite chips, marble chips or other suitable material approved by the Engineer. Organic mulch material shall be coco bean shell, shredded bark or other suitable material approved by the Engineer.

7. **Irrigation Water:** shall be provided from a source suitable for irrigation. Water shall be free from substances harmful to plant life. Water sources shall not exceed the following parameters:
    a. PH: 6 to 7
    b. Total dissolved solids: less than 1000 ppm

2.00 APPLICATION

Zones identified on the Site plan where grass or tree/ shrub plantings occur.

3.00 PREFERENCES
3.01 SUBMITTALS

Contractors shall submit for approval:
1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology
3. Window schedule

3.02 QUALITY ASSURANCE

1. Landscape work must be undertaken by an experienced subcontractor specializing in landscape work. Work shall be performed and supervised at all times by qualified personnel.

2. All landscape materials shall be shipped with certificates of inspection as required by the Engineer. Manufacturer's certified analysis for standard packaged products shall be provided.

3. Defective plant material shall be considered to be any tree, shrub or plant which is:

   a. Dead, dying or otherwise defective upon completion of the Works or six weeks after the first leafing out, whichever is later.
   b. Not in accordance with the Project Documentation.

4. Job Conditions:
   a. The Contractor shall proceed with and complete planting operations as rapidly as possible as portions of the Site become available, working within seasonal limitations for each type of landscape work required.
   b. No planting shall be carried out during periods of heavy rain and heavy winds. When special conditions warrant a variance to the planting time and conditions, a proposed planting schedule shall be submitted to the Engineer for review and approval
   c. Planting of trees and shrubs will occur prior to lawn plantings.

5. Transportation of plants: Prior to transporting, all plants shall be inspected, dug, and made ready for transit in accordance with standard practices and procedures. The Engineer shall be notified of the delivery schedule in advance so the plant material may be inspected upon arrival at the Site. All unacceptable plant material shall be removed from the Site immediately. The Engineer may request inspection at the source of the plants prior to delivery to the Site. The Engineer reserves the right to reject any plant material that does not meet the quality requirements of the Project Documentation. The Contractor shall protect plants to prevent damage to the root balls, containers or desiccation of leaves. Care shall be taken to avoid injury to the plants. Material shall not be dropped from vehicles. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball. Container grown plants shall be handled by the container. Plants shall not be handled by the trunk or stem.

6. Fertilizer, pesticides, fungicides, chemicals and seed shall be delivered to the Site in the original unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, or trademark. In lieu of containers, fertilizers and seed may be furnished in bulk and a certificate indicating the above information shall accompany each delivery. The fertilizer shall be kept dry and protected from contamination.

7. Storage:

   a. Plants shall be installed as soon as possible after delivery to the Site. Plant material shall be protected from exposure to wind and direct sunlight prior to installation. Plants not installed on the day of arrival shall be stored in shaded areas, protected from the wind and maintained and watered to good horticultural standards until planted. Care shall be taken to ensure that the plants do not dry out.
   b. Root balled and container grown trees and plants shall be placed close together with root balls covered with approved soil, peat or straw and kept medium moist until planted.
   c. Seed and fertilizers shall be kept in dry storage away from contaminants in areas as designated or approved by the Engineer.

d. Soil, compost, fertilizers and other amendments shall be delivered to the Site and stored separately in approved locations and in a manner to avoid contamination and wetting until soil mixing operations commence.
e. Fertilizers, antidessicants, pesticides and other chemicals shall be delivered to the Site in the manufacturer's unopened containers, each fully labelled, conforming to applicable regulations and bearing the trade name and warranty of the producer.

8. Site Preparation:
   a. The Contractor shall examine areas to receive landscaping for compliance with requirements and conditions affecting performance of work in this Section. The Contractor shall not proceed with plant operations until unsatisfactory conditions are discussed with the Engineer and corrected.
   b. The Contractor shall determine the location of above grade and underground utilities and perform work in a manner which will avoid 7 damage to them. Damage to underground utilities shall be repaired at the Contractor's expense.
   c. When conditions detrimental to plant growth are encountered, such as rubble, adverse drainage or obstructions, the Contractor shall notify the Engineer prior to planting.
   d. When grades are encountered that are detrimental to finished grading and planting operations, the Contractor shall notify the Engineer prior to planting.
   e. Sub-Surface Grading
      - All perennial weeds shall be treated with an approved herbicide and the period of time recommended by the manufacturer shall be allowed to elapse prior to commencing grading operations.
      - Grading operations shall occur when the sub-soil is reasonably dry and workable.
      - Areas to be graded shall be graded to smooth flowing contours with all minor hollows and ridges removed. Rock projections and boulders shall be removed and disposed of at a location as agreed with the Engineer.
      - Non-cohesive, light subsoil shall be loosened with a 3-tine ripper to a depth of 300 mm at 600 mm centers. Stiff clay and other cohesive subsoil shall be loosened with a single tine ripper to a depth of 450 mm at 1 m centers.
      - A minimum of 150 mm of approved soil shall be spread uniformly over the loosened area and incorporated into the sub-grade soil to obtain a uniform and well pulverized soil mix.
      - The area shall be compacted to a minimum of 90 % of maximum dry density as determined in accordance with Test 13 of BS 1377. 1.4.3 Finished Grading. Grades shall be brought to the finished ground levels as indicated on the Project Drawings or as agreed with the Engineer to a tolerance of ± 25 mm. finished ground levels shall be 30 mm below adjoining paving or kerbs after compaction and settlement.
      - Grading shall be carried out in such a manner that even gradients are formed between the spot levels indicated on the Project Drawings. No depressions shall remain which could collect standing water

9. Planting Operations and Layout:
   a. Plant material locations and planting bed outlines shall be staked two (2) days before any excavations are made. The Contractor shall notify the Engineer two (2) days before the start of planting operations. Plant locations may be adjusted by the Engineer to meet site conditions.
   b. Protection of Existing Vegetation :
      - Grassed areas that have been established prior to planting operations shall be covered before any excavations are made in a manner that will afford adequate protection.

- Existing shrubs, trees and groundcover shall be barricaded in a manner to protect them during planting operations.
- Plant pits shall be dug to produce vertical sides and flat incompact bottoms. Excavated material shall be disposed of in a proper manner. If approved by the Engineer, excavated material may be used as fill in areas where fill material is required. Upon completion of excavation, the pit shall be filled with water and then left to thoroughly drain prior to setting plants.

10. Backfill Mixture: Backfilling around plant shall be completed in 150 mm layers after water has drained away.

11. Guys and Stakes: plants shall be guyed or staked as required.

a. Trees 1.2 to 1.8 m tall shall be held in place with one (1) bracing stake. The stake shall be positioned close to the tree on the windward side. The stake shall be driven vertically into firm ground taking care not to injure the roots. The tree shall be held firmly to the stake with a double strand of wire. A chafing guard shall be used were the wire is in contact with the tree.

b. Trees 1.8 to 2.5 m tall shall be held in place with two (2) bracing stakes placed on opposite sides. The stake shall be driven vertically into firm ground taking care not to injure the roots. The tree shall be held firmly in place with a double stand of wire. Chafing guards shall be used where the wire is in contact with the tree.

c. Trees taller than 2.5 m shall be held firmly in place with three (3) guying lines of double strand wire placed equidistantly around the tree. The wire shall be anchored with ground stakes driven into firm ground outside the earth saucer. The wire shall be anchored to the tree at a point equal or greater than one half of its height. A flag shall be securely fastened to each guying wire.

12. Ancillaries To Planting :

a. Edging Plant Beds - Planting beds shall be uniformly edged, using a sharp tool to provide a clear cut division line between the planted area and adjacent area and to provide the required shape. The entire planted area shall be raked smooth while retaining the earth saucers. Edging materials shall be installed in accordance with the manufacturer's instructions.

b. Mulch shall be spread to a uniform depth of 100 mm no later than 48 hours after planting. Mulch should be kept out of lawn areas, crowns of shrubs and off paved areas and buildings.

c. Watering of Plants -The Contractor shall water the plants as necessary to maintain an adequate supply of moisture within the root zone and maintain healthy growth. The water shall be allowed to flow gently around the plant and shall not be delivered to cause disturbance to the roots or soil. Run-off, puddling and wilting shall be prevented. Earth saucers shall be rebuilt as needed to retain water.

d. Pruning - Immediately after planting, all plants are to be pruned as directed by the Engineer and in accordance with accepted horticultural practices. The total amount of foliage shall be pruned by one fourth to one third on the installed trees and shrubs to compensate for loss of roots and transporting shock.

e. Antidesiccant Application 1) Plants requiring additional protection against wilt and shock shall be sprayed with antidesiccant in accordance with the manufacturer's instructions.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement as applicable.

2. Clean Up and Site Restoration: Excess and waste material shall be removed daily. Pavements and work areas shall be kept in a clean and orderly fashion. Pedestrian access points and vehicular access points shall be maintained and kept clear at all times. All rubbish and litter shall be cleared as it accumulates within the landscape work area.
3. Application Of Pesticide :
    a. When pesticide becomes necessary to remove a disease or pest, a trained and certified operative shall apply the required pesticide in accordance with the recommendations of the manufacturer.
    b. Hydraulic equipment shall be provided for liquid application of pesticides with a leak proof tank, positive agitation methods, controlled application pressure and metering gauges.
    c. Prior to application the Contractor shall submit a pesticide treatment plan to the Engineer.

4.00 REFERENCED STANDARDS

1. ASTM C 516 Specifications for Vermiculite Loose Fill Thermal Insulation
2. ASTM C 549 Specification for Perlite Loose Fill Insulation

5.00 DURABILITY

Newly installed landscaping shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue a week until being handed over to the Engineer.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. When installing shrubs and trees, landscaping should have a warranty of 6 months, with care from the landscape installer.
2. Irrigation systems (if installed) should have a workmanship warranty of two years and a product warranty of 5 years.

SECTION 301- SITE SURVEY

1.0 GENERAL

1.01 DESCRIPTION

Site Surveys shall be detailed studies that verify or supplement site information or site appraisals that have been provided by the client or by Consultant teams on behalf of the client/Employer. The level of detail of Site Survey should directly correspond to project complexity. The Contractor may commission specialist consultants or agencies to carry out specific aspects of the site survey as determined and approved by the Client after initial feasibility studies.

1.02 SCOPE

Site Surveys may include one of multiple of the following:

1. Existing buildings (including valuation, measured surveys, structural surveys, structural inves tigations, condition surveys, and demolition surveys).
2. Geological and geotechnical Surveys
3. Topographical surveys
4. Environmental Surveys, including : Contamination, Ecological, Climatological, Flood inundation , air quality and Soil surveys
5. Traffic and transport.
6. Acoustic.
7. Photographic.
8. Historic use.
9. Boundary surveys.
10. Structural surveys (including retained structures, underground structures and obstructions).
11. Hazardous Materials surveys
12. Fire Life Safety Surveys/Reports
13. Utilities surveys, including: Telecommunications Surveys. Wireless networks and satellite reception Surveys, Electrical infrastructure and capacity Surveys, Gas network infrastructure and capacity Surveys, Sewage and drainage capacity Surveys, Existing water supply infrastructure and capacity.

2.00 APPLICATION

The project which is the subject of this Request for Proposals (RFP).

3.00 PREFERENCES

3.01 SUBMITTALS

a) Contractors shall give advance notification of all surveys to be undertaken to the Engineer.

b) Contractors shall submit all Survey drawings and comprehensive Survey reports (for all relevant surveys) with the following information:

1. Date of survey
2. Details of the specification being followed
3. Outline methodology
4. Equipment make, model, serial numbers and calibration certificates
5. Names of surveyors involved and roles
6. Site photography, details of quality control for site and processing work
7. Survey issues or difficulties encountered on site (i.e. omissions, access etc.)

c) Contractors shall submit Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

3.02 QUALITY ASSURANCE

1. The surveyor is responsible for ensuring that his/her staff are qualified, competent, appropriately insured and trained to do the tasks for which they are engaged. Relevant national or regional licenses, and memberships of other equivalent professional bodies is acceptable.
2. Contractor is responsible for ensuring all equipment is calibrated/verified and checked prior to use and maintained as such throughout the period of survey works, as well as ensuring it is fit for the survey purpose required.
3. Any foreseen constraints identified by the Contractor must be raised in writing to the client during the tender period. Where constraints are identified after commissioning of works these shall be communicated as soon as practicable to the client and agreement sought on resolution/impact.

3.03 SAFETY, SECURITY, OPERATIONS

1. The Contractor shall inform the client in advance of the proposed access dates required for surveys, so that the client may make arrangements with the owners/occupiers
2. The Contractor shall advise the client of any access restrictions or related issues which could have an impact on the survey requirements or deliverables as soon as practical, and ensure all reasonable steps are taken to reduce adverse impacts. The Client/Employer and Contractor shall agree on any actions to resolve identified access issues or provide explicit agreement on omission from the survey scope of areas proven to be inaccessible.
3. Contractor is responsible for the prevention of damage to property and/or the environment caused by his/her works or the actions of surveyors or employees under his/her direct control. Appropriate measures should be put in place to mitigate damage done to structures, underground utilities and to the environment by survey markings.
4. In cases where the surveyor has been supplied keys for access to normally locked areas and where no additional client security measures are in place, the Contractor shall be responsible for securing the areas being surveyed for the duration of the works.

SECTION 303 - DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

1.2 GENERAL REQUIREMENTS

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. Remove rubbish and debris from the project site; do not allow accumulations of resulting rubbish and debris. Store materials that cannot be removed daily in areas specified by the Contracting Officer. All demolition debris shall be removed from the island before Governments accept the building.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions; G

SD-07 Certificates

Demolition Plan; G

Deconstruction Plan; G

Notifications; G

Proposed demolition, and removal procedures for approval before work is started.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition projects to regional, and local authorities in accordance with 40 CFR 61, Subpart M.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.6 PROTECTION

1.6.1 Existing Conditions Documentation

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work.

Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 100 mm will be acceptable as a record of existing conditions.

1.6.2 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas.

1.6.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, the Government will disconnect and seal utilities serving each area of alteration or removal upon written request from the Contractor.

1.7 REQUIRED DATA

Prepare a Demolition Plan. Include in the plan procedures for careful removal and disposition of materials, coordination with other work in progress, a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

a. Remove existing structures and pier indicated to be removed to grade.

b. Demolish structures in a systematic manner from the top of the structure to the ground. Complete demolition work above each tier before the supporting members on the lower level are disturbed. Demolish concrete piles in small sections. Remove structural framing members and lower to ground by suitable methods as approved by the Contracting Officer.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.3 Concrete

Saw concrete along straight lines to a depth of a minimum 50 mm. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Remove concrete.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property and the Island. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3 CLEANUP

Remove debris and rubbish from excavations. Remove and transport in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.4 DISPOSAL OF REMOVED MATERIALS

3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other non-salvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Demolition Plan.

3.4.2 Removal from Government / Client Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government / Client property for legal disposal. Dispose of waste soil as directed.

-- End of Section --

SECTION 311 – FUNGUS/ TERMITE ERADICATION

1.0 GENERAL

1.01 DESCRIPTION

Fungus Eradication will refer to the elimination of molds and similar microbes. Termite Eradication will refer to treatment of ground nesting (subterranean) termites, and treatment of non-ground nesting termites.

1.02 SCOPE

Work to be completed under this section shall include all labour, equipment, plant and materials necessary to eradicate molds and microbes, and to eradicate both ground- nesting and non-ground-nesting termites.

Works may include:

1. For Mold and Microbe eradication in existing properties:
    a. Air filtration
    b. Containment of affected areas
    c. Demolition of affected areas that cannot be treated or restored
    d. Dehumidifying of air
    e. Application of detergents, disinfectants, Fungicidal agents

2. For Termite eradication:
    f. Application of Chemical termite control to soil and to foundation elements (subterranean termites)
    g. Inspection to locate termite infected areas within the building (if existing)
    h. Treatment of woodwork, masonry voids, electrical fixtures etc. (existing buildings)

1.03 PRODUCTS

1. For Mold and Microbe Eradication:
    a. **Air Filtration Units (AFU) :** Air filtration unit with High Efficiency particulate air (HEPA) filtered vacuum and / or exhaust ventilation equipment with a filter system capable of retaining 99.97 percent of particles 0.3 microns 1.2 by 10-6 inch or larger as indicated in UL 586. Discharge air from any AFUs located in the work area containment to the outside environment when creating a negative pressure containment to create a negative pressure relative to occupied areas of 5 pascals 0.02 inch H2O to 10 pascals 0.04 inch H20. Discharge air in excess of that required for creating the proper negative pressure to the work area. The AFUs shall provide four to six air changes per hour in the work area. Under no circumstances may air from AFUs discharge to an occupied area.
    b. **Dehumidifiers:** To maintain humidity below 60%
    c. **Fungicidal Agents:** A coating material that contains an EPA registered fungicide that inhibits the spread and growth of mold with the ability to withstand moist and humid conditions

    d. **Disinfectants or Biocide Sanitizing Solutions:** One of three groups of antimicrobials registered by the EPA for public health uses. The EPA considers an antimicrobial to be a disinfectant when it

destroys or irreversibly inactivates infectious or other undesirable organisms, but not necessarily their spores.

2. Personal protective Equipment (Mold and Microbe Remediation):

   Respirators as per Table 2 of EPA 402-K-01-001

   Disposable clothing: is recommended during a medium or large remediation project to prevent the transfer and spread of mold to clothing and to eliminate skin contact with mold.

   - Limited: Disposable paper overalls can be used.
   - Full: Mold-impervious disposable head and foot coverings, and a body suit made of a breathable material, such as TYVEK®, should be used. All gaps, such as those around ankles and wrists, should be sealed (many remediators use duct tape to seal clothing)

For Termite Eradication:

3. **Termiticides** – The Contractor shall be responsible for application of pesticides according to the product label. All pesticides used by the Contractor must be registered with the Environmental Protection Agency (EPA)

2.00 APPLICATION

1. Mold and Microbe Eradication: Not applicable for this project
2. For Termite Eradication: Subterranean treatment for termites at foundations as specified

3.00 PREFERENCES

3.01 ENVIRONMENTAL

1. Follow mold remediation guidelines presented in Table 1 of the EPA 402-K-01-001
2. Dispose of contaminated bagged waste materials removed during this remediation as general construction debris. Follow all applicable local statutory requirements for the disposal of this material.

3.02 TEMPORARY PROTECTION

Follow mold containment guidelines as presented in Table 2 of the EPA 402-K-01-001

3.03 SUBMITTALS

For Mold and Microbe Remediation:
1. Submit a job-specific, plan for final approval prior to start of work. The plan shall address the following items at a minimum:

   a. Description of materials to be remediated, providing location and quantities (map if available), and methods to be used for remediation.

   b. Types of biocides and fungicidal agents, (EPA).

c. Containment procedures to include description and locations of engineering controls and decontamination unit to include entry and exit procedures (provide sketch of floor plan showing location of containment barriers and decontamination units).
Plan shall include locations of AFUs and AFU discharges to the outside.
d. Description of personal protective equipment to be used during the remediation.
e. Construction barricades and barriers in occupied areas.
f. HVAC Shut down and start-up procedures.
g. HVAC Evaluation and remediation procedures.
h. Moisture and relative humidity control procedures and equipment.

1. For Termite treatments:
Prior to commencing application of termiticide, submit a Termiticide Application Plan addressing the following items:
   a. Proposed sequence of treatment work including dates and times of application
   b. Termiticide trade name
   c. Epa registration number
   d. Chemical composition
   e. Concentration of original and diluted material
   f. Formulation
   g. Manufacturer's recommended application rates
   h. Regional requirements
   i. Area or volume to be treated
   j. List of equipment to be used

3.04 QUALITY ASSURANCE

For Mold and Microbe Remediation:

1. Clearance Criteria Clearance will be based on visual assessment (all visible mold removed, all visible dust removed, based on a "white glove" test) . "White glove" test shall consist of wiping the surface with a clean cloth of color suitable to reveal expected type of dust. For most surfaces, a white cloth is suitable. For GWB dust, a dark cloth may be more appropriate. b. Failed remediation areas will be re-cleaned and the AFUs kept in operation another 12 hours, followed by another visual assessment. Subsequent failures will follow the same routine until a pass condition is secured.

For Chemical Termite Control:

2. Submit a list of equipment to be used. Conduct calibration test on the application equipment to be used immediately prior to commencement of termiticide application. Measure the volume and contents of the application tank. Testing must confirm that the application equipment is operating within the manufacturer's specifications and meets the specified requirements. Submit written certification of the equipment calibration test results within 1 week of testing.

3.05 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement. Safety Precautions to include lockout / tag-out, fall protection, confined space entry procedures, and fire protection. Description of the method to be employed to control cross contamination of areas not in the work area shall be included. A risk assessment related to the suitability of people to occupy areas adjoining the remediation area while remediation activities are ongoing shall be included.

1.00 REFERENCED STANDARDS

1. EPA 402-K-01-001: Mold Remediation in Schools and Commercial Buildings
2. UL 586 Standard for High-Efficiency Particulate, Air Filter Units

5.00 DURABILITY

1. Life expectancy for chemical termite barriers shall be no less than 5 years.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. The contractor shall guarantee that all work performed related to mold and microbe remediation under this contract to be free from defects in all materials and workmanship for a period of 12 months from the date of final acceptance (substantial completion).

2. Termite treatment: Include in the warranty against infestations or re-infestations by subterranean termites annual inspections of the buildings or building additions during the warranty period. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim:
    a. Retreat the site and perform other treatment as may be necessary for elimination of subterranean termite infestation;
    b. Repair damage caused by termite infestation; and
    c. Re-inspect the building approximately 180 days after the re-treatment

SECTION 400 - EARTHWORKS

PART 1.0 - GENERAL:

1.1 Description

1.1.1 General: Furnish all labor, materials, equipment and services required to complete all work as specified herein indicated, and/or shown on the drawings.

1.1.2 Work includes but is not limited to:

1. Site Preparation
   a. Stripping of top soil
   b. Removal and disposal of unsuitable materials

2. Excavations including excavation and hauling from borrow pits.

3. Compaction at 6" finished per layer

4. Subgrade Finishing

1.1.3 Standards: Except as modified by governing codes and by contract documents, comply with the provisions and recommendations of the following:

1. American Society for Testing and Materials (ASTM)

PART 2.0 - PRODUCTS:

2.1 Materials

2.1.1 General: Materials to be used for the project shall be free from debris, wood, refuse, unsound particles or objectionable matters.

2.1.2 Selected Fill: Fill shall be sand, gravel, friable earth or lean clay of low plasticity subject to approval of the Testing Laboratory.

For structures and under footing or concrete slab on grade shall conform to the general requirements for soil materials and shall be classified as GW, GM, GP, SW, SM by the ASTM D2487 and conforming to the following:

a. Liquid Limit shall not exceed 25% when tested in accordance with ASTM D 4318.
b. Plasticity Index - shall not exceed 12% when tested in accordance with ASTM D 4318.
c. CBR Value >= 30% (Blue Limestone Crusher-run or Quarry Fill/Spoil or Pitrun).
d, Lift should be no greater than 6" per layer compacted to 95% MDD

Potentially expansive soil (CH/MH) presents at site and must be removed underneate all structures. If to be used as fill this shall be under at least min. 3.0m high backfill of **Non Plastic Fill Material**:

2.1.3 Granular Fill: Shall conform to the general requirements for soil materials above and shall be clean, crushed stone or gravel conforming to ASTM C33.

2.1.4 Borrow Fill: If additional material is required for fill in excess of that obtained from excavation, obtain same from sources to be tested, and approved by independent Testing Laboratory and acceptable to the Engineer.

PART 3.0 - CONSTRUCTION REQUIREMENTS:

3.1 Site Preparation

3.1.1 Stripping: All areas of excavation shall be stripped of all vegetation, debris, organic materials, and unsatisfactory materials in accordance with field layout to a minimum of 8” or 200mm.

a. Topsoil shall be hauled and stockpiled to a designated area for later use by the landscaping contractor or agriculturist.

b. Unsatisfactory materials shall be disposed off site or as directed by Owners Representative at contractor's expense.

c. All exposed subgrade shall be subjected to two ironing passes to seal the subgrade. Temporary drainage slopes shall be induced draining into temporary ditches and drains.

3.1.2 Compaction Requirement: Subgrade and fill materials shall be compacted with acceptable equipment to achieved the specified percentage of maximum density at optimum moisture as determined by ASTM D698 or ASTM D-1557.

Contractor shall undertake trial compaction works to determine most the suitable equipment and procedure for compaction.

3.1.3 Excavation:

1. General: Excavation for all works shall be to lines, grades and dimensions shown on the drawings. Keep excavations free of water while construction is in progress.

2. Excavated materials, which are not suitable, for fill shall be disposed off the site in dumps to be provided by contractor.

3. All excavations > 1.50m shall be shored to ensure safety. Shorings shall be designed by Contractor’s Registered Engineer by BOETT or equivalent.

3.1.4 Filling and Backfilling:

1. This work shall consist of furnishing, placing and adequate compaction of suitable materials of acceptable quality in accordance with specification, to the lines, grades and dimensions shown on the drawings and as required by the Engineer.

2. Placement of backfilling materials shall be not exceed 200mm thick compacted to minimum compaction requirement. Quality of compaction shall be monitored by FIELD DENSITY TEST (FDT).

3. All areas to be filled shall be inspected by the Owner's Representative prior to placing of fill materials and tested for adequacy of compaction.

3.2 Quality Control

3.2.1 The following tests shall be performed by an Independent Testing Laboratory approved by the owner/engineer to determine the suitability of materials for the project. The results of these tests are final and binding to all parties.

	Tests	**Test Procedure**	**Frequency**
1.	Liquid Limit, Plastic Limit and Plasticity Index	ASTM D 4318	One (1) test for each type of material required.
2.	Fill Classification	ASTM D 2487	One (1) test for each type of fill.
3.	Field Density Test	ASTM D 1556	One (1) test for every 300 sq.m. of lift at random locations directed by the Engineer, but in no case less than three (3) tests per lift. One (1) test for every footing subgrade and backfill.
4.	Moisture Density Relationship	ASTM D 698	One (1) test for each Density type of soil. Compaction shall be 95% MDD.
5.	Moisture Density Relationship	ASTM D 1557	One (1) test for each Density type of soil. Compaction shall be 95% MDD.

3.3 Protection of Existing or New Facilities

3.3.1 Exercise particular care when excavating in the vicinity of existing structure or those under construction. The contractor shall be entirely responsible for the strength and adequacy of all bracing's and shoring and for the safety and support of such construction for any movement, settlement and damage.

3.3.2 Provide barricades, warning lights, signs and other control activities adjacent to all excavation both internal and at perimeter of construction site.

3.4 Environmental Protection

3.4.1 Contractor shall preserve and protect all trees and vegetation not identified for removal or destruction.

3.4.2 Contractor shall strip and grub only the area it can finish in a day and subject this to ironing passes and drainage slopes construction at the end of each working day.

3.4.3 Careless dumping of spoils is not allowed and contractor shall only dispose in areas designated by the Owner or outside the property.

3.4.4 All tree stumps, organic materials, roots, etc., encountered in excavation shall be completely removed at no cost to the owner before backfilling.

SECTION 501 – IN SITU CONCRETE (GENERAL)

1.0 GENERAL

1.01 DESCRIPTION

In- situ Concrete refers to concrete work which is carried out on the construction site itself, often in the finished position, as opposed to in an off- site location (as with pre- fabrication or pre-assembly techniques). Concrete shall be composed of the following: Portland cement, coarse aggregates such as crushed stone, fine aggregates such as sand, and water.

1.02 SCOPE

Work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install. All poured-in-place concrete, together with all miscellaneous and appurtenant items, as shown on the architectural and structural plans specific to the project. The work shall include, but not be limited to supplying and placing reinforcing steel; and supplying, placing, vibrating, heating and curing concrete.

1.03 PRODUCTS

In situ concrete shall include a combination of the following products / elements:

1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
    a. Portland Cement shall be fresh stock of an approved standard brand meeting the requirements of ASTM C 150, Standard Specification for Portland Cement.
    b. Fly Ash shall have a high fineness and low carbon content and shall exceed the requirements of ASTM C 618, Class 7 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
2. Concrete Aggregates:
    a. Unless otherwise specified all aggregate shall be normal weight aggregate in accordance with ASTM C 33, Standard Specification for Concrete Aggregates.
    b. Aggregate for concrete shall consist of clean crushed stone or gravel having hard, strong, uncoated particles free from injurious amounts of soft, thin, elongated or laminated pieces, alkali, organic or other deleterious matter.
    c. Maximum aggregate size shall be ¾-inch. The maximum permissible percentage of elongated particles shall not exceed 5 percent by weight.
    d. Provide aggregates from a single source.
    a. Concrete batched away from the job and delivered in mixer or agitator trucks shall conform to requirements of ASTM C94, Standard Specification for ready-mixed concrete.
3. Fine Aggregate:
    a. Shall consist of sand, stone screening, or other inert materials with similar characteristics having clean, strong, durable, uncoated grains and free from lumps, soft or flaky particles, clay, shale, alkali, organic matter or other deleterious substances with reactivity to alkali in cement.
4. Water:
    a. Shall be potable water in accordance with ASTM C94, Standard Specification for ready-mixed concrete.

5. Flexible PVC water stops:
    a. Provide PVC water stops in all construction joints in concrete walls and in concrete beams and slabs. PVC water stops shall also be provided between concrete beams and slabs at all expansion joints to form a continuous diaphragm. Install in longest lengths practicable.
    b. Support and protect exposed water stops during progress of the Work.
    c. Field fabricate joints in water stops according to manufacturer's written instructions.
6. Vapour Retarders:
    a. Sheet Vapour Barrier shall be minimum 10 mil polyethylene film that complies with ASTM C171, Standard Specification for Sheet Materials for Curing Concrete, and meets or exceeds test for water retention, ASTM C 156(20), Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
    b. Place, protect, and repair sheet vapour retarder according to ASTM E1643, Standard Practice For Selection, Design, Installation, And Inspection Of Water Vapour Retarders Used In Contact With Earth Or Granular Fill Under Concrete Slabs, and manufacturer's written instructions.
7. Crushed Stone Fill:
    a. Crushed Stone Fill shall be uniform 1-inch stone, no fines, in conformance to ASTM C33, Standard Specification for Concrete Aggregates.
8. Formwork:
    a. Shall be designed in accordance with ACI 347, Recommended Practice for Concrete Formwork, (latest edition) unless otherwise noted.

2.00 APPLICATION

Cast- in- Place concrete construction may apply to the following building elements:

1. Exterior Concrete.
2. Footing and Piers.
3. Slabs on Grade.
4. Columns.
5. Slabs above ground floor.
6. Concrete Beams.

3.00 PREFERENCES

3.01 DESIGN

1. Class and Finish of supported slabs on grade shall be Class 2 as per ACI 302.1R.
2. Recommended strength and maximum slump at point of placement for concrete floors shall be as according to Table 6.1 as per ACI 302.1R.

3.02 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology.

3. Drawings detailing the work to be done. Such drawings shall be furnished by a licensed Engineer. Examples of such include.
    a. Foundation Plan – fully dimensioned, foundation schedule and details, wall sections, mechanical pad details, and related miscellaneous details. All details, plans and sections shall show reinforcing. 2. Pier Details and Pier Schedule.
    b. Necessary Floor Plans – fully dimensioned plans with all depressions, rises, reinforcing steel, to include placement and accessories.
    c. Miscellaneous Items – All other reinforced concrete items shall be drawn at such scale as to give full dimensions, details and reinforcing with accessories as required.

3.03 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his representative.
3. The Contractor shall submit a schedule of his activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.04 SAFETY, SECURITY, OPERATIONS

4. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.

4.00 REFERENCED STANDARDS

1. ACI 318 – Building Code Requirement for Reinforced Concrete.
2. ACI 301 – Specifications for Structural Concrete for Buildings.
3. ACI 305 – Recommended Practice for Hot Weather Concreting.
4. ACI 347 – Recommended Practice for Concrete Formwork.
5. ACI 302 – Guide to Concrete Floor and Slab Construction.
6. ASTM C150 – Standard Specification for Portland Cement.
7. ASTM C618, Class 7 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
8. ASTM C33 – Standard Specification for Concrete Aggregates.
9. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
10. ASTM C156-20 – Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
11. ASTM E1643-18a – Standard Practice For Selection, Design, Installation, And Inspection Of Water Vapour Retarders Used In Contact With Earth Or Granular Fill Under Concrete Slabs.
12. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic,

excluding joint sealers.

2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Cast in Place concrete works shall have a warranty for a period of one year against faulty workmanship including: installation defects, cracking and settling. The warranty excludes discoloration or efflorescence of concrete based materials, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 502 - CONCRETE FORMWORKS

PART 1.0 - GENERAL:

1.1 Description

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1.1.1 SCOPE

a. Furnish materials and equipment and perform labor required to complete the work.
b. All work shall be done in accordance with the minimum requirements of the American Concrete Institute Building Code for reinforced concrete ACI 318-08 or latest except as modified herein.
c. Forms - shall be built with sufficient strength and rigidity to resist and carry the mass and pressure of concrete during placement and consolidation. Forms shall be free of bulge and warp.
d. All formed surfaces for Concrete shall be true to finish and must be smooth. Mortar patching shall not be allowed. Provide Phenolic resin form plywood or equivalent for exposed concrete to assure smooth finish.

1.2. PROTECTION

a. Provide adequately braced forms that will produce correctly aligned concrete, able to meet the specific weights and size pressure of newly placed concrete.
b. Choose form fittings that are adequate for the purpose.
c. Exercise care in the choice of surface forms and form fittings that will be in contact with concrete.

1.1.2 Work includes but is not limited to:

1. Construction of footing, grade beam, wall footing, pedestal column, slab-on-grade; super structure column, beams, girder, slab (if concrete frame/superstructure) etc.
2. Construction of ramp, walkway, roadway and parking pavement (if applicable) etc.

1.1.3 Standards

Except as modified by governing codes and by contract documents, comply with the provisions and recommendations of the following:

1. American Concrete Institute (ACI)
2. American Society for Testing and Materials (ASTM)

PART 2.0 - PRODUCTS:

2.1 Materials

2.1.1 Use minimum 5/8" plywood, or surfaced lumber forms where it will be given the most advantageous in the specific concrete work involved. It should be free from warp and grass deformities sufficiently braced with solid lumber and applied with form released agent at its casting surface before each casting.

PART 3.0 - CONSTRUCTION REQUIREMENTS:

3.1 FORMS

a. Check all forms to the shape, lines, and dimensions of the member as called for in the plans.
b. Check all formwork for plumbness , correct alignment and twist.

c. Cast all forms with form oil before reinforcement is placed. Remove all surplus oil on form surfaces.

3.2 FORMS & SHORING (REMOVAL)

Remove forms only upon approval of the Engineer in such manner and at such time as to ensure the complete safety of the structure in no case shall the supporting forms and shoring be removed until the members have attained sufficient strength to safely support weight and load thereon. The result of suitable control has attained sufficient strength to permit removal of shoring and supporting forms. Cylinders required for control test shall be made in addition to those required by this specifications.

3.3 TOLERANCE LIMITS

Set and maintain concrete form so as to insure completed works within the following tolerance limits.

1) Variations

a. In the line and surface of columns, walls, and rise

In 10 feet ..... 1/4 inch

In any storey or 20' max..... 3/8 inch

b. For exposed corner columns, control joints, grooves and other conspicuous lines

In anyway 20' or more…….1/4 inch

In 40' or more .....1/2 inch

2) In variation of the level from the grade indicated on the drawings.

a. In floors (before removal of forms, ceiling, soffits and rises)

In 10 feet .....1/4 inch

In anyway or 20 max ……..3/8 inch

For 40' or more .....3/8 inch

b. For exposed girts, fascia, horizontal grooves and other conspicuous lines

In anyway or 20' max ....1/4 inch

In 40 or more .....1/2 inch

3.) Footings

a. Variations of dimension in plan

Minus .....1/2 inch

Plus .....2 inches ;

(applies to concrete only and not to reinforcing bars and dowels)

4) Variation in steps if there is stair

a. In a flight of steps

Rise..... 1/8 inch

Tread ..... 1/4 inch

b. In consecutive steps

Rise ..... 1/16 inch

Tread ..... 1/8 inch

SECTION 503 - CONCRETE REINFORCEMENT

PART 1.0 - GENERAL:

1.1 Description:

1.1.1 General: Provide all labor, materials, equipment, transportation and services required to complete all work as specified herein, indicated, and/or shown on the drawings.

1.1.2 Work includes but is not limited to:

1.1.2.1 Provision of all concrete reinforcement.

1.1.3 Standards: Except as modified by governing Codes and Contract Documents comply with the applicable provisions and recommendations of the following:

1. American Concrete Institute (ACI)
2. American Society for Testing and Materials (ASTM)

PART 2.0 - PRODUCTS:

2.1 Materials:

2.1.1 Reinforcing Bars

a. Deformed Bars, Grade 60 conforming to ASTM A-615
b. Welded Wire Fabric shall conform to ASTM A185. Shall be lapped two full mesh panels and tied securely.

2.1.2 Accessories

1. Accessories for proper installation of reinforcement shall conform to ACI 318-77 "Building Code Requirements for Reinforced Concrete" and/or manual of Standard Practice for Reinforced Concrete Construction.

PART 3.0 - CONSTRUCTION REQUIREMENTS:

3.1 Installation:

3.1.1 General: All reinforcement bars, stirrups, wire fabrics and other reinforcing materials shall be provided as indicated or required by this specification, together with the necessary accessories to install and secure the reinforcement properly. All reinforcement, when placed, shall be free from rust, oil, grease, clay and other deleterious matters that would reduce or destroy the bond.

3.1.2 Reinforcing steel shall be placed accurately and securely.

3.1.3 Splicing of reinforcement shall be in accordance with ACI 318, except as indicated otherwise or modified herein. Staggered where possible.

3.1.4 Coordinate with other trades and properly place and locate in position all necessary reinforcement, dowels, anchors, inserts, metal ties and other fastening devices required.

3.2 Quality Control:

All reinforcement shall be tagged and temporarily stored in proper manner upon arrival at site and shall not be used before deformation have been measured and until tensile and bend test have been performed and reviewed by an approved Independent Testing Laboratory.

1. One (1) tensile test and one (1) bend test of each size per 5,000 kilograms or portion thereof but not less than 1 test for any batch delivery.

2. Test field placement by physical measurement of sizes and spacing after placement.

3. Provide additional testing as directed for reinforcing steel. Allow 20 percent additional tensile and bend tests.

4. Contractor shall submit Mill Certificates to verify and check if the proposed materials conform to specification.

SECTION 601 – BLOCK WALLING

1.0 GENERAL

1.01 DESCRIPTION

Block Walling shall incorporate the construction process of a wall composed of Concrete Masonry Units and other elements that comprise the wall. Walls are to be constructed in such a manner so as to provide fire resistance and security to the spaces enclosed therein.

1.02 SCOPE

Block Walling as pertaining to the project shall include all labour, equipment, plant and materials necessary to furnish and install:

1. Interior walls:
    a. Non-load bearing
    b. Load bearing
2. Exterior walls:
    a. Non-load bearing
    b. Load bearing

1.03 PRODUCTS

Block Walling may include a combination of the following products/ elements:

1. Concrete masonry units
    a. Hollow concrete masonry units shall be in accordance with ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units
    b. The manufacturer shall certify that the masonry units meet all requirements of specified standards as specified hereinafter.
2. Vent blocks
    a. Vent blocks shall be supplied by a manufacturer and approved by the Engineer.
3. Mortar and grout
    a. Mortar shall be strictly in accordance with ASTM C270 – Standard Specification for Mortar for Unit Masonry and shall be used for laying masonry units.
    b. Grout shall be used for filling the cores of masonry units in the manner specified hereinafter or as directed by the Engineer.
4. Joint reinforcement
    a. Joint reinforcement to comply with: ACI 530.1/ ASCE 6-02/ TMS 602-02 – Specification for Masonry Structures.
5. Vertical reinforcement
    a. All vertical reinforcing steel shall be plain bars conforming to ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
6. Horizontal reinforcement
    a. Unless otherwise specified, horizontal reinforcement shall be provided at every third course in masonry walls

b. Reinforcement shall consist of an approved welded wire mesh cut to match the thickness of the wall with at least two wires in longitudinal direction or brick force.

c. Lateral ties between two bars shall be at maximum 400mm centres.

d. The mesh shall be laid continuously in mortar bed with laps not less than 300mm.

e. Specifically fabricated L- and T-junctions shall be provided at wall intersections.

7. Lintels

   a. Install lintels over openings

   b. Bearing: to comply with engineers calculations

8. Control and expansion joints (define)

   a. All electrical instrumentation, piping and other embedded items or conduits, etc., shall not be installed until the mortar and grout have attained their specified strength, unless these are installed simultaneously with the construction of the wall.

   b. Vertical conduits shall be placed in unoccupied cells and horizontal conduits shall be placed approximately at the centre of a block height.

   c. Cutting of walls shall be done in a manner that will prevent damage or weakening to the wall that may affect its structural stability and appearance.

   d. Damage to or cutting of vertical reinforcing steel shall not be permitted.

   e. All cut areas in walls shall be repaired with mortar and finished flush with the face of the wall.

   f. Where the wall is to be finished fair-faced, conduits shall be installed simultaneously with the construction of the wall.

9. Wall anchorage

   a. A Masonry walls shall be anchored to all floors, roofs, columns, walls, etc. which provide lateral support for the walls as directed by the Engineer.

   b. Masonry walls that meet or intersect shall be bonded or anchored to each other by interlocking of masonry units from each wall. The intersection points of walls shall be reinforced as specified by the Engineer.

10. Fair Faced Block work

    a. Where block walls are required to be finished fair-faced, masonry unit shall be consistent in colour and texture.

    b. Masonry units shall be free form chips, cracks and other defects. All units with such defects shall be rejected. Making good with mortar shall not be permitted.

    c. All horizontal and vertical joints shall be uniform in depth, thickness, colour and properly aligned.

    d. All cuts in masonry units shall be sawed. Rough cutting made good with mortar shall not be permitted.

    e. After installation, all units shall be free from mortar on exposed surfaces.

    f. All surfaces of exposed block work shall be rubbed so as to expose a smooth surface.

2.00 APPLICATION

1. Interior wall partitions.
    a. Partitions providing vertical separation between adjacent spaces on the interior of the building.
2. Exterior walls.
    a. Partitions providing vertical separation between exterior and interior space and which exclude: uninvited people, animals, insects; weather.
3. Where block walling elements also function as elements defined within another element group, they must meet the requirements of both groups.

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

13. Materials listing and certification indicating that products adhere to standard specifications.
14. Installation methodology

3.03 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his representative.
3. The Contractor shall submit a schedule of his activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

5. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units
2. ASTM C270 – Standard Specification for Mortar for Unit Masonry and shall be used for laying masonry units.
3. ACI 530.1/ ASCE 6-02/ TMS 602-02– Specification for Masonry Structures.
4. ASTM A615– Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
5. IBC 2018 CHAPTER 2100 - Masonry

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Block wall shall have a warranty for a period of one year against faulty workmanship including: installation defects, breakage and settling. The warranty excludes discoloration or efflorescence of concrete based materials, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 701 – STRUCTURAL STEEL FRAMING

1.0 GENERAL

1.01 DESCRIPTION

Structural steel framing incorporates internal and external vertical and horizontal elements that are formed by a system of structural beams and columns.

1.02 SCOPE

Structural steel framing incorporates work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install. The work shall include, but not be limited to instillation of steel members; beams, columns and necessary connections.

1.03 PRODUCTS

Structural steel framing shall include a combination of the following products / elements:

1. Steel columns and beams:
    a. Steel pipes to comply with: ASTM A53 Standard Specification for pipe, steel, black and hot-dipped, zinc – coated, welded and seamless.
    b. Steel hollow structural section to comply with: ASTM A500 Standard Specification for cold – formed welded and seamless carbon steel structural tubing in rounds and shapes.
2. Steel connections:
    a. Steel structural wide flange shapes to comply with: ASTM A992 Standard Specification for structural steel shapes.
    b. Steel bolts to comply with: ASTM A307 Standard Specification for carbon steel bolts, studs and threaded rod 60 000 PSI tensile strength.
    c. Steel nuts to comply with: ASTM A563 Standard Specification for carbon and alloy steel nuts.
    d. Steel plates to comply with: ASTM A36 Standard Specifications for carbon structural steel.

2.00 APPLICATION

Structural steel framing may apply to the following building elements:

1. Exterior structural framing:
    a. Metal roof framing.
2. Internal structural framing:
    a. Internal load bearing walls.
    b. Elevator systems.
    c. Stair cases.

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology.
3. Drawings detailing the work to be done. Such drawings shall be furnished by a licensed Engineer.

3.02 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.

4.00 REFERENCED STANDARDS

1. ASTM A53 – Standard Specification for pipe, steel, black and hot-dipped, zinc – coated, welded and seamless.
2. ASTM A500 – Standard Specification for cold – formed welded and seamless carbon steel structural tubing in rounds and shapes.
3. ASTM A992 – Standard Specification for structural steel shapes.
4. ASTM A307 – Standard Specification for carbon steel bolts, studs and threaded rod 60 000 PSI tensile strength.
5. ASTM A563 – Standard Specification for carbon and alloy steel nuts.
6. ASTM A36 – Standard Specifications for carbon structural steel.

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers.
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Structural steel framing shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 802 – CURTAIN WALLING

PART 1GENERAL

1.1 SECTION INCLUDES

A.Extruded aluminum curtainwall.

B.Extruded aluminum doors and windows.

1.2 REFERENCES

A.American Society of Civil Engineers (ASCE):

1.ASCE/SEI 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B.American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

1.ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C.ASTM International (ASTM):

1.ASTM A 36 - Standard Specification for Carbon Structural Steel.
2.ASTM A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3.ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4.ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
5.ASTM A 1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
6.ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7.ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
8.ASTM B 308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
9.ASTM B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
10.ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
11.ASTM C 1184 - Standard Specification for Structural Silicone Sealants.
12.ASTM C 1401 - Standard Guide for Structural Sealant Glazing.
13.ASTM D 2000 - Standard Classification System for Rubber Products in Automotive Applications.
14.ASTM D 2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
15.ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
16.ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through

Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

17. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
18. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
19. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
20. ASTM E 1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
21. ASTM E 1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation.
22. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
23. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
24. ASTM E 1998 - Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances.
25. ASTM F 1642/GSA TS01 - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings.

D. Builders Hardware Manufacturers Association (BHMA):

1. BHMA A 156.1 - American National Standard for Butts and Hinges.
2. BHMA A 156.3 - American National Standard for Exit Devices.
3. BHMA A 156.4 - American National Standard for Door Controls-Closers.
4. BHMA A 156.5 - American National Standard for Cylinders and Input Devices for Locks.
5. BHMA A 156.6 - American National Standard for Architectural Door Trim.
6. BHMA A 156.8 - American National Standard for Door Control - Overhead Stops and Holders.
7. BHMA A 156.16 - American National standard for Auxiliary Hardware.
8. BHMA A 156.21 - American National standard for Thresholds.

E. Glass Association of North America (GANA).

F. International building code (IBC).

G. National Fenestration Rating Council (NFRC):

1. NFRC 100 - Procedure for Determining Fenestration Product U-Factors.
2. NFRC 500 - Procedure for Determining Fenestration Product Condensation Resistance Values.

H. National Fire Protection Association (NFPA):

1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

I.Society of Protective Coatings (SSPC).

J.Structural Engineering Institute (SEI).

K.United States General Services Administration (GSA).

L.Underwriters Laboratories (UL):
1.UL 305 - UL Standard for Safety Panic Hardware.

1.3 SUBMITTALS

A.Product Data: Manufacturer's data sheets on each product to be used, including:
1.Preparation instructions and recommendations.
2.Storage and handling requirements and recommendations.
3.Product testing reports.
4.Installation methods.
5.Maintenance data.

B.Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1.Include coordinated dimensions for equipment and furnishings specified in other Sections.
a.Moisture draining provisions.
b.Expansion and contraction provisions.
c.Flashing.

C.Delegated Design Submittal: Shop drawings complying with performance requirements and design criteria. Signed and sealed by professional Engineer licensed in Project location.

D.Verification Samples: For each finish product specified, two samples, representing actual product, color, and finish.

E.Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F.Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment, cleaning and maintenance.

1.4 QUALITY ASSURANCE

A.Manufacturer Qualifications: Five years or more experience in manufacture of laboratory casework and equipment of type specified.

B.Installer: Five years or more experience with installation of similar products, and acceptable to the manufacturer.

C.Mock-Up: Provide a mock-up for evaluation of fabrication techniques and application workmanship.
1.Install in areas designated by Architect.
2.Do not proceed with remaining work until installation is approved by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A.Store products in the manufacturer's unopened packaging until ready for installation.

B.Protect finished surfaces from soiling or damage during handling and installation.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty for against breakage, corrosion, and delamination under normal conditions.
   1. Warranty Duration: 6 years.

PART 2PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in location of Project, for design of glazed curtain wall.

B. Comply with performance requirements specified, determined by testing of systems representative of Project without failure. Withstand supporting structure movements including, but not limited to, story drift, twist, column shortening, long-term creep, and distributed and concentrated load deflections.

C. Structural Loads:
   1. Wind Loads: As per IBC codes
   2. Other Design Loads: As per IBC codes

D. Deflection of Framing Due to Design Wind Pressure:
   1. Deflection Normal to Wall Plane per IBC Requirements: From edge of glass perpendicular in direction to glass plane; 1/175 of glass edge length for each glazing lite, or amount that restricts edge deflection of glazing lites to 3/4 in (19.1 mm), whichever is less.
   2. Deflection Normal to Wall Plane per AAMA TIR-A11:
      a. Spans up to 13 ft 6 in (4.1 m): Limited to 1/175 of clear span.
      b. Spans Greater than 13 ft 6 in (4.1 m): Limited to 1/240 of clear span plus 1/4 in (6.35 mm).
      c. Limited to an amount restricting edge deflection of individual glazing lites to 3/4 in (19.1 mm), whichever is less.
   3. Deflection Parallel to Glazing Plane: 1/360 of clear span or 1/8 in (3.2 mm), whichever is smaller.
   4. Deflection Parallel to Glazing Plane per GANA Glazing Manual: Not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 in (3.2 mm).
      a. Operable Units: 1/16 in (1.6 mm) minimum clearance between framing members and operable units.
   5. Cantilever Deflection for Framing Members Overhanging an Anchor Point:
      a. Perpendicular to Plane of Wall:
         1) Spans less than 11 ft 8-1/4 in (3.6 m): 1/175 times span.
         2) Spans greater than 11 ft 8-1/4 in (3.6 m): 1/240 of clear span plus 1/4 in (6.35 mm).

E. Structural Performance per ASTM E 330:

1. Test at positive and negative wind-load design pressure. No deflection beyond specified limits.
2. Tested at 150 percent of positive and negative wind-load design pressures. No failure of materials, no structural distress, and no deformation of framing members beyond 0.2 percent of spans.

F. Air Infiltration per ASTM E 283: Fixed framing and glass area per ASHRAE 90.1:
1. Maximum air leakage: 0.06 cu ft per min per sq ft (0.30 L per s per sq. m).
   a. Static-air-pressure differential: 1.57 lbf per sq ft (75 Pa) equivalent to windspeed of 25 miles per hr (40 km per hr).
   b. Static-air-pressure differential: 6.24 lbf per sq. ft. (300 Pa) equivalent to windspeed of 50 miles per hr (80 km per hr).
2. Entrance Doors:
   a. Maximum air leakage for Single Door: 0.5 cu ft per min per sq ft (2.54 L per s per sq. m).
      1) Static-air-pressure differential: 1.57 lbf per sq ft (75 Pa) equivalent to windspeed of 25 miles per hr (40 km per hr).
   b. Maximum air leakage for Door Pairs: 1.0 cu ft per min per sq ft (5.08 L per s per sq. m).
      1) Static-air-pressure differential: 1.57 lbf per sq ft (75 Pa) equivalent to windspeed of 25 miles per hr (40 km per hr).

G. Water Penetration under Static Pressure per ASTM E 331: None.
1. Tested at static-air-pressure differential of 20 percent of positive wind-load design pressure but not less than 6.24 lbf per sq ft (300 Pa).
2. Tested at static-air-pressure differential of 20 percent of positive wind-load design pressure but not less than 10 lbf per sq ft (480 Pa).
3. Tested at static-air-pressure differential of 20 percent of positive wind-load design pressure but not less than 15 lbf per sq ft (720 Pa).

H. Water Penetration under Dynamic Pressure per AAMA 501.1: None.
1. Tested at dynamic pressure equal to 20 percent of positive wind-load design pressure but not less than 6.24 lbf per sq ft (300 Pa).
2. Tested at dynamic pressure equal to 20 percent of positive wind-load design pressure but not less than 10 lbf per sq ft (480 Pa).
3. Tested at dynamic pressure equal to 20 percent of positive wind-load design pressure but not less than15 lbf per sq ft (720 Pa).
4. Water Leakage per AAMA 501.1: No uncontrolled water penetration or water appearing on normally exposed interior surfaces except due to condensation. Does not apply to water controlled by flashing and gutters, or water drained to exterior.

I. Interstory Drift: Test Performance according to AAMA 501.4: Pass. Accommodate design displacement of adjacent stories indicated.

J. Seismic Performance per ASCE/SEI 7: Pass.
1. Seismic Drift Causing Glass Fallout per AAMA 501.6: Pass.
2. Vertical Interstory Movement per AAMA 501.7: Pass

K. Energy Performance: Certify and label energy performance per NFRC:
1. Thermal Transmittance (U-factor) per NFRC 100: Fixed glazing and framing areas.
   a. U-factor: 0.45 Btu per sq ft x h x degrees F (2.55 W per sq m x degrees K) maximum.
   b. U-factor: 0.57 Btu per sq ft x h x degrees F (3.23 W per sq m x degrees K) maximum.

c.U-factor: 0.69 Btu per sq ft x h x degrees F (3.92 W per sq m x degrees K) maximum.

2.Solar Heat Gain Coefficient per NFRC 100: Fixed glazing and framing areas: 0.35.
3.Solar Heat Gain Coefficient per NFRC 100: Fixed glazing and framing areas: 0.40.
4.Solar Heat Gain Coefficient per NFRC 100: Fixed glazing and framing areas: 0.45.
5.NFRC 500 Condensation Resistance Rating: Fixed glazing and framing areas: 15.
6.NFRC 500 Condensation Resistance Rating: Fixed glazing and framing areas: 25.
7.NFRC 500 Condensation Resistance Rating: Fixed glazing and framing areas: 35.
8.NFRC 500 Condensation Resistance Rating: Fixed glazing and framing areas: 45.

L.Noise Reduction per ASTM E 90: Ratings per ASTM E 1332:
1.Outdoor-Indoor Transmission Class: Minimum 26.
2.Outdoor-Indoor Transmission Class: Minimum 30.
3.Outdoor-Indoor Transmission Class: Minimum 34.

M.Blast Resistance per ASTM F 1642:
1.Hazard Rating: No break.
2.Hazard Rating: No hazard.
3.Hazard Rating: Minimal hazard.
4.Hazard Rating: Very low hazard.
5.Hazard Rating: Low hazard.
6.Hazard Rating: High hazard.
7.Performance Condition per GSA-TS01: 1.
8.Performance Condition per GSA-TS01: 2.
9.Performance Condition per GSA-TS01: 3a.
10.Performance Condition per GSA-TS01: 3b.
11.Performance Condition per GSA-TS01: 4.
12.Performance Condition per GSA-TS01: 5.

N.Windborne-Debris Impact Resistance per ASTM E 1886 and ASTM E1996:
1.Wind Zone 1: Pass.
2.Wind Zone 2: Pass.
3.Wind Zone 3: Pass.
4.Wind Zone 4: Pass.
5.Large Missile Test: Glazed openings less than 30 ft (9.1 m) of grade.
6.Small Missile Test: Glazed openings greater than 30 ft (9.1 m) above grade.

O.Thermal Movements:
1.Temperature Change; Ambient: 120 degrees F (67 degrees C).
2.Temperature Change; Material Surfaces: 180 degrees F (100 degrees C).
3.Thermal Cycling per AAMA 501.5: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.
a.Exterior Ambient Air Temperature Range: 0 degrees F (minus 18 degrees C) to exterior ambient air temperature producing exterior metal surface temperature of 180 degrees F (82 degrees C).

P.Structural Sealant Joints: Designed to carry gravity loads of glazing.

Q.Structural Sealant Joints: Designed to produce tensile or shear stress of less than 20 lbs per sq in (138 kPa).

R.Structural Sealant: Withstand without failing adhesively or cohesively the tensile and shear stresses imposed by structural sealant glazed curtain walls. Preconstruction Compatibility Testing: Cohesive failure prior to adhesive failure.
1.Adhesive Failure: Sealant separates cleanly from substrate.
2.Cohesive Failure: Sealant ruptures internally but does not separate from each substrate. Sealant to substrate bond exceeds sealant's internal strength.

2.2 FRAMING

A.Framing Members: Manufacturer's extruded or formed aluminum framing members of thickness required and reinforced as required to support imposed loads.
1.Construction: Thermally broken.
2.Glazing System: Retained mechanically with gaskets on four sides.
3.Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
4.Glazing Plane: Front.
5.Finish: Clear anodized.
6.Finish: Color anodized.
7.Finish: Baked enamel or powder coat.
8.Finish: High performance organic.
9.Fabrication Method: Factory and or field fabricated system.

B.Pressure Caps:
1.Aluminum components that mechanically retain glazing.
2.Include snap on aluminum trim that conceals fasteners.

C.Backer Plates: continuous plate backing for framing abutting adjacent construction.

D.Brackets and Reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.

E.Materials:
1.Aluminum: Alloy and temper recommended by manufacturer.
a.Sheet and Plate: ASTM B 209.
b.Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c.Extruded Structural Pipe and Tubes: ASTM B 429.
d.Structural Profiles: ASTM B 308.
2.Steel Reinforcement: Corrosion resistant zinc primer per SSPC-PS Guide No. 12.00. Prepare surfaces according to SSPC-SP COM, and applicable SSPC standard.
a.Structural Shapes, Plates, and Bars: ASTM A 36.
b.Cold Rolled Sheet and Strip: ASTM A 1008.
c.Hot Rolled Sheet and Strip: ASTM A 1011.

2.3 GLAZING

A.Glazing Components:
1.Glazing Gaskets: Corner sealed pressure glazing system. Resilient elastomeric materials, setting blocks, and shims.
2.Glazing Sealants: Use manufacturer recommended sealants.
3.Structural Glazing Sealants per ASTM C1401 and ASTM C 1184: Silicone based compatible with system components. Approved by sealant manufacturer for use

in curtainwall installations.
a.Color: Black.
b.Color: Gray.
c.Color: As selected by Architect from manufacturer's selection.

4.Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O. Silicone based sealants compatible with structural sealant and other components it contacts. Recommended by Manufacturer.
a.Color: Match structural sealant.

2.4 ACCESSORIES

A.Fasteners and Accessories: Manufacturer's standard.
1.Corrosion resistant, and compatible with adjacent materials.
2.Self locking devices not subject loosening due to thermal or structural movements.

B.Anchors: Adjustable 1 in (25 mm) minimum three way. Finish: recommended by manufacturer.
1.Concrete and Masonry Inserts: Per ASTM A 123 or ASTM A 153 requirements.

C.Concealed Flashing: Corrosion resistant, nonstaining, nonbleeding flashing recommended by manufacturer.

D.Cold applied asphalt mastic, non-asbestos per SSPC Paint 12.
1.Coating: 30 mil (0.762 mm).

2.5 FABRICATION

A.Welding to be limited to concealed locations. Descale or grind away spatter and oxides.

B.Fabrication and Assembly Characteristics:
1.Profiles: Straight with no defects or deformations.
2.Joints: Accurately fitted; coped or mitered.
3.Glazing Isolation from Framing: Physical and thermal
4.Framing and glazing accommodation of thermal and mechanical movement.

C.Glazing Field Replacement Provisions: Exterior and interior.

D.Hardware, connectors, and anchors concealed from view.
1.Components curved to indicated radii.

E.Water Mitigation: Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

F.Water Mitigation: Pressure equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

G.Aluminum Extruded Curtainwall: Fabricate and assemble per manufacturer's standard methods.

H.Aluminum Extruded Doors and Windows: Fabricate and assemble per manufacturer's standard methods.

1.Reinforce as required to meet loading requirements.
a.Weather strip exterior doors.
b.Provide stops and silencers for interior doors.

2.6 ALUMINUM FINISHES

A.Clear Anodic Finish: Per AAMA 611.
1.AA-M12C22A41, Class I, 0.0007 in (0.018 mm) minimum.
2.AA-M12C22A31, Class II, 0.0004 in (0.010 mm) minimum.

B.Color Anodic Finish: Per AAMA 611.
1.AA-M12C22A42/A44, Class I, 0.0007 in (0.018 mm) minimum.
2.AA-M12C22A32/A34, Class II, 0.0004 in (0.010 mm) minimum.
3.Color: Match sample from Architect's.
4.Color: As determined by the Architect from Manufacturer's selection.

C.Baked Enamel or Powder Coat Finish per AAMA 2603:
1.Dry Film Thickness of 1.5 mils (0.04 mm) minimum.
2.Color and Gloss: Match sample from Architect.
3.Color and Gloss: As selected by Architect from manufacturer's selection.

D.High Performance Organic Finish:
1.Two coat fluoropolymer per AAMA 2604.
2.Two coat fluoropolymer per AAMA 2605.
3.PVDF or FEVE Resin: 50 percent by weight in color coat.
4.PVDF or FEVE Resin: 70 percent by weight in color coat.
5.Color and Gloss: Match sample from Architect.
6.Color and Gloss: As selected by Architect from manufacturer's selection.

E.High Performance Organic Finish:
1.Three coat fluoropolymer per AAMA 2605.
2.Four coat fluoropolymer per AAMA 2605.
3.PVDF or FEVE Resin: 50 percent by weight in color coat and clear top coat.
4.PVDF or FEVE Resin: 70 percent by weight in color coat and clear top coat.
5.Color and Gloss: Match sample from Architect.
6.Color and Gloss: As selected by Architect from manufacturer's selection.

PART 3EXECUTION

3.1 EXAMINATION

A.Examine areas for requirements compliance, dimensions and other criteria that could affect installation. Report discrepancies to the Architect.

B.Do not begin installation until substrates have been properly prepared.

C.If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A.Clean surfaces thoroughly prior to installation.

B.Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A.Install in accordance with approved submittals, manufacturer's instructions and the following:

1.Install framing and other items rigid, straight, plumb, and level, with items laid out as shown on shop drawings.
2.Be sure items are properly isolated to prevent corrosion or galvanic action.
3.Clearance at vertical edges of doors shall be uniform top to bottom.
4.Verify moisture properly drains from systems.
5.No evidence of cutting, drilling, and/or patching shall be visible on the finished work.
6.Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.4 PROTECTION

A.Take protective measures to prevent exposure to other construction activity.

B.Protect installed products until completion of project.

3.5 FIELD QUALITY CONTROL

A.Field Tests: Architect shall select areas to be tested as soon as a representative portion of the project has been installed, glazed, caulked and cured. Conduct tests with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies must be corrected by the Contractor or Manufacturer.

1.Testing per AAMA 503: Performed by qualified independent testing agency.
a.Air Infiltration Tests: Per ASTM E 783.
b.Water Infiltration Tests: Per ASTM E 1105.
c.Water Spray Testing per AAMA 501.2: Test prior to starting interior finishing.
d.Perform Texting at 10, 35, and 75 percent completion.

3.6 CLEANING

A.Clean surfaces to remove soiling, stains, dust, and dirt using materials acceptable to manufacturer.

B.Touch up, repair or replace damaged products and defective work, as directed by Architect.

C.Leave installation area clean, free of residue and debris resulting from work of this Section.

3.7 DOOR HARDWARE SETS SCHEDULE

A.Designate the manufacturer products and design, grade, function, finish, size, of door hardware.

END OF SECTION

SECTION 809 – METAL PROFILED / FLAT SHEET CLADDING / COVERING

1.0 GENERAL

1.01 DESCRIPTION

Metal Profiled/ flat sheet cladding shall refer to metal panels into which profiles are induced by feeding them through banks of forming rollers. Typically used profiles are trapezoidal, sinusoidal or half round profiles. Cladding panels can be manufactured from prefinished steel or aluminium / aluminium alloys in a vast array of colours; providing a wide choice of aesthetic finish. These cladding sheets are then affixed to the steel structure of a building with concealed, non-penetrating fasteners.

1.02 SCOPE

Work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install all metal roof sheets and soffit panels (where specified), including accessories. For metal flashings, see related SECTION 822- Aluminium strip/ sheet coverings/ flashings.

1.03 PRODUCTS

Metal Profiled / flat sheet cladding / covering shall include a combination of the following products / elements

1. Galvalume Sheets (Standing Seam): tension levelled flat panels with continuously interlocked standing seam; 24ga and 26ga galvalume conforming to ASTM-791, 80 KSI where a coating of aluminium / zinc alloy bonded to the steel base by a continuous hot dipping process.
2. Material: 0.032 inch (0.8 mm) aluminium, ASTM B 209 3105-H14 alloy onto 0.5mm.
3. Flashings: all exposed flashings shall be formed in same gauge, finish, colour and texture matching the panels.
4. Sealant: shall be elastomeric.

2.00 APPLICATION

Galvalume (Aluzinc) roof sheets (standing seam) shall be used in all metal roof applications as specified or required in this project.

3.00 PREFERENCES

3.01 DESIGN REQUIREMENTS

1. General: Factory fabricated panels; panels fabricated on site using portable roll former are prohibited.
2. Performance Requirements: Provide sheet metal roofing that has been manufactured, fabricated and installed to achieve the following performance without defects, damage, failure or infiltration of water:
    a. Minimum 26GA. Steel sheets to be used.
    b. Wind Uplift: Provide UL 580 Class 90 rated assembly.
    c. ASTM-E-1646-95 and ASTM-E-331 water penetration tested ASTM-E-1680-95 and ASTM-E-283 air infiltration tested.
    d. ASTM-E-1592-98 and ASTM-E-330 uplift tested (24 ga. steel).

e. ASTM-E-84 Class A fire rating on coating and substrate.

3.02 SUBMITTALS

Contractor shall submit the following:

1. Product Data: Manufacturer's data sheets on each product to be used, including:
    a. Preparation instructions and recommendations.
    b. Storage and handling requirements and recommendations.
    c. Installation methods.
2. Shop Drawings: of all necessary roofing components, including profiles, anchorage, accessories, finishes, colours and textures.
3. Warranty Documentation: Submit 2 executed copies of both the manufacturer and applicator warranties for the periods stipulated, starting from the date of the substantial completion. Each warranty must be signed by an authorized representative of the issuing company.
4. Verification Samples: For each finish product specified, samples are to be provided, preferably 6 inches (150mm) square, representing actual product, colour, and patterns.
5. Operation and Maintenance Data: Include methods for maintaining installed products and precautions relating to cleaning materials and methods that might be detrimental to finishes and performance.
6. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

3.03 QUALITY ASSURANCE

1. Installer Qualifications: Installer with documented experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.
2. Material Storage: Store materials protected from exposure to harmful conditions. Store material in dry, above ground location:
    a. Stack pre-finished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture to run off.
    b. Prevent contact with material that may cause corrosion, discoloration or staining.
3. Protection of completed works: Protect installed products until completion of project.

3.04 SAFETY, SECURITY, OPERATIONS

1. HSE Documentation: Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.
2. Pre-Installation Meeting: Conduct pre-installation meeting to acquaint installers of roofing and related work with project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

4.00 REFERENCED STANDARDS

1. UL 580 – Safety Testing for Uplift Resistance of Roof Assemblies.
2. ASTME-1646-95 – Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
3. ASTM-E-331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors,

and Curtain Walls by Uniform Static Air Pressure Difference.

4. ASTM-E-1680-95 – Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
5. ASTM-E-283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
6. ASTM-E-1592-98 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
7. ASTM E-330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
8. ASTM-E-84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM A792 / A792M – Standard Specification for Steel Sheet, 55 percent Aluminium-Zinc Alloy-Coated by the Hot-Dip Process.

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers.
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage.

6.0 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official covering finish, including colour, fade, chalking and film integrity.
2. Warranty Period: minimum 20 years commencing on Date of Substantial Completion.

SECTION 905 – WATERPROOFING (LIQUID APPLIED WATERPROOF ROOF COATINGS)

1.0 GENERAL

1.01 DESCRIPTION

Liquid-applied membranes are applied on site in a liquid form which is allowed to set and form into a water impermeable membrane. They can be Bituminous-based or polymeric-based, monolithic and fully-bonded, and suitable for application over many substrates, e.g. including asphalt, bitumen and concrete.

1.02 SCOPE

1. Work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install all liquid applied membranes to the roof slab.
2. Works may include:
    a. Provision of reinforced, liquid applied waterproofing membrane system including membrane, penetration flashings, base flashings, and expansion joints.
    b. Substrate preparation, cleaning, levelling and patching.
    c. Insulation and base/ply sheet installation.
    d. Temporary waterproofing and priming.
    e. Waterproofing membrane installation.
    f. Flashing installation and expansion joint installation.
    g. Protective surfacing.
    h. Alkalinity protection.
    i. Preparation for overburden installation.

1.03 PRODUCTS

Liquid applied waterproofing coating shall include a combination of the following products / elements:

1. Waterproofing Membrane:
    a. Cold Fluid-Applied Waterproofing- Single component, [reinforced,] high solids. ASTM C 836/C 836M, Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
2. Accessory Materials:
    a. Installation instructions, recommended to produce complete waterproofing system meeting performance requirements, and compatible with waterproofing material and adjacent materials.
3. Primer:
    a. Liquid primer meeting VOC limitations and recommended for substrate by waterproofing manufacturer.
4. Joint Sealant:

a. ASTM C 719, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle), high performance, medium-modulus, low-VOC, UV-stable, non-sag elastomeric sealant approved by waterproofing manufacturer for adhesion and compatibility with waterproofing and accessories.

5. Expansion Joint:
    a. Pre-compressed or Closed Cell, Monolithic Foam System. Foam Structure Must not Contain Unbonded Foam Laminations
6. Protection Course:
    a. Waterproofing manufacturer's standard protection course material recommended for application.

2.00 APPLICATION

3. Liquid applied membranes shall be used on all flat roof slabs in locations shown within the design drawings.

3.00 PREFERENCES

3.01 ENVIRONMENTAL

1. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
2. Do not apply roofing/waterproofing membrane during or with the threat of inclement weather.
3. When ambient temperatures reach 85 degrees F (30 degrees C) or higher, follow Membrane System Manufacturer's recommendations for weather related additives and application procedures.
4. Ensure that substrate materials are dry and free of contaminants. DO NOT commence with the application unless substrate conditions are suitable. Contractor shall demonstrate that substrate conditions are suitable for the application of the materials.
5. Odour control and elimination measures are not typically necessary, but if required by the owner or his designated Representative, Contractor shall implement odour control and elimination measures prior to and during the application of the roofing/waterproofing materials. Control/elimination measures shall be field tested at off-hours.

3.02 TEMPORARY PROTECTION

1. Building components shall be protected adequately (with tarp or other suitable material) from soil, stains, or spills at hoisting points and area of application. Contractor shall be responsible for preventing damage from any operation under its contract. Any such damage shall be repaired at Contractor's expense to Owner's satisfaction or be restored to original condition.
2. Protect finished roofing/waterproofing membrane from damage by other trades. Do not allow waste products containing hydrocarbons such as petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil or animal fat, or direct steam venting to come into direct contact with the membrane.

3.03 SUBMITTALS

Contractor shall submit the following:

1. Product Data: Provide current standard printed product literature indicating characteristics of membrane materials, flashing materials, components, and accessories product specification and

installation; submit copies of current Material Safety Data Sheets (MSDS) for components of the work:

a. Preparation instructions and recommendations.

b. Storage and handling requirements and recommendations.

c. Cleaning methods.

2. Shop Drawings: Submit shop drawings of liquid applied membrane showing a project plan, size, relevant flashing details etc. for review and approval by the Owners Representative and Membrane Manufacturer.

3. Warranty Documentation: Submit 2 executed copies of both the manufacturer and applicator warranties for the periods stipulated, starting from the date of the substantial completion. Each warranty must be signed by an authorized representative of the issuing company.

3.06 QUALITY ASSURANCE

2. Evaluate moisture content of substrate materials. Contractor shall determine substrate moisture content throughout the work and record with Daily Inspection Reports or other form of reporting acceptable to the Owner or designated Representative and Membrane Manufacturer.
3. Random tests to determine tensile bond strength of membrane to substrate shall be conducted by the Contractor at the job site using an adhesion tester, or by the performance of a manual pull test. Contractor shall perform tests at the beginning of the Work, and at intervals as required to assure specified adhesion with a minimum of 3 tests. Test results shall be submitted to the Owner or his designated Representative and the Membrane Manufacturer. Contractor shall immediately notify the Owner or his designated Representative and Membrane Manufacturer in the event bond test results are below specified values.
4. Adequate surface preparation will be indicated by tensile bond strength of membrane to substrate greater than or equal to 220 psi (1.5 N/mm2), as determined by use of an adhesion tester.
5. Adequate surface preparation will be indicated by peel bond strength of membrane to substrate such that cohesive failure of substrate or membrane occurs before adhesive failure of membrane/substrate interface.

3.07 SAFETY, SECURITY, OPERATIONS

2. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.
3. Contractor shall convene a pre-installation meeting at the jobsite 1 week before starting work of this section and require attendance of parties directly affecting work of this section, including but not limited to the following:
    a. Architect.
    b. Engineer
    c. Roofing/Waterproofing Consultant.
    d. Owner's Representative.

5.00 REFERENCED STANDARDS

Most recent versions of the standards below

1. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Damp- proofing, and Waterproofing.
2. Underwriters Laboratories (UL): ANSI/UL 790 - Standard Test Methods of Roof Coverings.
3. ASTM D312 - Standard Specification for Asphalt Used in Roofing.
4. ASTM D471 - Standard Test Method for Rubber Property - Effect of Liquids
5. ASTM C836/C 836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric

Waterproofing Membrane for Use with Separate Wearing Course

6. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

5.00 DURABILITY

2. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
3. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

3. Waterproofing shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
4. Manufacturer's product Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 10 years commencing on Date of Substantial Completion.

SECTION 1001 – PLASTERBOARD DRY LININGS, PARTITIONS & CEILINGS

1.0 GENERAL

1.01 DESCRIPTION

Plasterboard dry linings/ partitions/ ceilings incorporates the process of instilling plasterboard to for interior walls and ceilings

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following:

1. Plasterboard dry lining:
    a. Interior surfaces of external walls
2. Partitions:
    a. Instillation of internal non-load bearing walls
    b. Walls are to provide fire resistance
3. Ceilings
    a. Painted gypsum board ceiling

1.03 PRODUCTS

Plasterboard dry linings/ partitions/ ceilings may include a combination of the following products/ elements:

1. Gypsum boards referencing ASTM C1396 - Standard specification for gypsum boards:
    a. Gypsum board
    b. Type X Gypsum
    c. Type C Gypsum
    d. Moisture resistant Gypsum Board
2. Cement boards complying with:
    a. ASTM C1186 – Standard specification for cement board fabricatiors.
3. Framing to comply with:
    a. ASTM A1003 – Standard specification for steel sheets, carbon, metallic and non-metallic coated for cold form framing members
    b. ASTM C754 – Standard specification for instillation of steel framing members to receive screw attached gypsum panel products
    c. ASTM A653 – Standard specification for steel sheet, Zinc-coated (galvanized) or zinc iron alloy coated (Galvannealed) by the hot dip process
    d. ASTM E119 – Standard test methods for fire test for building construction and materials. Fire rated for 1, 2, 3 and 4 hour rated walls.
4. Fasteners to comply with:
    a. ASTM C1002 – Standard Specification for steel self-piercing tapping screws for application of gypsum panel products or metal plaster bases to wood studs or steel studs or ASTM C954 Standard specification for steel drill screw for the application of gypsum panel products for metal plaster bases to steel studs.

5. Joint reinforcement and joint tape for fixing gypsum boards to comply with:
    a. ASTM C475/C475M – Standard specification for joint compound and joint tape for finishing gypsum board
6. Fire, sound, thermal insulation to comply with:
    a. ASTM C553 – Standard specification for mineral fibre blanket thermal insulation for commercial and industrial applications
    b. ASTM C665 – Standard specification for mineral fibre blanket thermal insulation for light frame construction and manufactured housing
    c. ASTM C726 – Standard specification for mineral wall roof insulation board
    d. ASTM E84 – Standard test method for surface burning characteristics of building materials. Class A

2.00 APPLICATION

1. Interior wall partitions.
    a. Partitions providing vertical separation between adjacent spaces on the interior of the building.
2. Interior surfaces of external wall.
3. Ceilings

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.03 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM C1396 – Standard specifications for gypsum boards
2. ASTM C1186 – Standard specification for cement board fabrications
3. ASTM A1003 – Standard specification for steel sheets, carbon, metallic coated for cold form framing members
4. ASTM C754 – Standard specification for instillation of steel framing members to receive screw attached gypsum panel products

5. ASTM A653 – Standard specification for steel sheet, Zinc-coated (galvanized) or zinc iron alloy coated (Galvannealed) by the hot dip process
6. ASTM E119 – Standard test methods for fire test for building construction and materials. Fire rated for 1, 2, 3 and 4 hour rated walls.
7. ASTM C1002 – Standard Specification for steel self-piercing tapping screws for application of gypsum panel products or metal plaster bases to wood studs or steel studs or ASTM C954 Standard specification for steel drill screw for the application of gypsum panel products for metal plaster bases to steel studs.
8. ASTM C475/C475M – Standard specification for joint compound and joint tape for finishing gypsum board.
9. ASTM C553 – Standard specification for mineral fiber blanket thermal insulation for commercial and industrial applications
10. ASTM C665 – Standard specification for mineral fiber blanket thermal insulation for light frame construction and manufactured housing
11. ASTM C726 – Standard specification for mineral wall roof insulation board
12. ASTM E84 – Standard test method for surface burning characteristics of building materials. Class A

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Plasterboard dry linings/ partitions/ ceilings shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1008 – DEMOUNTABLE SUSPENDED CEILINGS

1.0 GENERAL

1.01 DESCRIPTION

Demountable suspended ceilings incorporates grid ceiling systems that are used in conjunction with suspended ceiling systems.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following:

1. Interior ceiling treatments
2. Suspended ceiling systems

1.03 PRODUCTS

Demountable suspended ceiling may include a combination of the following products/ elements:

1. Interior ceiling treatment in compliance with:
    a. ASTM E1264 – Standard classification for acoustical ceiling products
    b. ASTM C1396 – Standard specification for gypsum boards
2. Suspended ceiling framing in compliance with:
    a. ASTM C635 – Standard specification for manufacture, performance and testing of metal suspension systems for acoustical tile and lay-in panel ceilings.
    b. ASTM G30 – Standard specifications for making and using u-bend stress-corrosion test specimens
    c. ASTM A153 – Standard specification for zinc coating (hot-dip) on iron and steel hard wear
    d. ASTM A653 – Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process
    e. ASTM E119 – Standard test methods for fire test for building construction and materials. Fire rated for 1, 2, 3 and 4 hour rated walls.
3. Fire, sound, thermal insulation in compliance with:
    a. ASTM C553 – Standard specification for mineral fibre blanket thermal insulation for commercial and industrial applications

2.00 APPLICATION

1. Ceiling.

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.04 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM E1264
2. ASTM C635
3. ASTM G30
4. ASTM A153
5. ASTM A653
6. ASTM C553

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Demountable suspended ceilings shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 15 years commencing on Date of Substantial Completion.

SECTION 1101 – WINDOWS, ROOFLIGHTS, SCREENS & LOUVERS

1.0 GENERAL

1.01 DESCRIPTION

Windows / roof lights / screens / louvers incorporates wall openings and features / accessories that provide light and airflow while retaining the structure's profile.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following:

1. Windows:
2. Roof lights
3. Screens
4. Louvers

1.03 PRODUCTS

Windows / roof lights / screens / may include a combination of the following products/ elements:

1. Exterior windows and structural elements to comply with:
    a. ASTM E2112: Standard practice for installation of exterior windows, doors and skylights.
    b. ASTM F2912: Standard specifications for glazing and glazing system subject to air blast loading.
    c. ASTM E1105: Standard test method for fire determination of water penetration of installed exterior windows, skylights, doors and curtail walls, by uniform or cyclic static air pressure difference
2. Framing to comply with:
    a. ASTM E2112: Standard practice for installation of exterior windows, doors and skylights.
3. Louvers to comply with:
    a. ASTM E1886: Standard test method for performance of exterior windows, curtain walls, doors and impact protective system impacted by missile(s) and exposed to cyclic pressure differentials.
    b. ASTM E1996: Standard specification for performance of exterior windows, curtain walls, doors and impact protective systems impacted by windborne debris in hurricanes.
4. Screening to comply with:
    a. ASTM D3656 / D3656M: Standard specification for insect screening and louver cloth woven from vinyl – coated glass yarns
5. Fire, sound and thermal control to comply with:
    a. ASTM E119 – Standard specification for fire tests of building construction and materials

2.00 APPLICATION

1. Specified exterior walls openings.
2. Specified roof openings
3. Ceilings
4. Window treatments

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology
3. Window schedule

3.05 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM E2112
2. ASTM F2912
3. ASTM E1105
4. ASTM E1886
5. ASTM E1996
6. ASTM D3656 /D3656M
7. ASTM E119

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Windows / roof lights / screens / louvers shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 15 years commencing on Date of Substantial Completion for the window frames and for a minimum of 5 years for laminated glass and window hardware.

SECTION 1102 – DOORS / SHUTTERS / HATCHES

1.0 GENERAL

1.01 DESCRIPTION

1. The elements comprising doors/ shutters/ hatches includes the aforementioned items of all sizes and uses and elements that form or complete the openings, unless they are an integral part of another element.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following:

1. Internal Doors
2. External Doors
3. Internal doors with glazed vision panels
4. External doors with glazed vision panels
5. Internal Door Frames
6. External Door Frames
7. Shutters
8. Hatches

1.03 PRODUCTS

Doors / Shutters / Hatches may include a combination of the following products/ elements:

1. Internal and external doors shall comprised of galvanized steel and shall comply with:
    a. ANSI A250.8 – Standard Specification for Standard Steel doors and Frames (SDI-100)
    b. ASTM A879 – Standard specification for steel sheet, zinc coated by the electrolytic process for applications requiring designation of the coating on each surface.
    c. ASTM E2112 (19c) – Standard practice for instillation of exterior windows, doors and skylight
2. Frames shall be galvanized steel and shall comply with:
    a. ANSI A250.8 – Standard Specification for Standard Steel doors and Frames (SDI-100)
3. Glazed Vision Panels:
    a. Doors shall consist of glazed vision panels where appropriate based on user requirements
4. Hatches:
    a. ASTM C1802 (20) – Standard specification for design, testing, manufacture, selection, and installation of horizontal fabricated metal access hatches for utility, water and wastewater structures
5. Security:
    a. ASTM E2395 (18) – Standard specification for voluntary security performance of window and door assemblies with glazing impact
6. Fire resistance:
    a. ASTM E119 (20) – Standard test method for fire test of building construction and materials
    b. NFPA 252 or UL 10B – Ratings for fire walls and fire doors
7. Weather resistance:
    a. ASTM E1996(20) – Standard for performance of exterior windows, curtain walls, door and impact protective system impacted by windborne debris in hurricanes
    b. ASTM E115(15) – Standard test method for field determination of water penetration of installed exterior windows, skylights, doors and curtain walls, by uniform cyclic static air pressure difference

2.00 APPLICATION

1. Exterior doors
2. Interior doors
3. Overhead / ceiling access
4. Underground access

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.06 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

2. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM E 2112(19C)
2. ANSI/SDI A250.8
3. ASTM A879
4. ASTM C1802 (20)
5. ASTM E2395 (18)
6. ASTM E119 (20)
7. NFPA 252 IR UL 10B
8. ASTM E1996 (20)

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.0 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Doors / Shutters / Hatches shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by

authorized company official for a minimum of 5 years commencing on Date of Substantial Completion.

SECTION 1104 –STAIRS/ RAMPS/ HANDRAIL & GUARD RAILS

1.0 GENERAL

1.01 DESCRIPTION

This section includes devices for connecting various building levels (stairs & ramps) and the protection and guidance systems (rails & guards) associated with these devices.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following:

1. External Stairs
2. Internal Stairs
3. External Ramps
4. Internal Ramps
5. Handrails
6. Guard Rails

1.03 PRODUCTS

This section may include a combination of the following products/ elements:

1. Internal & External Stairs
    a. Cast in place treads and landings shall comply with the standards set out in Section 501 “In situ & Precast Concrete”
    b. Precast treads & landings shall comply with the standards set out in Section 501 “In situ & Precast Concrete”
    c. Steel stairs and landings
        i. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
        ii. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
        iii. Steel Sheets shall comply with ASTM A1008 – Standard specification for cold rolled structural steel.
        iv. Galvanized Steel Sheets shall comply with ASTM A653 – Standard specification for steel sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
        v. External stairs shall be fabricated to shed water and provide weep holes where water may accumulate
    d. External stairs shall be fabricated to shed water and provide weep holes where water may accumulate
2. Internal & External Ramps
    a. Cast in place ramps and landings shall comply with the standards set out in Section 501 “In situ & Precast Concrete”
    b. Precast concrete ramps & landings to comply with the standards set out in Section 501 “In situ & Precast Concrete”
    c. Steel framed ramps and landings
        i. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
        ii. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
        iii. Steel Sheets shall comply with ASTM A1008 – Standard specification for cold rolled structural steel.

iv. Galvanized Steel Sheets shall comply with ASTM A653 – Standard specification for steel sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
v. External ramps shall be fabricated to shed water and provide weep holes where water may accumulate

3. Metal railings
    a. Hand rails & Guard rails
        i. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
        ii. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
4. Concrete railings
    a. Hand rails & Guard rails shall comply with the standards set out in Section 501 “In situ & Precast Concrete”
5. Fasteners
    a. Post-Installed Anchors/ chemical anchors shall comply with ASTM E1512 – Standard test methods for testing bond performance of Bonded anchors
    b. Stainless steel fasteners shall comply with ASTM F593 – Standard specification for stainless steel bolts, hex cap screws and studs.
    c. Connection Bolts shall comply with ASTM A307 – Standard specification for carbon steel bolts, studs and threaded rod 60,000 PSI Tensile strength,
    d. Steel Nuts shall comply with ASTM A563 – Standard specification for carbon and Alloy Steel Nuts
6. Finishes
    a. Primer to be applied to all surfaces except those to be field welded or embedded in concrete.
    b. A second coat of primer is to be applied to surfaces that will be concealed when installed, and to bolts and welds.
    c. Galvanizing is to comply with ASTM A153 – Standard specification for Zinc coating (Hot-dip) on iron and steel hardware and ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products.

2.00 APPLICATION

1. External walking surfaces connecting various levels
2. Internal walking surfaces connecting various building floors/ levels
    a. Partitions providing vertical separation between adjacent spaces on the interior of the building.
3. Protection for open stair, ramp or landing edges above 762mm (30”)

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology
3. Shop Drawings: Plans, sections, elevations, details, attachments
4. Certificates
    a. Welding qualifications
    b. Paint compatibility

c. Mill certificates
d. Test certificates ensuring code compliance of steel and anchors

3.07 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

4.01 ACCESSIBILITY REQUIREMENTS

1. The components detailed in this section shall comply with the accessibility standards of the ICC/ ANSI A117.1 - Accessible and Usable buildings and Facilities Standard

4.02 SEISMIC REQUIREMENTS

1. The design of elements in this section shall comply with the requirements of ASCE / SEI 7.

4.03 INTERNATIONAL BUILDING CODE (IBC) REFERENCES

1. The design of elements in this section shall comply with the requirements the IBC generally paying particular attention to the comply withing:
    a. Section 1007 – Accessible means of egress
    b. Section 1009 – Stairs
    c. Section 1010 – Ramps
    d. Section 1012 – Handrails
    e. Section 1013 – Guards

4.04 ASTM STANDARDS

1. ASTM A36
2. ASTM A1008
3. ASTM A653
4. ASTM E1512
5. ASTM F593
6. ASTM A563
7. ASTM A153 and ASTM A123

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Stairs/ Ramps/ Handrail & Guardrails shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1105 – BURGLAR PROOFING AND GRILLEWORK

1.0 GENERAL

1.01 DESCRIPTION

The erection of grillwork and gates to secure the doors and windows, access and egress points of the perimeter of the building.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following works:

1. Gates
2. Decorative grillwork

1.03 PRODUCTS

The fencing works may include a combination of the following products/ elements:

1. Gates shall include the properties detailed for and must provide a gate width appropriate to the use (pedestrian access).
2. Metal grillwork gates shall include the following properties:
    a. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
    b. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
    c. Coatings on the iron/ steel shall comply with ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products.
3. Decorative Grillwork shall include the following properties:
    a. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
    b. Steel shapes shall comply with ASTM A36 – Standard specification for carbon structural steel.
    c. Coatings on the iron/ steel shall comply with ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products.

2.00 APPLICATION

1. Masonry boundary walls
2. “Anti-climb” medium security perimeter fencing
3. “Anti-climb” medium security perimeter fencing gates
4. Grillwork (burglar proof) gates providing access to the building through the door masonry openings on perimeter building walls and/or the verandah perimeter grillwork.
5. Decorative grillwork (burglar proofing) panels along open air verandah perimeters.
6. Decorative grillwork (burglar proofing) panel inserts in window openings.

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.08 QUALITY ASSURANCE

4. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
5. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
6. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

3. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

2.00EFERENCED STANDARDS

1. ASTM A153– Standard specification for Zinc coating (Hot-dip) on iron and steel hardware
2. ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products
3. ASTM A36 – Standard specification for carbon structural steel

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers: Lifespan expectancy equal to that specified for primary weather barriers.

6.0 WARRANTIES, GUARANTEES AND MAINTENANCE

2. Grillwork (Burglarproofing) shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1205 – PLASTERED, RENDERED, ROUGHCAST COATING

1.0 GENERAL

1.01 DESCRIPTION

Plastered, rendered, roughcasting coating incorporates coarse finishing materials that hardens while drying and are applied to wall or ceilings for aesthetic purposes or as weather protection.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install plastered, rendered or roughcast coatings on the following surfaces:

1. Exterior walls
2. Interior walls
3. Exterior ceilings
4. Interior ceilings
5. Interior partitions

1.03 PRODUCTS

Plastered, rendered, roughcasting coating may include a combination of the following products/ elements:

1. Lime in compliance with:
    a. ASTM C25 – Test methods for chemical analysis of limestone, quicklime and hydrated lime
    b. ASTM C206-14 – Standard specification for finishing hydrate lime
2. Portland Cement in compliance with:
    a. ASTM C150/C150M-20 Standard specification for Portland cement
    b. ASTM C926 – Standard specification for application of Portland cement based plaster
3. Aggregate in compliance with:
    a. ASTM C35 – Specification for inorganic aggregates for use in gypsum plaster
    b. ASTM C897 - Standard specification for aggregate job-mixed Portland cement-based plasters
4. Plaster Mix in compliance with:
    a. ASTM C1157 – Standard performance specification for hydraulic cement
    b. ASTM C260 – Specification for blended hydraulic cement
    c. ASTM C91 – Standard specification for masonry cement
5. Partitions in compliance with:
    a. ASTM C59/C59M – Standard specifications for gypsum casting plaster and gypsum molding plaster
    b. ASTM C595 – Specifications for bonding compounds for interior gypsum plastering
    c. ASTM C932 – Specifications for surface-applied bonding compounds for exterior plastering
    d. ASTM C631 – Specification for bounding compounds for interior gypsum plastering
6. Fire, thermal and sound insulation in compliance with:
    a. ASTM E119 - Test methods for fire tests building materials
    b. ASTM E90 – Test methods for laboratory measurement of airborne sound transmission of building partitions and elements

2.00 APPLICATION

1. Interior surfaces
    a. Walls
    b. Partitions
    c. Ceilings
2. Exterior surfaces
    a. Walls
    b. Ceilings

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.09 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM C25
2. ASTM C206-14
3. ASTM C150M-20
4. ASTM C926
5. ASTM C1157
6. ASTM C260
7. ASTM C91
8. ASTM C59
9. ASTM C595
10. ASTM C932
11. ASTM C631
12. ASTM E119
13. ASTM E90

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Plastered, rendered and roughcast coatings shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1209 – STONE, CONCRETE, QUARRY, CERAMIC & MOSAIC TILING

1.0 GENERAL

1.01 DESCRIPTION

1. Stone incorporates natural material used aesthetically as surface finishes.
2. Concrete handmade tile primarily used as decorative floor finishes
3. Quarry construction tile made of natural clays commonly ½" to ¾" thick
4. Ceramic tiling
5. Mosaic

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install plastered, rendered or roughcast coatings on the following surfaces:

1. Walls
2. Floors

1.03 PRODUCTS

Stone / concrete / quarry / ceramic tiling / mosaic may include a combination of the following products/ elements:

1. ASTM C503 – Standard specifications for marble dimension stone
2. ASTM C126 – Standard specification for ceramic glazed structural clay facing tile, facing brick and solid masonry units
3. ANSI A137.1 – Standard specification for ceramic tile
4. ASTM C1670 – Standard specifications for adheres manufactured stone masonry veneer units

2.00 APPLICATION

1. Exterior floor surfaces
2. Interior floor surfaces
3. Exterior wall surfaces
4. Interior wall surfaces

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.10 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will

be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM C503
2. ASTM C126
3. ANSI A137.1
4. ASTM C1670

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Stone, concrete, quarry, ceramic & mosaic tiling shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1212 – RUBBER / PLASTIC / CORK / LINOLEUM / CARPET TILING / SHEETING

1.0 GENERAL

1.01 DESCRIPTION

This section incorporates flooring finishes consisting of synthetic and natural materials as an alternative to traditional floor finishing, providing durability, longevity once maintained properly

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following types of flooring:

1. Rubber
2. Plastic
3. Cork
4. Linoleum
5. Carpet tiling
6. Sheeting
7. Vinyl sheet flooring
8. Luxury vinyl tiles (LVT) flooring

1.03 PRODUCTS

Rubber / plastic / cork / lino / carpet tiling / sheeting may include a combination of the following products/ elements:

1. Rubber flooring:
    a. ASTM F1859 – Standard specification for rubber sheet floor covering without backing
    b. ASTM F1860 – Standard specification for rubber sheet floor covering with backing
    c. ASTM F2041 – Standard specification for bonded rubber crumb floor coverings
2. Cork Flooring:
    a. ASTM F3008 – Standard specification for cork floor tile
3. Lino (linoleum) flooring:
    a. ASTM F2195 – Standard specification for linoleum floor tile
4. Luxury vinyl flooring
    a. ASTM F1066 – Standard specification for vinyl composition floor tile
    b. ASTM F1700 – Standard specification for solid vinyl floor tile
    c. ASTM F3261 – Standard specification for resilient flooring in modular format with rigid polymeric core
    d. ASTM F386 – Standard test method for thickness of resilient flooring material having flat surfaces
    e. ASTM F1514 – Standard test method for measuring heat stability of resilient flooring by colour change
5. Vinyl sheet flooring
    a. ASTM F1303 – Standard specification for sheet vinyl floor covering with backing
    b. ASTM F1913 – Standard specification for vinyl sheet floor covering without backing

2.00 APPLICATION

1. Flooring pertaining to this project me include the following common areas of application:
    a. Auditorium
    b. Staff room / offices

c. Kitchen
d. Restrooms
e. Dressing rooms
f. Classrooms
g. Day care
h. Intermediate areas not mentioned

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.11 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM F1859
2. ASTM F1860
3. ASTM F2041
4. ASTM F3008
5. ASTM F2195
6. ASTM F1066
7. ASTM F1700
8. ASTM F3261
9. ASTM F386
10. ASTM F1514
11. ASTM F1303
12. ASTM F1913

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

2. Rubber / plastic / cork / lino / carpet tiling / sheeting shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
3. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 10 years commencing on Date of Substantial Completion.

SECTION 1215 – PAINTING / CLEAR FINISHING

1.0 GENERAL

1.01 DESCRIPTION

Painting / Clear Finishing incorporates the application of stain, paint or thin coating as the finial finish or layer of protection to various surfaces as instructed.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to paint/ clear finish the following surfaces:

1. Exterior wooden surfaces
2. Interior wooden surfaces
3. Exterior masonry surfaces
4. Interior masonry surfaces
5. Exterior partitions (cement board)
6. Interior partitions (gypsum/ cement board)
7. Interior rendered/ plastered or roughcast surfaces
8. Exterior rendered/ plastered or roughcast surfaces
9. Interior Ceilings
10. Exterior Ceilings
11. Exterior metal surfaces
12. Interior metal surfaces

1.03 PRODUCTS

Painting / Clear Finishing may include a combination of the following products/ elements:

1. Paint arrangements:
    a. Paint
    b. Undercoats
    c. Primers
    d. Varnish stains
    e. Polyurethane lacquers
    f. Emulsion paints
2. All paint arrangements detailed above shall be digitally mixed as specified by the employer
3. Manufacturers' quality control: sample testing may be engaged by the client/architect.

2.00 APPLICATION

1. Interior, exterior wood work surfaces
    a. Cabinetry
    b. Partitions
    c. Joinery
2. Interior, exterior masonry surfaces
    a. Brick
    b. Stone
    c. Plastered / rendered materials
    d. Stucco
    e. Concrete
3. Interior/ exterior metal surfaces.

a. Aluminium
b. Iron
c. Steel
d. Copper

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.12 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. All paint works shall be in compliance with the guidelines of the latest version of the Painting Contractors Association (PDCA) Industry Standards.

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers in exterior walls: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Painting and clear finishing shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 10 years commencing on Date of Substantial Completion.

SECTION 1301 – MOVABLE FURNITURE

1.00 GENERAL

1.01 DESCRIPTION

9. This section includes commercial grade furniture that can be moved around and adapted easily. It is designed to work within a space by providing functionality that can meet the current and future needs of the building's occupants and includes the following:
    a. All furniture, necessary fittings and configurations required for the occupancy and use of the facility and its proposed functions.
    b. All furniture, necessary fittings and configurations required as specified by the user requirements, the International Building Code (IBC) 2015 and/ or by the local Authority Having Jurisdiction (AHJ).

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following movable furniture:

1 Office Chairs

2 Lounge and public seating

3 Desks

4 Panel Systems

5 Tables

6 Storage & Filing

1.03 PRODUCTS

This section may include a combination of the following products/ elements:

7. Office Chairs
    a. Chairs shall be of one or more of the following categories:
        i. Task Chairs
        ii. Guest Chairs
    b. Chairs shall comprise of one or more of the following properties:
        i. Office chairs in compliance with the quality standards of ANSI/BIFMA X5.1
        ii. Weight capacity of minimum 275lbs without loss of performance
        iii. Seating fabrics complying with the Martindale abrasion rub test and should achieve score of 40,000 or more - heavy duty commercial grade upholstery
        iv. Furniture Sustainability Standard at a minimum ANSI/BIFMA e3 – level 1
        v. Available fabric choices which meet MBDC Cradle-to-Cradle Gold sustainable design certification - fabrics contain less than 100 parts per million of any heavy metals of concern, which includes antimony, which is traditionally found in polyester fabrics.

vi. Painted components - coated with powder coat paint.

8. Lounge & Public seating
    a. Lounge and public seating shall be of one or more of the following categories:
        i. Sofas
        ii. Lounge Chairs
        iii. Reception chairs
        iv. Dining Chairs
        v. Nesting Chairs
        vi. Stacking Chairs
    b. Lounge and public seating shall comprise of one or more of the following properties:
        i. Lounge and public seating in compliance with the quality standards of ANSI/BIFMA X5.4
        ii. Weight capacity of minimum 270 lbs without loss of performance
        iii. Seating fabrics complying with the Martindale abrasion rub test and should achieve score of 40,000 or more - heavy duty commercial grade upholstery
        iv. Furniture Sustainability Standard at a minimum ANSI/BIFMA e3 – level 1
        v. Available fabric choices which meet MBDC Cradle-to-Cradle Gold sustainable design certification - fabrics contain less than 100 parts per million of any heavy metals of concern, which includes antimony, which is traditionally found in polyester fabrics.
        vi. Painted components - coated with powder coat paint.
        vii. Solid wood components - termite treated hardwoods, non-porous, resistant to rot, chips, scratches and dents.

9. Desks
    a. Desks shall be of one or more of the following categories:
        i. Desks
        ii. Workstations
        iii. Student Desks
    b. Desks shall comprise of one or more of the following properties:
        i. Desks in compliance with the quality standards of ANSI/BIFMA X5.5
        ii. Furniture Sustainability Standard at a minimum ANSI/BIFMA e3 – level 1
        iii. Painted components - coated with powder coat paint.
        iv. Solid wood components - termite treated hardwoods, non-porous, resistant to rot, chips, scratches and dents.
        v. Minimum 1” (25.4mm) thick MDF or HDF laminated top
        vi. Plastic or woodgrain laminate shall be 1.22mm thick by 'Wilsonart' / Arborite (or equal and approved by Architect).
        vii. Fire-Rated Laminate must be bonded to a substrate of reliable quality and appropriate fire rating, such as particleboard, incombustible cement board or plywood with one A-face. Bond with adhesives, and follow the techniques recommended by the adhesive manufacturer.

viii. Laminate with scratch and mold resistance and NEMA tested surface wear of min 400 cycles.
ix. Laminate with a minimum Class B minimum fire rating.

10. Panel Systems

a. Panel systems shall be of one or more of the following categories:

i. Privacy Panels
ii. Vision Panels
iii. Modesty Panels
iv. Electrified Panels
v. Cable Management
vi. Room dividers and partitions

b. Panel systems shall comprise of one or more of the following properties:

i. Panel systems in compliance with the quality standards of ANSI/BIFMA X5.6
ii. Furniture sustainability standard at a minimum ANSI/BIFMA e3 – level 1
iii. Painted components - coated with powder coat paint.
iv. Solid wood components - termite treated hardwoods, non-porous, resistant to rot, chips, scratches and dents.
v. Plastic or woodgrain laminate shall be 1.22mm thick by 'Wilsonart' / Arborite (or equal and approved by Architect).
vi. Fire-Rated Laminate must be bonded to a substrate of reliable quality and appropriate fire rating, such as particleboard, incombustible cement board or plywood with one A-face. Bond with adhesives, and follow the techniques recommended by the adhesive manufacturer.
vii. Laminate with scratch and mold resistance and NEMA tested surface wear of min 400 cycles.
viii. Laminate with a minimum Class B minimum fire rating.
ix. Frosted or clear acrylic panels min 4mm thick with metal framed edges
x. Frosted or clear toughened safety glass min 4mm thick with metal framed edges
xi. Electrified panels in compliance with the standards of the Underwriters Laboratory (UL).

11. Tables

a. Tables shall be of one or more of the following categories:

i. Meeting Tables
ii. Dining Tables
iii. Side Tables
iv. Coffee Tables
v. Folding/ Nesting Tables

b. Tables shall comprise of one or more of the following properties:

i. Tables in compliance with the quality standards of ANSI/BIFMA X5.5
ii. Furniture Sustainability Standard at a minimum ANSI/BIFMA e3 – level 1
iii. Painted components - coated with powder coat paint.

iv. Solid wood components - termite treated hardwoods, non-porous, resistant to rot, chips, scratches and dents.
v. Minimum 1" (25.4mm) thick MDF or HDF laminated top
vi. Plastic or woodgrain laminate shall be 1.22mm thick by 'Wilsonart' / Arborite (or equal and approved by Architect).
vii. Fire-Rated Laminate must be bonded to a substrate of reliable quality and appropriate fire rating, such as particleboard, incombustible cement board or plywood with one A-face. Bond with adhesives, and follow the techniques recommended by the adhesive manufacturer.
viii. Laminate with scratch and mold resistance and NEMA tested surface wear of min 400 cycles.
ix. Laminate with a minimum Class B minimum fire rating.

12. Storage & Filing

a. Storage & Filing shall be of one or more of the following categories:

i. Lateral filing cabinets
ii. Vertical filing Cabinets
iii. Storage Shelves
iv. Storage Cabinets
v. Storage lockers
vi. Bedside storage cabinets

b. Storage and filing shall comprise of one or more of the following properties:

i. Storage and filing in compliance with the quality standards of ANSI/BIFMA X5.9
ii. Furniture Sustainability Standard at a minimum ANSI/BIFMA e3 – level 1
iii. Painted components - coated with powder coat paint.
iv. Flush mounted doors with 180 degree opening capacity.
v. Lockable doors
vi. Minimum 18 gauge steel construction
vii. Availability in a wide range of colours to be confirmed by the employer.

2.00 APPLICATION

1. To provide all furniture, necessary fittings and configurations required for the occupancy and use of the facility and its proposed functions in the configurations required as specified by the user requirements, the International Building Code (IBC) 2015 and/ or by the local Authority Having Jurisdiction (AHJ).

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3. Specification/ Cut Sheets

3.13 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.14 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

4.01 INTERNATIONAL BUILDING CODE (IBC) REFERENCES

1. The design of elements in this section are to comply with the requirements the IBC 2015 generally paying particular attention to the following:
    f. Chapter 11 – Accessibility

4.02 ACCESSIBILITY STANDARDS

1. Components of the design requiring accessibility are to comply with the standards of the ICC/ ANSI A117.1 - Accessible and Usable buildings and Facilities Standard

4.03 STANDARD SPECIFICATIONS

1. ANSI/BIFMA X5.1 – Office chairs
2. ANSI/BIFMA X5.4 – Lounge & Public seating
3. ANSI/BIFMA X5.5 – Desks & Tables
4. ANSI/BIFMA X5.6 – Panel systems
5. ANSI/BIFMA X5.9 – Storage & Filing

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

3. All movable furniture shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

4. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 8 years commencing on Date of Substantial Completion for the movable furniture detailed in this section. Also provide warranties as follows for the elements described below:
    a. Laminates and wood veneers shall have a minimum 12 year warranty.
    b. Modular power components shall have a minimum 12 year warranty.
    c. Vertical surface textiles shall have a minimum 12 year warranty.

SECTION 1304 –SANITARY APPLIANCES & FITTINGS

1.0 GENERAL

1.01 DESCRIPTION

This section includes plumbing fixtures comprising of the following:

1. All fixtures necessary for the sanitation, occupancy and use of the facility connected to the water supply and/or drainage
2. Fixtures required as specified by the user requirements, the International Building Code (IBC) and/ or by the local Authority Having Jurisdiction (AHJ).

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following sanitary appliances and fittings:

1. Water Closets
2. Urinals
3. Lavatories
4. Accessible washroom fixtures
5. Kitchen sinks
6. Faucets and trims
7. Drinking Fountains
8. Utility/ Mop/ Janitor's Sinks

1.03 PRODUCTS

This section may include a combination of the following products/ elements:

1. Water Closets shall comprise of one or more of the following properties:
    a. Vitreous china that complies with BS 3402:1969 – Specification for quality of vitreous china sanitary appliances
    b. Floor mounted fixtures
    c. Wall mounted fixtures
2. Urinals
    a. Vitreous china that complies with BS 3402:1969 – Specification for quality of vitreous china sanitary appliances
    b. Wall mounted fixtures
3. Lavatories
    a. Vitreous china that complies with BS 3402:1969 – Specification for quality of vitreous china sanitary appliances
    b. Countertop mounted fixtures
    c. Under-counter mounted fixtures
    d. Pedestal mounted fixtures
4. Accessible washroom fixtures
    a. Toilets/ toilet compartments and all fixtures, fittings and accessories contained therein required by specific user requirements or as guided by the International Building Code shall conform to ICC/ ANSI A117.1 - Accessible and Usable buildings and Facilities Standard
5. Kitchen sinks
    a. Stainless steel that complies with ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet And Strip For Pressure Vessels And For General Applications
    b. Countertop mounted fixtures

c. Under-counter mounted fixtures

6. Faucets and trims
    a. Polished chrome – plated finish
    b. Satin nickel – plated finish
    c. Brushed stainless steel finish
7. Utility/ Mop/ Janitor's Sinks
    a. Stainless steel that complies with ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet And Strip For Pressure Vessels And For General Applications
    b. Vitreous china that complies with BS 3402:1969 – Specification for quality of vitreous china sanitary appliances
    c. Wall mounted fixture
    d. Floor mounted fixture

1.04 DESIGN CRITERIA

1. Fixture Functions
    a. Lavatories shall have a standard spout with integral overflow
    b. Urinals shall have a siphon jet flushing actions
    c. Kitchen sinks shall have a swivel spout and water spray nozzle
2. Fixture installation is to be in compliance with IPC Section 405 – Installation of fixtures
3. Water Consumption
    a. Shall be in compliance with table 604.4 of the International Plumbing code (IPC) which indicates the "Maximum Flow Rates for Plumbing Fixtures and Fittings"

2.00 APPLICATION

1. To provide plumbing fixtures necessary for occupancy, use and sanitation of the facility as specified by the user requirements, the International Building Code (IBC) and/ or by the local Authority Having Jurisdiction (AHJ).

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology
3. Specification/ Cut Sheets

3.15 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

4.01 INTERNATIONAL BUILDING CODE (IBC) REFERENCES

1. The design of elements in this section are to comply with the requirements the IBC generally paying particular attention to the following:
    a. Chapter 29 – Plumbing Systems

4.02 INTERNATIONAL PLUMBING CODE (IBC) REFERENCES

1. The design is to comply with the standards of the International Plumbing Code (IPC) generally paying particular attention to the following:
    a. IPC Section 405 – Installation of fixtures
    b. IPC table 604.4 - Maximum Flow Rates for Plumbing Fixtures and Fittings

4.04 ACCESSIBILITY STANDARDS

1. Components of the design requiring accessibility are to comply with the standards of the ICC/ ANSI A117.1 - Accessible and Usable buildings and Facilities Standard

4.05 STANDARD SPECIFICATIONS

1. BS 3402:1969
2. ASTM A240

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. All sanitary appliances shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 10 years commencing on Date of Substantial Completion for the sanitary appliances and fittings detailed in this section.

SECTION 1305 – INTERNAL SIGNAGE

2.0 GENERAL

1.01 DESCRIPTION

A. It is the intent of these specifications to establish a sign standard for the Owner including but not limited to, wall-mounted directional signs, primary room identification, restrooms, conference rooms and all code compliant Braille signage.

B. Comply with all applicable provisions of the 2010 ADA Standard for Accessible Design codes that apply to the State and Local jurisdiction of the project.

C. If required text and graphics are not indicated in specification or on drawings, obtain Owner's instructions as to text and graphics prior to preparation of shop drawings.

D. Typography: See Drawings. Copy shall be a clean and accurate reproduction of typeface(s) specified. Upper and lower case and all caps as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be set by manufacturer.

E. Arrows, symbols, and pictograms will be provided in style, sizes, colors and spacing as indicated in drawings for each sign system.

F. Braille: Grade 2

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install one or more of the following:

1. Room Identification
2. Stairs
3. Restroom
4. Elevator Lobby
5. Informational Signage
6. Directory Signage
7. Plastic exterior panel signs
8. Room Identification
9. Stairs
10. Restroom
11. Elevator Lobby
12. Informational Signage
13. Directory Signage

1.03 PRODUCTS

B. This section may include a combination of the following products/ elements:

1. Comply with all applicable provisions of the 2010 ADA Standard for Accessible Design.
2. Character Proportion: Letters and numbers on signs must have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.
3. Color Contrast: Characters and symbols must contrast with their background - either light characters on a dark background or dark characters on a light background.
4. Raised Characters or Symbols: Letters and numbers on signs must be raised 1/32 in (0.8 mm) minimum. Raised characters or symbols must be at least 5/8 in (16 mm) high but no higher than 2 in (50 mm). Symbols or pictograms on signs must be raised 1/32 in (0.8 mm) minimum.
5. Symbols of Accessibility: Accessible facilities required to be identified must use the international symbol of accessibility.
6. Braille: Grade II with accompanying text.

C. Fire Performance Characteristics:

1. Provide photopolymer signage with surface burning characteristics that consist of a flame spread of 75 and a smoke development of 120 when tested in accordance with UL 723 (ASTM E 84).
2. Self-Extinguishing: Provide photopolymer signage with a CC1 classification for .060 in thick material when tested in accordance with the procedures in ASTM D 635, Standard Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.
3. Vertical Burn: Provide photopolymer material that is classified as 94V-2 for material .118 in thick or greater and 94HB for material .118 in thick or less when tested in accordance with UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
4. Self-Ignition Temperature: Provide photopolymer material that has a self-ignition temperature of 800 degrees F (427 degrees C) when tested in accordance with ASTM D 1929.

2.00 APPLICATION

2. External building signage as specified by the user requirements, and in keeping with the requirements of the local Authority Having Jurisdiction (AHJ).

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

3. Materials listing and certification indicating that products adhere to standard specifications.
4. Installation methodology.
5. Specifications/ Product Data: Manufacturer's data sheets on each product to be used, including:
   i. Preparation instructions and recommendations.
   ii. Storage and handling requirements and recommendations.
   iii. Installation methods.
6. Shop drawings - fabrication and installation and attachment details indicating mounting heights, locations of supports and/or accessories.
7. Manufacturer's Installation Instructions: Printed installation instructions for each signage system.
8. Listing of the fonts, typestyles and graphics to be utilized.
9. Samples of the colours and materials to be utilized for approval.

3.16 QUALITY ASSURANCE

7. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
8. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
9. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
    i. Furnish signs designated by Architect.
    ii. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
    iii. Refinish mock-up area as required to produce acceptable work.

3.03 SAFETY, SECURITY, OPERATIONS

4. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ANSI 117.1 - For Buildings and Facilities
2. ASTM D149, ASTM D150, ASTM D256, ASTM D542, ASTM D570, ASTM D635, ASTM D638, ASTM D648, ASTM D695, ASTM D696, ASTM D732, ASTM D785, ASTM D79, ASTM D792, ASTM D1003, ASTM D1929, ASTM D2843, ASTM D3418, ASTM D3763, ASTM E84, ASTM E2072-04, ASTM E2073-02.
3. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
4. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
5. NFPA 70 – The National Electrical Code (NEC) Handbook

5.00 DURABILITY

4. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
5. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

5. All signage shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
6. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 5 years commencing on Date of Substantial Completion.

SECTION 1307 – BIRD, INSECT & VERMIN CONTROL SYSTEMS

3.0 GENERAL

1.02 DESCRIPTION

10. This section includes the supply and installation of the following:
    a. Bird barriers to block access to pest birds from any open area, opening or complicated bird roost in order to prevent damage from droppings and nesting materials.
    b. Insect barriers to exclude insects from certain areas preventing the spread of microorganisms, disease and damage to food stocks from droppings and nesting materials.
    c. Rodent barriers to exclude insects from certain areas preventing the spread of microorganisms, disease and damage to food stocks from droppings and nesting materials.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following:

7 Bird barriers

8 Insect barriers

9 Rodent barriers

1.03 PRODUCTS

This section may include a combination of the following products/ elements:

13. Bird Barriers
    a. Barriers constructed of polyethylene twine, available in a range of colours to blend with the background, with a range of mesh sizes to occlude various pest birds (from ¾" - 4" mesh). Available in a range of widths and lengths to suit a variety of applications.
    OR
    b. Barriers constructed of minimum 27 gauge galvanized steel mesh available in a range of mesh sizes to occlude various pest birds (from ¾" - 4" mesh). Available in a range of widths and lengths to suit a variety of applications.
14. Insect Barriers
    a. Barriers constructed of porous fabric with a mesh small enough to exclude certain insects without excluding light and airflow. Available in a range of widths and lengths to suit a variety of applications.
15. Rodent Barriers
    a. Rodent accessible openings: exposed pipes, wires, conduits etc. shall be covered with the following:
        i. a wire cloth at least 0.035 inches (.089mm) wire OR
        ii. solid sheet metal guards 0.024 inches (0.61 mm) thick or heavier
    b. Windows and other openings for the purpose of light and ventilation located in exterior walls within 2 feet (610mm) of the ground level shall be covered for their entire height with wire cloth 0.035 inches (.089mm)

2.00 APPLICATION

1. To provide systems necessary for bird, insect & vermin control within the facility as specified by the user requirements, the International Building Code (IBC) and/ or by the local Authority Having Jurisdiction (AHJ).

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

4. Materials listing and certification indicating that products adhere to standard specifications.
5. Installation methodology
6. Specification/ Cut Sheets

3.17 QUALITY ASSURANCE

4. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
5. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
6. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.18 SAFETY, SECURITY, OPERATIONS

2. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

4.01 INTERNATIONAL BUILDING CODE (IBC) REFERENCES

2. The design of elements in this section are to comply with the requirements the IBC generally paying particular attention to the following:
    a. IBC 2015 Appendix F101 Rodent Proofing

5.00 DURABILITY

3. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
4. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

7. All bird, insect & vermin control systems shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
8. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 5 years commencing on Date of Substantial Completion for the bird, insect & vermin control systems detailed in this section.

SECTION 1310 – EXTERNAL SIGNAGE

4.0 GENERAL

1.01 DESCRIPTION

This section includes external building signage comprising of the following:

All fixtures, fittings, fastening and accessories and electrical components necessary for the fabrication and installation of the external building signage as specified by the user requirements, and in keeping with the requirements of the local Authority Having Jurisdiction (AHJ).

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install one or more of the following:

1. Signage consisting of cast metal dimensional characters.
2. Signage consisting of extruded metal dimensional characters.
3. Signage consisting of cut-out metal dimensional characters.
4. Signage consisting of moulded-plastic dimensional characters.

1.03 PRODUCTS

This section may include a combination of the following products/ elements:

1. Cast metal dimensional characters having one or more of the following characteristics:
    a. Characters having uniform faces, precisely formed lines and profiles.
    b. Aluminium Castings complying with : ASTM B26 – Standard Specification for Aluminium – Alloy Sand Castings
    c. Copper Alloy (Brass) Castings complying with : ASTM B584 – Standard Specification for Aluminium – Alloy Sand Castings
2. Extruded metal dimensional characters having one or more of the following characteristics:
    a. Characters having uniform faces, precisely formed lines and profiles.
    b. Aluminium Extrusions complying with: ASTM B221 – Standard Specification for Aluminium and Aluminium Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
3. Cut-out metal dimensional characters having one or more of the following characteristics:
    a. Characters having uniform faces, smooth, clean cuts and precisely formed lines and profiles.
    b. Aluminium cut-out characters complying with ASTM B209 – Standard Specification for Aluminium and Aluminium Alloy Sheet and Plate
    c. Copper Alloy (Brass) cut-out characters complying with ASTM B36 – Standard Specification for Brass Plate, Sheet, Strip and Rolled Bar
4. Moulded-plastic dimensional characters.
    a. Characters having uniform faces, precisely formed lines and profiles.
    b. Acrylic characters complying with ASTM D4802 – Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet
5. Electrical components devices and accessories tested by the Underwriters Laboratory (UL) and in compliance with NFPA 70 – The National Electrical Code (NEC) Handbook
6. Fasteners, anchors and adhesives
    a. For external signage stainless-steel fasteners shall be used
    b. Concealed fasteners and anchors shall be used unless otherwise indicated
    c. Exposed metal fasteners shall be matched to final finish of the sign
    d. Adhesives shall have a VOC content of less than 70 g/L
    e. Asphalt-base emulsion protective coatings for Metal shall comply with ASTM D1187- Standard specification for Asphalt-Base Emulsion for Use as Protective Coatings for Metal

2.00 APPLICATION

1. External building signage as specified by the user requirements, and in keeping with the requirements of the local Authority Having Jurisdiction (AHJ).

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology.
3. Specification/ Cut Sheets.
4. Shop drawings - fabrication and installation and attachment details indicating mounting heights, locations of supports and/or accessories.
5. Listing of the fonts, typestyles and graphics to be utilized.
6. Samples of the colours and materials to be utilized.

3.19 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM B26
2. ASTM B584
3. ASTM B221
4. ASTM B209
5. ASTM B36
6. ASTM D4802
7. ASTM D1187
8. NFPA 70

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and

anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. All signage shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 5 years commencing on Date of Substantial Completion.

SECTION 1404 – UNFRAMED ISOLATED TRIMS/ SKIRTINGS/ SUNDRY ITEMS

1.0 GENERAL

1.01 DESCRIPTION

Trims shall refer to mouldings applied around doors and windows, or to conceal rough cuts, conceal joints, corners and changes in material

Skirtings shall refer to a continuous border material at the base of a wall to be both protective and decorative in nature.

Sundry Items shall refer to miscellaneous items or works that do not readily fit into standard categories.

1.02 SCOPE

Work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install all trims and skirtings as indicated in the design drawings.

1.03 PRODUCTS

1. Mouldings:
    a. Solid Concrete Mouldings
    b. Structural Foam Mouldings
2. Skirtings:
    a. Timber Skirtings
    b. Tile Skirtings
    c. Vinyl Skirtings
3. Adhesives.

2.00 APPLICATION

1. Mouldings: Exterior windows as indicated in the design, special façade elements as indicated in the design drawings.
2. Skirtings: In all interior spaces
3. Sundry Items: Not applicable

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval the following:

1. For door and window hardware:

a) Cut sheets for all products to be used
b) Verification Samples: representative units of each type, size, surface finish of door or window hardware
c) Approved Door and Window Schedules with corresponding Hardware Schedules
d) Door and Window Hardware supplier information and contact information upon closeout.
e) Care and maintenance instructions for all hardware upon closeout.

2. For Grille work elements:
   a) Shop Drawings: Include plans, elevations, sections, and attachment details
   b) Samples of welded connections; Show method of finishing members at intersections. Samples need not be full height.

3.20 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All structural aspects of work covered in this specification shall be subject to inspection by the Engineer, or his representative. The Contractor shall submit a schedule of his activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.
3. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.

4.00 REFERENCED STANDARDS

Consult latest versions of the following standards:
1. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes
2. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
3. ANSI /BHMA A156 Series

5.00 DURABILITY

6. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
7. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Supply Warranties for door and window hardware as per supplier. Warranty period shall be a minimum of 3 years against defects in material and workmanship from the date of substantial completion.
2. Grille-work elements shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration or stains caused by foreign substances, Acts of God (environmental disasters beyond normal climactic conditions) and

modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1405 – UNFRAMED ISOLATED TRIMS/ SKIRTINGS/ SUNDRY ITEMS

1.0 GENERAL

1.01 DESCRIPTION

Trims shall refer to mouldings applied around doors and windows, or to conceal rough cuts, conceal joints, corners and changes in material

Skirtings shall refer to a continuous border material at the base of a wall to be both protective and decorative in nature.

Sundry Items shall refer to miscellaneous items or works that do not readily fit into standard categories.

1.02 SCOPE

Work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install all trims and skirtings as indicated in the design drawings.

1.03 PRODUCTS

1. Mouldings:
    a) Solid Concrete Mouldings
    b) Structural Foam Mouldings
2. Skirtings:
    a) Timber Skirtings
    b) Tile Skirtings
    c) Vinyl Skirtings
3. Adhesives

2.00 APPLICATION

1. Mouldings: Exterior windows as indicated in the design, special façade elements as indicated in the design drawings.
2. Skirtings: In all interior spaces
3. Sundry Items: Not applicable

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval the following:

3. For door and window hardware:
    f) Cut sheets for all products to be used
    g) Verification Samples: representative units of each type, size, surface finish of door or window hardware
    h) Approved Door and Window Schedules with corresponding Hardware Schedules
    i) Door and Window Hardware supplier information and contact information upon closeout.
    j) Care and maintenance instructions for all hardware upon closeout.

4. For Grille work elements:
    c) Shop Drawings: Include plans, elevations, sections, and attachment details

d) Samples of welded connections; Show method of finishing members at intersections. Samples need not be full height.

3.21 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All structural aspects of work covered in this specification shall be subject to inspection by the Engineer, or his representative. The Contractor shall submit a schedule of his activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.
3. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.

4.00 REFERENCED STANDARDS

Consult latest versions of the following standards:

4. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes
5. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
6. ANSI /BHMA A156 Series

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

3. Supply Warranties for door and window hardware as per supplier. Warranty period shall be a minimum of 3 years against defects in material and workmanship from the date of substantial completion.
4. Grille-work elements shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration or stains caused by foreign substances, Acts of God (environmental disasters beyond normal climactic conditions) and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1405 – DOOR & WINDOW IRONMONGERY

1.0 GENERAL

1.01 DESCRIPTION

Architectural ironmongery shall refer to items made from iron, steel, aluminium, brass or other metals. Such items, sometimes also described as architectural hardware, include door handles, locks, door closers, hinges, window fittings, metal door and window grille work / burglar proofing .

1.02 SCOPE

Work to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install all ironmongery items including anchorage systems.

1.03 PRODUCTS

1. **Door Hardware:** door hinges, escutcheons, latches, bolts, cylinders, pulls must be at minimum Commercial / security Grade 2, provided that Grade 2 is sufficiently granted warranty by the supplier for the specific application. Otherwise, door hardware will be Commercial Grade 1 with functions as defined by ANSI /BHMA A156. Confirm that functions are permitted by Local Codes and Regulations. Consult NFPA 80 (latest version) concerning hinge requirements for fire doors.

2. **Window Hardware:** locks, pulleys, sash handles, fasteners, catches, hinges must be at minimum Commercial / security Grade 2, provided that Grade 2 is sufficiently granted warranty by the supplier for the specific application. Otherwise, door hardware will be Commercial Grade 1 with functions as as defined by ANSI /BHMA A156

3. **Grille Work Elements:** Hollow section steel elements (Square hollow section: SHS, Rectangular Hollow Section: RHS, Circular Hollow Section: CHS). Bars and Shapes: ASTM A 276, Type 304.

   a) For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes.

   b) Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

   c) Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 0.8 millimetre 1/32

inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

d) Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

e) Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

f) Seismic Performance: Where seismic resilience is required, provide railings, connections, and/or components identified which will accommodate movement without permanent inelastic deformation.

4. **Paints and Coatings:** Coatings on ferrous and galvanized metal surfaces shall consist of a prime coat and not less than two finish coats. Coatings shall have high abrasion resistance, good flexibility and chemical resistance, UV resistance and be applied in a manner that yields a uniform coverage and thickness, without bubbles, bulges and other textural inconsistencies.

5. **Fasteners for Anchoring to Other Construction:** Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

   Fastener materials – Unless otherwise indicated, provide the following:
   a) Stainless-Steel Components: Type 304 stainless-steel fasteners.
   b) Brackets, Flanges, and Anchors: Same metal and finish as supported members unless otherwise indicated.
   c) Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless steel fasteners where exposed.
   d) Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
   e) Dissimilar Metals: Type 304 stainless-steel fasteners.

2.00 APPLICATION

1. Interior and exterior doors
2. Exterior Windows
3. Exterior Grille-work building entry

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval the following:

1. For door and window hardware:
    k) Cut sheets for all products to be used
    l) Verification Samples: representative units of each type, size, surface finish of door or window hardware
    m) Approved Door and Window Schedules with corresponding Hardware Schedules
    n) Door and Window Hardware supplier information and contact information upon closeout.
    o) Care and maintenance instructions for all hardware upon closeout.

2. For Grille work elements:
    e) Shop Drawings: Include plans, elevations, sections, and attachment details
    f) Samples of welded connections; Show method of finishing members at intersections. Samples need not be full height.

3.22 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All structural aspects of work covered in this specification shall be subject to inspection by the Engineer, or his representative. The Contractor shall submit a schedule of his activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.
3. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement.

4.00 REFERENCED STANDARDS

Consult latest versions of the following standards:

1. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes
2. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
3. ANSI /BHMA A156 Series

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. Supply Warranties for door and window hardware as per supplier. Warranty period shall be a minimum of 3 years against defects in material and workmanship from the date of substantial completion.
2. Grille-work elements shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration or stains caused by foreign substances, Acts of God (environmental disasters beyond normal climactic conditions) and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1506 –EXTERNAL WORKS – INTERLOCKING BRICKS/ BLOCKS, ROADS & PAVING

1.0 GENERAL

1.01 DESCRIPTION

1. External works incorporates the immediate surrounding context of a building.
2. Paving incorporates the variation of materials uses to create hard surface area “hardscape” for a buildings surroundings.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following works:

1. Minor roads
2. Pathways
3. Driveways
4. Parking

1.03 PRODUCTS

External works / Paving may include a combination of the following products/ elements:

1. Paving to comply with:
    a. ASTM D3666(16): Standard specification for minimum requirements for agencies testing and inspecting road and paving materials
2. Aggregate to comply with:
    a. ASTM D448(12) – Standard classification for sizes of aggregate for road and bridge construction
    b. ASTM D242M(19 – Standard specification for mineral filler for asphalt mixtures
    c. ASTM D692M(20) – Standard specification for course aggregate for asphalt paving mixtures
    d. ASTM D1073(16) – Standard specification for fine aggregate for asphalt paving mixtures
3. Asphalt to comply with:
    a. ASTM D5710M – Standard specification for Trinidad lake modified asphalt
    b. ASTM D977(20) – Standard specification emulsified asphalt
    c. ASTM D4215(20) – Standard specification for cold mixed, cold laid asphalt paving mixtures
    d. ASTM D946 – Standard specification for penetration – graded asphalt binder for use in pavement construction
    e. ASTM D2026, D2027, D2028 – Standard specification for cutback asphalt
4. Filler materials to comply with:
    a. ASTM D5078 – Standard specification for crack fillers, hot applied for asphalt concrete and Portland cement concrete pavements
5. Surface texture to comply with:
    a. ASTM E501 – Standard specifications for standard rib tire for pavement skid-resistance test
    b. ASTM E524(08)2020 – Standard specification for smooth tire for pavement skid-resistance test

2.00 APPLICATION

1. External site work
2. Minor road surfaces
3. Pavements

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.23 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM D3666(16)
2. ASTM D448(12)
3. ASTM D242M(19)
4. ASTM D692M(20)
5. ASTMD1073(16)
6. ASTM D5710M
7. ASTM D977(20)
8. ASTM D4215(20)
9. ASTM D946
10. ASTM D2026,2027,2028
11. ASTM D5078
12. ASTM E201
13. ASTM E524(08) 2020

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers: Lifespan expectancy equal to that specified for primary weather barriers.

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. External works interlocking bricks/ blocks, roads & paving shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.

SECTION 1511 –EXTERNAL WORKS - FENCING

1.0 GENERAL

1.02 DESCRIPTION

The erection of fencing, perimeter walls, grillwork and gates to secure the boundary of the immediate surrounding context of the building.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following works:

1. Boundary walls
2. Boundary Fencing
3. Gates
4. Decorative grillwork

1.03 PRODUCTS

The fencing works may include a combination of the following products/ elements:

4. Boundary walls which may include one or more of the following:
    a. In situ concrete which shall comply with the standards set out in Section 501 “In situ & Precast Concrete”
    b. Precast concrete which shall comply with the standards set out in Section 501 “In situ & Precast Concrete”
    c. Block walling which shall comply with the standards set out in Section 601 “Block walling”
5. “Anti-climb” medium security perimeter fencing which shall include the following properties:
    a. Panel height minimum of 2440mm (8ft)
    b. Mesh size maximum of 200mm (8”) high x 50mm (2”) wide.
    c. Wire diameter minimum of 5mm
    d. Wire gauge minimum of 4g
    e. Post system minimum 2.25” x 2.25” (57mm x 57mm) square galvanized steel post. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
    f. Finish: hot dipped galvanize Powder coated – colour to be selected by the employer. Galvanizing is to comply with ASTM A153 – Standard specification for Zinc coating (Hot-dip) on iron and steel hardware and ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products.
6. Gates in the “Anti-climb” medium security perimeter fencing which shall include the properties detailed for the fencing and must provide a gate width appropriate to the use (pedestrian and/or vehicular access)
7. Metal grillwork gates shall include the following properties:
    a. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
    b. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
    c. Coatings on the iron/ steel shall comply with ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products.
8. Decorative Grillwork shall include the following properties:
    a. Exposed surfaces shall be free of seam marks, rolled names, and other irregularities.
    b. Steel shapes shall comply with ASTM A36 - Standard specification for carbon structural steel.
    c. Coatings on the iron/ steel shall comply with ASTM A123 – Standard specification for Zinc (Hot-dip galvanized) coatings on Iron and steel products.

2.00 APPLICATION

7. Masonry boundary walls

8. “Anti-climb” medium security perimeter fencing
9. “Anti-climb” medium security perimeter fencing gates
10. Grillwork gates providing access to the site through the masonry boundary walls and/or the perimeter fencing
11. Decorative grillwork panel inserts between sections of the perimeter wall

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology

3.24 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

4.00 REFERENCED STANDARDS

1. ASTM A153
2. ASTM A123
3. ASTM A36

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic, excluding joint sealers
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage
3. Joint sealers: Lifespan expectancy equal to that specified for primary weather barriers.

7.0 WARRANTIES, GUARANTEES AND MAINTENANCE

1. External works - fencing shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of 10 years commencing on Date of Substantial Completion for the “Anti-climb” medium security perimeter fencing.

SECTION 1701 – PLUMBING

PART 1 GENERAL

1.01 SCOPE OF THE WORKS

All plumbing systems are to be installed in accordance with the RFP, End User requirements and the national plumbing code of Trinidad & Tobago.

2.01 SECTION INCLUDES

A. Plumbing elements comprise the following:

1. Water Supply: Water sources and storage.

    a. Water source for fire suppression systems.

2. Domestic Water: All elements required to distribute water to fixtures, including piping and equipment for water cooling, heating and storage.

    a. Water Distribution: Piping within the building, serving fixtures, specialties, and equipment.

    b. Plumbing Equipment: Pumps, tanks, filters, controls and treatment equipment.

3. Sanitary Waste: All elements required for removal of sanitary waste, including piping, venting, discharge and disposal, and equipment.

4. Rain Water Drainage: All elements required for drainage of rain water from building areas in which it may accumulate and drainage of clear wastes from building services; not including gutters and downspouts or sub drainage.

5. Plumbing Fixtures: All fixtures necessary for sanitation, occupancy, and use that are connected to water supply or drainage; not including water heating or conditioning equipment or kitchen appliances.

6. Other Plumbing Elements: Services elements required for a complete plumbing system.

A. Utility Sources and Outlets:

1. Water Source: Existing public utility.

2. Sewage Disposal: Connect building sewer to the existing public sewage system.

3. Rain Water Drainage Outlet: Existing public utility storm drainage system independent of sanitary sewer.

2.02 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 400 – Earthworks
- Section 1101 – Windows, Rooflights, Screens & Louvers
- Section 1304 – Sanitary Appliances & Fittings
- Section 1506 – External Works – Interlocking Bricks/Blocks, Roads & Paving
- Section 2315 – Mechanical (HVAC)
- Section 2316 – Mechanical (Elevators)
- Section 2320 – Electrical
- Section 2321 – Electrical (Lighting)
- Section 2330 – ICT
- Section 2340 – Plumbing
- Section 2345 – Fire Suppression
- Section 2350 – Commissioning
- Section 2360 – Training
- Section 2370 – Handover Documentation
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

2.03 REFERENCE STANDARDS

- ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- ASME B16 – Standards of Pipes and Fittings
- ASME B31 – Standards of Pressure Piping
- ASME B31.9 – 20120 Building Services Piping
- ICC IFC 2018-2021 International Fire Code
- ICC IPC 2018-2021 International Plumbing Code
- ICC IMC 2018-2021 International Mechanical Code
- NFPA 13 – 2019 Standard for the Installation of Sprinkler System
- NFPA 14 - 2019 Standard for the Installation of Standpipes and Hose Systems
- NFPA 20 – 2019 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 22 – 2018 Standard for Water Tanks for Private Fire Protection
- NFPA 24 – 2019 -2022 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- NFPA 70 – 2020 National Electric Code
- NFPA 101 - 2021 Life Safety Code
- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the EMA of Trinidad and Tobago & Water Pollution Rules 2019
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago
- Requirements of the Public Health Department in accordance with the Public Health Ordinance Act

- The National Plumbing Code of Trinidad and Tobago
- Trinidad & Tobago Electricity Commission Wiring for Light & Power 8th Edition
- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Water and Sewerage Authority Guidelines for Design and Construction of Water and Wastewater Systems in Trinidad and Tobago

PART 2 PRODUCTS (NOT USED)

PART 3 DESIGN CRITERIA

3.01 PIPING, IN GENERAL

3.02 DOMESTIC WATER PIPING AND EQUIPMENT

A. Water Piping, Buried:

1. Use one of the following:

a. Polyvinyl chloride (PVC) SCH 40 plastic pipe and fittings, with solvent welded joints.

B. Water Piping, Not Buried:

1. Use one of the following:

a. Polyvinyl chloride (PVC) SCH 40 plastic pipe and fittings, with solvent welded joints.

C. Valves For Shut-Off or Isolation of Equipment, Fixtures, and Parts of Systems:

1. Use one of the following:

a. Ball valves.

b. Gate valves.

c. Butterfly valves.

D. Method of Removing Air from Supply Piping:

1. Use one of the following:

a. Automatic air vents.

b. Manual air vents.

3.03 SANITARY WASTE AND VENT PIPING AND EQUIPMENT

A. Sanitary Waste and Vent Piping, Buried:

1. Use one or more of the following:

a. Polyvinyl chloride (PVC) DWV pipe and fittings, with solvent welded or gasketed joints.

B. Sanitary Waste and Vent Piping, Not Buried:

1. Use one or more of the following:

a. Polyvinyl chloride (PVC) DWV pipe and fittings, with solvent welded joints.

3.04 RAIN WATER PIPING AND DRAINS

A. Rain Water Piping, Not Buried:

1. Use one or more of the following:

a. Polyvinyl chloride (PVC) DWV pipe and fittings, with solvent welded joints.

B. Rain Water Piping, Buried:

1. Use one or more of the following:

a. Polyvinyl chloride (PVC) pipe and fittings, with solvent welded or gasketed joints.

C. Roof Drains, Area Drains, and Floor Drains:

1. Use one or more of the following:

a. Bronze.

b. Galvanized cast iron.

3.05 PLUMBING FIXTURES

A. Water Closets:

1. Use one or more of the following:

a. External flush valve type.

a. Vitreous china.

b. Wall mounted fixtures.

B. Urinals:

1. Use one or more of the following:

a. Vitreous china.

a. Wall mounted fixtures.

C. Lavatories:

1. Use one or more of the following:

a. Vitreous china.

b. Countertop-mounted fixtures.

b. Under counter-mounted fixtures.

D. Kitchen Sinks:

1. Use one or more of the following:

a. Stainless steel.

b. Countertop-mounted fixtures.

c. Pedestal-mounted fixtures.

E. Faucets and Trim:

1. Use one or more of the following:

a. Polished chrome-plated finish.

F. Drinking Fountains:

1. Use one or more of the following:

a. Electric water coolers.

G. Utility (Mop or Janitor's) Sinks:

1. Use one or more of the following:

a. Stainless steel.

b. Wall-hung fixtures.

3.06 BASIC FUNCTION

A. Provide water supply necessary for building occupancy and use.

B. Provide delivery of domestic water to points of utilization.

C. Provide water supply for fire sprinkler system and standpipes.

D. Provide drainage for disposal of waste as required by the code and for the following:

1. Fixtures and equipment which have a waste connection or a domestic water connection.

a. Waste connections are not required on icemakers, refrigerators with icemakers, exterior hose bibs, and coffee makers.

2. Indirect Drainage: Floor drains to receive piping from:

a. Equipment drain pans.

b. Condensate drains.

c. Other equipment that produces clear wastes.

d. Other equipment specified to have indirect drain.

E. Provide drainage for disposal of rain water and clear wastes, as required by the code.

F. Provide plumbing fixtures necessary for occupancy, use, and sanitation.

G. Equipment that is Not Part of Services Systems: Specified in the project program and in Sections DC E1 through DC E19.

H. In addition to the requirements of this section, comply with all applicable requirements of Section DC 0 - Facility Design Criteria.

3.07 AMENITY AND COMFORT CRITERIA

A. Noise:

1. Design to prevent noise due to air trapped in piping systems.

2. Provide water hammer arrestors as shown on drawings to eliminate noise produced by the domestic water fixtures.

3. Minimize noise produced by fixtures.

B. Convenience:

1. Fixture Heights: As specified in code.

2. Fixture Configurations: As specified in code.

3. Maneuvering Space: Provide comfortable space between and around fixtures.

4. Faucets: Single action operation in the following locations.

a. Restrooms

b. Executive restrooms

5. Install floor drains flush with the surface on which they are installed, out of pedestrian traffic patterns wherever possible.

6. Do not locate floor drains and floor cleanouts in doorways or directly in traffic paths.

C. Odors:

1. Locate odor producing elements in areas separate from human occupancy in dedicated equipment rooms.

2. Do not locate sanitary waste vent openings where odors are noticeable by occupants or by occupants of adjacent properties or where odor-bearing air may enter building spaces. a. Do not terminate vents within 3 m horizontally of doors, windows, air intake or exhaust openings, or other openings in the exterior enclosure, unless vent termination is at least 1 m above the top of the opening.

3. Provide traps for all indoor drains connected to rain water drainage system.

D. Appearance:

2. Do not locate rain water leaders or downspouts where they are visible from the outside of the building.

2. Vents: Conceal vents from view.

1. Fixtures:

a. Smooth, corrosion-resistant, non-absorbent, with no crevices to collect dirt.

b. Aesthetically pleasing and easy and comfortable to use; high style appearance is very important.

c. Color: White, except where metal fixtures are required.

3.08 HEALTH AND SAFETY CRITERIA

A. Health: Provide potable water.

1. Public utility water can be considered to be potable.

2. Maintain the safety of the potable water source at all times.

3. Do not connect the potable water source to any non-potable water source.

4. Keep animals and vermin out of open pipes, tanks, and other system components.

5. Keep other contaminants out of the distribution systems, equipment, and water source.

6. All openings and edges around the sides and bottom of each fixture permanently sealed with waterproof material.

7. Do not locate indirect drains in toilet rooms, unventilated or inaccessible rooms, or in air distribution or return plenums.

8. Provide a backflow prevention device in the sewer discharge to prevent back-up into plumbing fixtures and floor drains.

B. Waste Disposal: Connect each fixture to sanitary drainage system for proper disposal of waste and harmful materials.

C. Pressure Control: Control pressures to protect the building, fixtures, equipment, and occupants from harm.

1. Maximum Water Distribution Working Pressure: 550 kPa.

D. Burn Hazards:

3.09 DURABILITY CRITERIA

A. Expected Service Life Span: Same as service life of building unless otherwise indicated.

1. Plumbing Fixtures: Same as building service life.

3.10 OPERATION AND MAINTENANCE CRITERIA

A. Fixture Functions:

1. Lavatories: Standard spout, with integral overflow.
2. Urinals: Siphon jet flushing action.
3. Kitchen Sinks: Swivel spout, water spray nozzle.

B. Water Consumption:

1. Water Closets: 6 liters per flush, maximum, with complete waste removal in one flush.
2. Urinals: 3.8 liters per flush, maximum, with complete waste removal in one flush.
3. Lavatory Faucets in Public Restrooms: 0.95 liters per use.
4. Shower Heads: 9.5 liters per minute, maximum.

C. Capacity of Water Service: Provide adequate water flow and pressure to supply peak demand requirements. Comply with requirements specified in the code and the following.

1. Validation:

a. Preliminary Design: Analysis and documentation of water supply source and flow conditions.

b. Construction: Prior to installation of plumbing fixtures and prior to concealment of piping, air and water tests of piping systems at 110 percent of operating pressure, maintaining pressure for 2 hours to demonstrate system is watertight.

c. Construction: Functional tests of fixtures and equipment.

D. Waste Pipe Sizing:

1. Size piping as required by code.

2. Building Drain: 100 mm diameter, minimum.

3.11 WARRANTIES AND GUARANTEES

1. All Plumbing components and systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (2) years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (2) two years commencing on Date of Substantial Completion with the option for extended warranties past the (3) two years.

SECTION 1705 – FIRE SUPPRESSION

PART 1 GENERAL

1.01 SCOPE OF THE WORKS

The supply and installation of the fire suppression systems made up of 1) Sprinkler System and 2) Fire Hose Reel System 3) Gas Suppression System for ICT equipment rooms in accordance with the relevant codes.

2.01 SECTION INCLUDES

A. Fire suppression comprises the following elements:

B. Fire Sprinkler and Extinguishing Systems: Elements which automatically extinguish fires; automatic fire suppression is required only for the following areas:

1. Lobby.
2. General offices.
3. Computer room.
4. Kitchen.
5. Other areas per NFPA and Trinidad & Tobago Fire Service requirements.

C. Standpipe and Hose Systems: Elements that deliver adequate supplies of water to locations in the building for manual fire-fighting.

D. Other Fire Protection Elements: Elements that are not covered in other fire protection Sections.

E. Products: Where specific products are required or allowed, use products complying with the additional requirements specified elsewhere.

2.02 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 1304 – Sanitary Appliances & Fittings
- Section 2310 – Design Procedures and Validation Requirements
- Section 2315 – Mechanical (HVAC)
- Section 2316 – Mechanical (Elevators)
- Section 2320 – Electrical
- Section 2321 – Electrical (Lighting)
- Section 2330 – ICT
- Section 2340 – Plumbing
- Section 2350 – Commissioning
- Section 2360 – Training
- Section 2370 – Handover Documentation
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

2.03 REFERENCE STANDARDS

- ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- ASME B16 – Standards of Pipes and Fittings
- ASME B31 – Standards of Pressure Piping
- ASME B31.9 – 20120 Building Services Piping
- ICC IFC 2018-2021 International Fire Code
- ICC IPC 2018-2021 International Plumbing Code
- ICC IMC 2018-2021 International Mechanical Code
- NFPA 10 – 2018 Standards on Portable Fire Extinguishers
- NFPA 13 – 2019 Standard for the Installation of Sprinkler System
- NFPA 14 - 2019 Standard for the Installation of Standpipes and Hose Systems
- NFPA 15 – 2022 Standard water spray fixed systems for fire protection
- NFPA 17 – 2021 Standard for Dry Chemical Extinguishing Systems
- NFPA 17A – 2021 Standard for Wet Chemical Extinguishing Systems
- NFPA 20 – 2019 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 22 – 2018 Standard for Water Tanks for Private Fire Protection
- NFPA 24 – 2019 -2022 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- NFPA 70 – 2020 National Electric Code
- NFPA 72 – 2019 National Fire Alarm and Signalling Code
- NFPA 90A – 2021 Standard for the Installation of Air-Conditioning and Ventilating Systems
- NFPA 92 – 2021 Standard for Smoke Control Systems
- NFPA 101 - 2021 Life Safety Code
- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago
- Requirements of the Public Health Department in accordance with the Public Health Ordinance Act
- The National Plumbing Code of Trinidad and Tobago
- Trinidad & Tobago Electricity Commission Wiring for Light & Power 8th Edition
- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Water and Sewerage Authority Guidelines for Design and Construction of Water and Wastewater Systems in Trinidad and Tobago

PART 2 PRODUCTS NOT USED

PART 3 DESIGN CRITERA

3.01 FIRE SUPPRESSION SYSTEM TYPES

A. Do not use:

1. CFC, HCFC, or Halon-based extinguishing agents.

B. Use one or more of the following:

1. Wet pipe sprinkler system.

2. Dry pipe sprinkler system.

3. Standpipe system.

3.02 FIRE SPRINKLER AND EXTINGUISHING SYSTEM COMPONENTS

A. Pipe:

1. Use one or more of the following:

a. Materials permitted by code.

b. SCH 40 Carbon black steel

B. Fittings:

1. Use one or more of the following:

a. Materials permitted by code.

b. SCH 40 Carbon black steel fittings

C. Fire Pumps:

1. Use one or more of the following:

c. Main Duplex pump set with associated control panel and accessories

d. Jockey Pump as permitted by code.

3.03 STANDPIPE AND HOSE SYSTEM COMPONENTS

A. Pipe:

1. Use one or more of the following:

a. Materials permitted by code.

b. SCH 40 Carbon black steel

B. Fittings:

1. Use one or more of the following:

e. Materials permitted by code.

f. SCH 40 Carbon black steel fittings

3.04 BASIC FUNCTION

A. Provide code-required fire suppression regardless of type or coverage specified.

B. Fire Sprinklers: Types as indicated for specific spaces and areas.

1. Design and construction in accordance with code and NFPA 13.

2. Provide wet pipe sprinkler systems unless otherwise indicated or required by code.

3. General Use (Not Indicated as another Type): Wet pipe.

4. Lobby:

a. System Type: Wet pipe.

b. Occupancy: Light Hazard.

c. Density/Area: 3.3 L per min per sq m over 185 sq m.

5. General Offices:

a. System Type: Wet pipe.

b. Occupancy: Light Hazard.

c. Density/Area: 3.3 L per min per sq m over 185 sq m.

6. Computer Room:

a. System Type: Dry pipe.

b. Occupancy: Light Hazard.

c. Density/Area: 3.3 L per min per sq m over 185 sq m.

C. Fire Extinguishing Systems: Types as indicated for specific spaces and areas.

1. Dry-Chemical Extinguishing Systems: Design and construction in accordance with code and NFPA 17.

2. Foam Extinguishing Systems: Design and construction in accordance with code and NFPA 11.

D. Where fire protection elements also must function as elements defined within another element group, meet the requirements of both element groups.

E. In addition to the requirements of this section, comply with all applicable requirements of Section DC 0 - Facility Design Criteria.

F. Validation:

1. Proposal: Description of systems required, sources, input-side capacities, and means of distribution.

2. Preliminary Design: Fire protection areas identified.

3. Design Development: Fire protection zones indicated on the drawings with riser locations identified.

4. Construction Documents: Complete system details.

5. Construction and Closeout: Functional performance testing.

3.05 AMENITY AND COMFORT CRITERIA

A. Leakage: Provide systems that are leak-free.

B. Accessibility: Provide clearances around system components for service and use.

1. Provide a hose cabinet at the end of each corridor.

C. Convenience: Provide fire department connections for each standpipe as required by code.

D. Appearance:

1. All spaces unless indicated otherwise on the drawings: Concealed sprinklers.

3.06 HEALTH AND SAFETY CRITERIA

A. Path of Egress: Provide systems which safeguard path of egress.

B. Fire Source: Provide system materials which do not contribute to the spread of the fire.

C. Fire Spread: Provide systems to limit spread of fire from storage area to office area.

D. Chemical Exposure or Use: Provide systems which limit exposure of occupants to extinguishing agents.

E. Dry-Chemical Nozzle Performance: As required by code and NFPA 17.

F. Sprinkler Head Performance: As required by code and NFPA 13.

1. Flammable Storage Room: ESFR sprinklers.

3.07 STRUCTURAL CRITERIA

A. Seismic Design:

1. Provide a sprinkler system which allows movement where differential movement is anticipated.

2. Provide sprinkler system supports capable of supporting twice its installed wet weight.

3.08 DURABILITY CRITERIA

A. Expected Service Life Span:

1. Provide a sprinkler system which will last a minimum of 10 years in service without major repairs or operating expense when maintained as specified in NFPA 25.

2. Sprinkler Heads, Valves, and Other Inlet and Outlet Components: Same as building service life.

3.09 OPERATION AND MAINTENANCE CRITERIA

A. Capacity: As required by code.

B. Ease of Use: Provide easy access to and working clearances around system components.

C. Ease of Use: Provide standpipes which comply with the acceptance requirements of NFPA 14.

D. Ease of Service:

E. Unauthorized Use: Provide systems which minimize activation and use by unauthorized persons.

F. Maintenance:

1. Provide sprinkler system and fire pump maintenance in accordance with NFPA 25.

2. Provide standpipe maintenance in accordance with NFPA 25.

3. Provide dry-chemical system maintenance in accordance with NFPA 17.

3.10 WARRANTIES AND GUARANTEES

1. All Fire Suppression components and systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (3) years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (3) three years commencing on Date of Substantial Completion with the option for extended warranties past the (3) three years.

SECTION 1802 – HVAC

PART 1 GENERAL

1.01 SCOPE OF THE WORKS

1.02 SECTION INCLUDES

A. HVAC: Artificial means of maintaining interior space comfort and air quality, including heating, cooling, ventilation, and energy supply.

B. The HVAC system consists of the following elements used to maintain occupant comfort:

1. Air Distribution: Elements required to supply, return, and exhaust air associated with cooling the building.

3. Hydronic Distribution: Elements required to distribute water and other liquids for cooling.

a. System(s) required include low temperature water system, medium pressure water system, high temperature water system, chilled water system, and low temperature water system and chilled water system.

b. Configuration - All Systems: Reverse return.

c. Configuration - Heating Water: Reverse return.

d. Configuration - Chilled Water: Reverse return.

4. DX R410a minimum Refrigerant Distribution: Elements required to distribute refrigerant for heating or cooling.

5. HVAC Controls: Elements required to monitor and control HVAC equipment and systems.

6. Smoke Control Systems: Elements required to control smoke in the event of a fire and to remove smoke after the fire is extinguished.

7. Dedicated Secondary Cooling Units

8. External Louvres, Supply and Return Grilles/Diffusers, Volume Control Dampers, Fire Dampers, MERV 10 minimum filters.

1.03 RELATED REQUIREMENTS

A. Section 2310 – Design Procedures and Validation Requirements.

B. Section 2320 - Electrical

C. Section 2310 – Design Procedures and Validation Requirements

D. Section 2350 - Commissioning Requirements: Functional performance testing; additional training requirements.

1.04 REFERENCED STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment;

B. AHRI 310/380 - Packaged Terminal Air-Conditioners and Heat Pumps;

C. ASHRAE Handbook—HVAC Applications, 2019

D. ASHRAE Handbook—HVAC Systems and Equipment, 2020

E. ASHRAE 55 – 2017 Thermal Environmental Conditions for Human Occupancy

F. ASHRAE 62.1 - 2019 Ventilation for Acceptable Indoor Air Quality

G. ASHRAE 90.1 - 2019 Energy Standard for Buildings except Low-Rise Residential Buildings

H. ASHRAE Standard 202-2018 Commissioning Process for Buildings and Systems

I. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

PRODUCTS

2.01 HVAC SYSTEM TYPES

A. Air Cooled Chiller and Chiller Water System

B. DX R410a Refrigerant System

2.02 AIR DISTRIBUTION

A. Variable Air Volume Terminal Units

1. Factory assembled externally powered, variable air volume control terminal. Unit shall be complete with damper assembly, flow sensor, externally mounted volume controller, collars for duct connection and all features.

2. Damper Assembly

B. Ductwork:

1. Use one or more of the following:

a. Galvanized sheet metal duct

b. Flexible duct.

C. Diffusers, Registers, and Grilles:

1. Use one or more of the following:

a. Aluminum diffusers.

D. Fans:

1. Use one or more of the following:

a. Steel fan housing with an aluminum propeller.

E. Air Filters:

1. Use one or more of the following:

a. Panel filters.

2.03 HVAC CONTROLS

A. Communications Protocols:

1. Use one of the following:

a. BACnet

b. TCP/IP

B. Control System Types:

1. Use one or more of the following:

a. Direct digital control (DDC) system.

C. Operators and Sensors:

1. Use one or more of the following:

a. Pneumatic valve actuators.

b. Electric valve actuators.

c. Pneumatic sensors

d. Electrical sensors

PART 3 DESIGN CRITERIA

3.01 BASIC FUNCTION

A. Provide natural and artificial means of controlling temperature, relative humidity, velocity and direction of air motion in the interior spaces enclosed by the shell, and reduction of airborne odors, particulates, and contaminant gases.

1. Design HVAC to provide partially redundant systems.

B. Distribute air to maintain the required space conditions.

1. Maximum Air Velocity:

a. For 2500 Pa Duct Pressure Class: 10 m/s.

C. Smoke Control: Provide a system to evacuate smoke after fire has been extinguished.

D. Provide the elements necessary to control the building's indoor environment.

1. Provide a building control system which controls the indoor environment, manages energy consumption, schedules preventative maintenance, controls interior lighting, controls exterior lighting, integrates fire alarm and security functions, monitors fuel consumption, monitors water usage, and monitors packaged equipment controls.

a. Provide a thermostat for each zone to maintain the required space conditions.

2. Zoning and Space Temperature Control:

a. Dedicated terminal unit and thermostat for each corner space.

b. Single thermostat and terminal unit for spaces with similar function, exposure, and location.

1) Zone interior spaces together, separate from exterior spaces.

a. Maximum Interior Zone Size - Cooling Mode: a minimum of 19 square meters.

b. Maximum Interior Zone Size - Heating Mode: a minimum of 19 square meters.

c. Zone each conference room, separately. Dedicate at least one terminal unit and thermostat to each zone.

d. Provide each computer room with a dedicated zone. Provide humidity and temperature control.

E. Provide monitoring of major pieces of HVAC equipment.

F. Monitor the following equipment:

1. Air terminals.

G. Control the following equipment:

1. Air terminals.

2. Fan coil units.

H. Where HVAC elements also must function as elements defined within another element group, meet the requirements of both element groups.

I. Validation:

1. Design Development: Design calculations; documents showing zoning, air handlers, air terminals, equipment locations, equipment sizes, and air distribution; sample manufacturer data showing capacity available.

2. Construction Documents: Complete system details.

3. Construction: Manufacturer's data showing performance, certified by independent testing agency.

4. Construction: Testing, adjusting, and balancing report indicating initial airflow, final airflow, initial temperature, and final temperature of each conditioned space. Measurement of parameters during dry season when the outside air temperature is within 10 percent of the dry season design conditions and during the winter when the outside air temperature is within 10 percent of the wet season design conditions.

5. Construction and Closeout: Functional performance testing.

3.02 AMENITY AND COMFORT CRITERIA

A. Thermal Performance: Design and construct to provide comfortable interior environment in accordance with the code and the following:

1. Interior Design Conditions:

a. Daytime Set point: 22 degree C, plus or minus 2 degree C except as specified otherwise.

b. Night Setback: 25 degree C.

c. Interior Relative Humidity range: 50 to 60 percent.

d. Interior Ventilation: Office space 5 CFM/person + 0.06 CFM/sq ft

e. Public Restroom Exhaust minimum: 70 CFM/Fixture (water closet /urinal), Private Toilet Exhaust minimum 70 CFM per Guest Room /Fixture (water closet /urinal).

f. Air Filtration: At minimum MERV 10 filters for HVAC equipment

2. Outside Air Design Conditions:

a. Outside Air Design Temperature: 35 degree C dry-bulb; 30 degree C wet-bulb.

b. Dehumidification: 30 degree C dry-bulb; 26 degree C wet-bulb.

c. Exterior Relative Humidity range: 75 to 85 percent.

B. Odors: Eliminate, isolate, or exhaust odors produced by occupant functions and building services.

C. Sound Transmission and Vibration Resistance:

1. Services:

a. Maintain the sound transmission characteristics of assemblies through which services must pass.

b. Prohibited Plumbing Noises: All sounds of flushing and of liquid running through pipes ("bathroom sounds") are prohibited outside of the rooms housing toilets, bathtubs, and showers, with the exception of when doors to those rooms are open.

c. Equipment Noises: Noise level below that which will be objectionable, based on occupancy of spaces.

d. When services are located within assemblies that perform sound isolation functions, consider the noise produced by the service itself as one of the external sound sources.

2. Structure-Borne Sound and Vibration: Prevent transmission of perceptible sound and vibration from equipment that rotates, vibrates, or generates sound, by isolating such equipment from superstructure or by isolating equipment support foundations from building foundations.

a. Validation:

1) Construction Documents: Details of isolation methods.

2) Closeout: Measurement of sound transmitted through structure during functional performance testing and during full operation of all systems.

D. Convenience: Maintain existing entrances open during construction period; protect from weather, keep clear of construction debris and stored materials, and maintain safe walking surfaces.

E. Cleanliness:

1. Exterior Surfaces: Design and select materials to:

a. Prevent attraction and adherence of dust and air-borne dirt and soot, and minimize appearance of settled dust and dirt.

b. Be washed reasonably clean by normal precipitation.

c. Prevent precipitation from washing settled dust and dirt over surfaces exposed to view.

2. Services: Prevent accumulation of debris and dirt at floor mounted equipment, such as air handlers, chillers, pumps, switchgear, and panelboards by one or more of the following methods.

a. Provide 100 mm thick, concrete housekeeping pads.

b. Provide corrosion-resistant equipment stands.

F. Appearance:

1. Exterior Appearance: Design and select materials to provide exterior appearance with characteristics as follows:

a. Compatible with adjacent buildings on same campus.

b. Validation:

1) Proposal: Concept drawings of proposed solution indicating overall building configuration, massing, and scale.

2) Preliminary Design: Drawings showing facade treatment for principal elevations identifying visible materials.

3) Design Development: Drawings and artist's rendering showing all building elements that are part of the shell with sizes and locations to scale.

4) Construction Documents: Details of building shell, annotated to show compliance with performance requirements.

2. Services Elements:

a. Conceal services elements from view to greatest extent possible, with exposed portions of simple, neutral design and color.

1) Exception: Standard designs of manufacturers, without consideration for appearance, may be used for fire suppression sprinkler heads.

2) Where exposed portions are acceptable, do not obstruct or diminish clear dimensions of doorways, windows, other operable openings, access panels and cabinet doors, or passageways, stairs, and other exit ways.

3) Where exposed piping is acceptable, install it close to walls and overhead structure, parallel and square to finished construction, plumb and nominally horizontal (except where required to slope for drainage).

b. Cover annular spaces around pipes, ducts, and conduits, where they pass through walls, ceilings, and floors with escutcheons or cover plates.

c. Mountings: On finished surfaces, use concealed attachments with cover plates, frames, or trim overlapping finishes.

H. Specific Space Temperature Setpoint as specified and as follows:

1. Computer Room: 21 deg C, plus or minus 2 deg C.

2. Uninterruptible Power Supply Room: 22 deg C, plus or minus 1 deg C.

I. Acoustical Performance:

1. Air Distribution Background Noise: Provide systems which comply with the acoustical

requirements.

J. Indoor Air Quality: Provide sufficient ventilation to obtain acceptable indoor quality, determined using the Ventilation Rate Procedure of ASHRAE 62.1.

K. Appearance:

1. Diffuser Shape: Provide diffusers as per architect/interior designer requirements.

3.03 HEALTH AND SAFETY CRITERIA

A. Life Safety: Provide interconnection and coordination of HVAC controls with other life safety systems.

B. Fire Sources:

1. Provide products which are rated for the specific locations where they are installed.

2. Provide distribution elements constructed from incombustible materials.

C. Fire Spread: Provide interlocks to prevent operation or start-up of air distribution elements when fire or smoke detection systems are in alarm condition.

3.04 DURABILITY CRITERIA

A. Expected Service Life Span:

1. HVAC:

a. Shut-Off Valves: Minimum (10) ten years.

b. Dampers, Louvers, Registers, Grilles: Same as service life of building.

c. Ducts, Piping, and Wiring in All Services: Same as the service life of the building.

d. Software and Firmware Integral to Operation of Services Equipment: Minimum (5) five years functional life without reprogramming required.

B. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 38 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage.

C. Validation: Since actual service life cannot be proven, validation of actual service life is not required; however, the following are reasonable indicators of anticipatable service life:

a. Preliminary Design or Design Development: Service life expectancy analysis, for each element for which life span is specified; including:

1) Length of effective service life, and aesthetic service life if specified, with action required at end; e.g. complete replacement, partial replacement, and refurbishment.

2) Conditions under which estimate will be valid; e.g. expected uses, inspection frequency, maintenance frequency, etc.

b. Design Development: Replacement cost, in today's dollars, for each major element that has a service life expectancy less than that of the project; include both material and labor cost, but not overhead or profit; base costs on installing in existing building, not as a new installation.

c. Design Development: Life cycle cost of project, over the specified project service life, excluding operating staff costs; include costs of:

1) Replacement of each element not expected to last the life of the project; identify the frequency of replacement.

2) Deduct salvage value of replaced elements.

3) Calculate costs in today's dollars, disregarding the time value of money, inflation, taxes, and insurance.

D. Water Penetration Resistance:

1. Shell: Design and select materials to prevent water penetration into the interior of shell assemblies, under conditions of rain driven by 56 km/h wind.

a. Exception: Controlled water penetration is allowed if materials will not be damaged by presence of water or freezing and thawing, if continuous drainage paths to the exterior are provided, and water passage to the building interior is prevented.

b. Validation: In addition to requirements specified for proven-in-use and proven by mock-up construction, drawings showing paths of water movement, with particular attention to changes in direction or orientation and joints between different assemblies.

2. Component Mountings: Where components are mounted to surfaces that are required to be moisture-resistant, seal mounting surface of components to finish surface so that moisture cannot penetrate under or behind component, using material that is not affected by presence of water, that is mildew-growth resistant, and that has a minimum service life of 10 years.

E. Corrosion Resistance: Prevent corrosion by using corrosion-resistant materials, by preventing galvanic action, by preventing contact between metals and concrete and masonry, and by preventing condensation on metals.

1. Separation of Dissimilar Metals:

a. Where different metals subject to galvanic action are exposed to weather or moisture, prevent direct contact between them.

b. Piping Connections for Piping of Dissimilar Metals: Dielectric adapters.

2. Aluminum: Prevent direct contact of aluminum with concrete or cementitious materials.

3. Steel: Where permitted to be coated with other than zinc, zinc-alloy, or aluminum-zinc alloy, follow the recommendations of Society for Protective Coatings (SSPC) in regard to preparation for coating and coating type.

4. Outdoor Metal Elements Except in Contact with Soil: The following are considered corrosion-resistant metals:

a. Aluminum.

b. Stainless steel, Type 304 or 316.

c. Hot-dipped galvanized steel, with minimum zinc coating of 275 gm/sq m total, both sides, or equivalent aluminum-zinc alloy coating.

d. Cadmium-plated steel, with minimum coating of 12 micrometers.

5. Indoor Metal Elements Potentially Exposed to Moisture: The following are considered corrosion-resistant metals:

a. All metals listed above for exterior exposure.

b. Brass and bronze, but not copper.

c. Cast iron, ductile iron, and malleable iron.

d. Steel coated with high-build epoxy or coal tar-based paint, with minimum coating of ?

e. Chrome-plated steel.

F. Weather Resistance: Design and select materials to minimize deterioration due to precipitation, sunlight, ozone, normal temperature changes, salt air, and atmospheric pollutants.

1. Weather resistance requirements apply to all components exposed to the outdoor environment, including services, unless specifically accepted; equipment enclosures are considered the equivalent of the exterior enclosure.

1. Deterioration includes corrosion, shrinking, cracking, spalling, delamination, abnormal oxidation, decay and rot.

2. Surfaces Exposed to View: Deterioration adversely affecting aesthetic life span includes color fading, crazing, and delamination of applied coatings.

3. Joint Components and Penetration Seals: Capable of resisting expected thermal expansion and contraction; use overlapping joints that shed water wherever possible.

4. Transparent Elements (Glazing): No haze, loss of light transmission, or color change, during entire expected service life.

a. Test Criteria: Less than one percent change in haze, transmission, and color over two years exposure, when tested after natural exposure conditions or accelerated light and water conditions simulating natural exposure at project, in accordance with ASTM D1003; accelerated exposure documented with comparison to natural conditions.

5. Service Temperature: Low temperature equal to historically-recorded low; high temperature equal to that expected due to any combination of air temperature and heat gain from solar and other sources.

6. Ozone Resistance: Do not use materials that are adversely affected by ozone.

7. Liquid Storage and Distribution Components: Prevent freezing during longest duration of low temperature anticipated, based on historical weather data; if necessary, provide automatically controlled supplemental heating.

G. Temperature and Humidity Endurance: Design equipment to endure temperature and humidity that will be encountered and to resist damage due to thermal expansion and contraction.

H. Impact Resistance: Design and select materials to resist damage due to impact in accordance with code and the following:

1. Minimize damage from windborne debris propelled at up to 56 km/h.

2. Design and select materials to resist damage from hail of size up to 12 mm.

3. Minimize damage due to potential vandalism.

4. Natural Hazards: Design to resist damage from perching, nesting, and feeding birds.

5. Validation:

a. Design Development: Identification of building elements required to resist impact damage, quantification of impact criteria, materials to be used, and methods of validation.

b. Design Development: Proven in-use or proven by mock-up data.

I. Accidental Damage Resistance:

1. Minimize potential for damage to built elements due to accidents.

2. Accidental Water Leakage: Locate components that would be damaged by water leakage from pipes or through foundations or roof out of likely paths of water and at least 100 mm above floor level.

3. Buried Components: Minimum of 300 mm below surface of ground.

4. Underground Piping and Conduit: Watertight and root proof.

5. Finishes on Exposed Components Subject to Touching by Occupants: Durable enough to withstand regular scrubbing using ordinary methods.

6. Equipment: Provide equipment which has been designed to prevent tampering.

7. Underground Piping: Protect Electrical ducting, HVAC and Plumbing piping from accidental damage with a warning tape buried 300 mm above the pipe.

J. Wear Resistance: Design and select materials to provide resistance to normal wear-and-tear in accordance with code and the following:

1. Elements Within Reach of Pedestrians: Minimize degradation from rubbing and scratching caused by pedestrians.

2. Minimize degradation caused by windblown sand and acid rain.

K. Resistance to Biological Factors:

1. Animals: Do not use materials that are attractive to or edible by animals or birds.

2. Insects: Do not use materials that are edible by insects, unless access by insects is prevented.

3. Wood: When wood is used, provide at least the protection recommended by AWPA as contained in AWPA U1.

3.05 OPERATION AND MAINTENANCE CRITERIA

A. Comply with requirements of all utility provider and local authorities having jurisdiction.

B. Space Efficiency: Minimize floor area required while providing specified spaces and space relationships, circulation and services areas required for functions.

C. Energy Efficiency: Design and construct to minimize energy consumption while providing function, amenity, and comfort specified, in accordance with the code.

D. Water Consumption: Minimize water consumption.

E. Ease of Operation and Use:

1. Intended operating personnel are personnel with a reasonable level of training for similar activities.

2. Provide facility, equipment, and systems that are easily operated by intended personnel.

a. Space around Components: Working clearances and access routes as required by code and as recommended by component manufacturer.

b. Access: All mechanical and electrical equipment located to allow easy access. Provide access doors for equipment accessed through walls, partitions, or fixed ceilings.

c. Valves and Other Control Devices: Accessible handles, switches, control buttons; valve handles on top/upper side; chain or other remote operators where located out of normal reach above floor level in SU1 and SU2 spaces.

3. Minimize the need for specialized training in operation of specific equipment or systems; identify all equipment and systems for which the manufacturer recommends or provides training programs.

a. Validation:

1) Proposal: Type of operating personnel and amount of training required; identification

of each equipment item or system for which more than one day of training is required; identify source of data.

2) Design Development: Operating impact analysis, including identification of type and quantity of staff, tools, and supplies required; estimate of impact that aging materials will have on operating requirements; no cost calculations required; identify source of data.

3) Construction Documents: Updated operating impact analysis, based on actual product selections.

4. Preparation for Use: Prepare services for use by testing appropriately for proper operation before start-up, eliminating operational anomalies, adjusting control systems for optimum operation, and demonstrating proper functioning.

a. Validation:

1) Proposal: General outline of commissioning procedures and responsibilities of the parties.

2) Design Development: Identification of systems and equipment to be tested and method of test.

3) Construction Documents: Complete commissioning plan.

4) Construction and Closeout: Commissioning reports.

5. Preparation for Operation: Provide assistance for the Employer/End User's preparations for operation, as follows:

a. Demonstration of all services to Employer/End User personnel.

b. Training Employer/End User personnel in the operation of all service systems.

c. Validation:

1) Construction Documents: Schedule of demonstrations.

2) Construction Documents: Training plan and schedule.

3) Construction and Closeout: Documentation of training conducted.

F. Ease of Maintenance:

1. Minimize the amount of maintenance required.

2. Do not locate any equipment requiring maintenance on the roof, in attics, in crawl spaces, where access must be through attics or crawl spaces, or where access is not possible using removable panels or doors.

3. Light Levels: Provide adequate lighting for locating and maintaining equipment; emergency lighting for critical components.

4. Cleaning: Where not otherwise specified, design equipment mountings to allow easy cleaning

around, and under, equipment, if applicable, without crevices, cracks, and concealed spaces where dirt and grease can accumulate and with raised, closed bases for equipment mounted on the floor.

5. Equipment Enclosures: Provide removable access panels to allow cleaning.

6. Site Utilities: Record or mark locations of existing, abandoned, and new utility lines in such a manner that they can be easily located during and after completion of construction.

7. Piping Systems:

   a. Piping Other Than Gravity Drains: Provide means of isolating convenient portions of piping system, so that small portions may be shut down leaving the remainder in operation and so that drainage of the entire system is not required to enable repair of a portion of it.

   b. Piping: Entire systems drainable without disassembly of piping.

   c. Above Ground Piping: Labeled to identify contents and direction of flow, each shut-off valve, each piece of equipment, each branch take off, and at 6 m maximum spacing on exposed straight pipe runs.

   d. Equipment in Piping Systems: Each unit provided with a union or flanged connector at each pipe connection to allow easy removal.

8. Replaceability of Parts:

   a. Parts Having Service Life Less Than That Specified for Element: Easily replaceable, without de-installation or de-mounting of the entire element, component, or equipment item.

   b. Valves: Easily replaceable internal parts, eliminating necessity of removal of entire valve for repair.

   c. Parts Availability: Readily available from stocking distributors within 80 km of project location.

9. Exceptions: Elements that do not meet the specified requirements for ease of maintenance may be used, provided:

   a. They meet the specified requirements for ease of replacement of elements not required to have service life span equal to that specified for the project as a whole,

   b. The service life expectancy analysis and life cycle cost Validation specified for service life are provided, and 3) Employer/End User's acceptance is granted.

G. Ease of Replacement:

1. Elements not required to have Expected Service Life Span Equal to that specified for the facility as a whole: Make provisions for replacement without undue disruption of building operation.

2. Large Equipment: Provide doors and corridors large enough for removal of major pieces of equipment, such as, chillers and boilers.

H. Maintenance after Occupancy: Where maintenance service after occupancy is specified, such services are to be performed at no extra cost to Employer/End User.

1. Individual maintenance contracts will be between maintenance organization and Employer.

2. Services will be included under Design-Build Contractor's contract with Employer.

3. Maintenance Services: Examination at frequency consistent with reliable operation; cleaning, adjusting, and lubricating; replacement of parts whenever required, using parts produced by the original manufacturer.

4. Maintenance Organizations: Approved by manufacturer and Employer; transfer or assignment of contracts without prior written consent of Employer not allowed.

I. Allowance for Changes in Occupancy and Arrangement:

1. Office Spaces: Design for churn of at least 75 percent, requiring very frequent minor changes in location and workplace layout, as defined in ASTM E1692.

a. Size and Layout: So that relocation of individuals and small groups can be accomplished overnight with no disruption of work and no disruption of work of neighbors and no degradation of functionality or amenity.

b. Employer requires that operations staff be able to make such adjustments without technical help, with only a few days ordering/delivery time for new components.

c. Where fixed partitions are used to separate spaces, relocated partitions must be completely salvageable.

d. All spaces involved in changes described above include special air exhausts, special lighting, and special cooling which must be moved at the same time.

2. Validation:

a. Preliminary Design: Method of accomplishing changes anticipated; degree of salvage anticipated.

b. Design Development: Incorporation of costs of anticipated changes into life cycle cost analysis.

J. Air Distribution Efficiency: Provide duct construction in accordance with SMACNA HVAC Duct Construction Standards, based on the following:

1. Supply Duct Pressure Class: 500 Pa.

2. Return Duct Pressure Class: 500 Pa.

K. Ease of Use:

1. Design access to and working clearances around heating equipment as recommended by the manufacturer.

2. Air Distribution: Provide terminal units with individual controls adjustable by occupant of space.

L. Employer Personnel Training:

1. Operational: Minimum of 8 hours, for 1 person, for each separate system.

2. Maintenance: Minimum of 8 hours, for 1 person, for each separate system.

3.06 WARRANTIES AND GUARANTEES

1. All HVAC systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (2) two years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (2) two years commencing on Date of Substantial Completion with the option for extended warranties past the (2) two years.

SECTION 1901 – ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical: Provision and distribution of electrical power to operate all electrically-operated devices, including those included under other services and those provided separately by the Employer; artificial lighting to illuminate spaces and tasks, both interior and exterior, independent of reliance on natural light; and grounding systems; comprising the following elements.

B. Electrical Energy Supply and Generation: Utility power sources, engine-generator systems, battery power systems, uninterruptible power supply systems and unit power conditioners.

1. Electrical Power Source: Existing public utility.

C. Service and Distribution: Service entrance equipment, distribution equipment, transformers, motor control equipment, service and feeder wiring (conductors and raceways), monitoring, safety and control equipment, and other elements required for a complete functional system. 1. Main Electrical Service: The utility will provide a service transformer to convert its distribution voltage to the building's utilization voltage.

D. Branch Circuits: Branch circuit wiring and receptacles and other branch circuit wiring systems, comprising the following elements:

1. Branch circuit breakers.

2. Conductors and cable from panel boards to fixtures, wiring devices, and mechanical equipment.

3. Raceways and boxes.

4. Wiring devices, including, but not limited to, receptacles, floor boxes and plates, wall switches, wall dimmers, remote control switching devices, and wall plates.

E. Special Grounding Systems: Elements for lightning protection, fence grounding, and raised access floor grounding.

1. Lightning Protection on roof level to protect building and equipment.

F. Cathode Protection: Supplementary corrosion prevention using cathode protection.

G. Products: Where specific products are required or allowed, use products complying with the additional requirements specified elsewhere.

1.03 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 400 – Earthworks
- Section 2315 – Mechanical (HVAC)
- Section 2316 – Mechanical (Elevators)
- Section 2310 – Design Procedures and Validation Requirements
- Section 2321 - Electrical (Lighting)

- Section 2330 – ICT
- Section 2335 – Building Management System
- Section 2340 – Plumbing
- Section 2345 – Fire Suppression
- Section 2350 – Commissioning
- Section 2360 – Training
- Section 2370 – Handover Documentation
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

1.04 REFERENCE STANDARDS

- ANSI C37.13 – 2015 Standard For Low-Voltage AC Power Circuit Breakers Used In Enclosures
- ANSI C37.14 - 2015 Standard for DC (3200 V and below) Power Circuit Breakers Used in Enclosures
- ANSI C57.12.00 – 2010 Standard For General Requirements For Liquid-Immersed Distribution, Power, And Regulating Transformers
- ANSI C57.12.01 – 2015 Standard For General Requirements For Dry-Type Distribution And Power Transformers
- ANSI C63.12 – 2015 Standard Recommended Practice For Electromagnetic Compatibility Limits And Test Levels
- ANSI C80.1 - 2015 Electrical Rigid Steel Conduit
- ANSI C80.3 - 2015 Electrical Metallic Tubing - Steel (EMT-S)
- ANSI C80.6 - 2018 Electrical Intermediate Metal Conduit
- ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- ASHRAE 90.1 - 2019 Energy Standard for Buildings except Low-Rise Residential Buildings
- ASHRAE Standard 202-2018 Commissioning Process for Buildings and Systems
- ICC IFC 2018-2021 International Fire Code
- IEEE 830 Recommended Practice for Software Requirements Specifications
- NFPA 70 – 2020 National Electric Code
- NFPA 72 – 2019 National Fire Alarm and Signalling Code
- NFPA 101 - 2021 Life Safety Code
- NFPA 110 – 2019-2022 Standard for Emergency and Standby Power Systems
- NFPA 111 – 2019-2022 Standard on Stored Electrical Energy Emergency and Standby Power Systems
- NFPA 780 – 2020 Standard for the Installation of Lightning Protection Systems
- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago

- Requirements of the Electrical Inspectorate Division, Ministry of Public Utilities of Trinidad and Tobago
- Trinidad & Tobago Electricity Commission Wiring for Light & Power 8th Edition
- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Trinidad & Tobago Electrical Wiring Code Part 2 - High Voltage Installations (TTS 171: Part 2: 2002)
- Trinidad & Tobago Electrical Wiring Code Part 3 – Renewable Energy Systems and Interconnection Requirements (TTS 171: Part 3: 2011)
- Workplace Design – Lighting of Indoor work places – Specification (TTS 611-2008)

PART 2 PRODUCTS

2.01 ELECTRICAL ENERGY GENERATION

A. Generator Sets: New and in place. The Contractor is to provide for during this contract.

2.02 SERVICE AND DISTRIBUTION

A. Secondary Service and Distribution Feeders:

1. Conduits:
    a. Use one of the following:
        1) Below Grade: GRS conduit or PVC conduit.
        2) Exterior, Exposed: GRS conduit or PVC conduit.
        3) Interior, Exposed: IMC conduit.
        4) Interior, Concealed: IMC conduit.
2. Conductors:
    a. Use one of the following:
        1) Aluminum.
        2) Copper.

B. Main Service Equipment:

3. Types of Equipment:
    a. Use one of the following:
        1) Low voltage switchgear.
        2) Switchboards.

3) Distribution panels.

4. Main Devices:

a. Use one of the following:

1) Power circuit breakers.

2) Molded case circuit breakers.

3) Fused switches.

C. Branch Circuit Panel boards:

1. Bus bars:

a. Use one of the following:

1) Copper.

2.03 BRANCH CIRCUITS

A. Receptacle Cover Plates:

1. Use the following:

a. Material and Finish: Metal, chrome plated.

A. Receptacle types:

1. Use the following:

a. One dedicated for clean and one dedicated for normal power.

2.05 SPECIAL GROUNDING SYSTEMS

A. Lightning Protection Conductors:

1. Use one or more of the following:

a. Stranded copper cable.

b. Solid copper strip.

B. Lightning Protection Grounding Terminals:

1. Use one or more of the following:

a. Solid copper ground rods.

b. Concrete encased electrodes located in or near footings.

c. Ground ring electrode in direct contact with earth.

C. Lightning Protection Strike (Air) Terminals:

1. Use one or more of the following:

a. Solid copper.

b. Hollow tubular copper.

c. Solid aluminum.

PART 3 DESIGN CRITERIA

3.01 BASIC FUNCTION

A. Provide electrical power with the appropriate characteristics to operate all electrically operated devices, including those in other services.

1. Capacity: Calculated in accordance with NFPA 70.

2. General Receptacle System Voltage: 120 volts/3-phase/60 Hz.

a. Provide 240 volt/3-phase/60 Hz receptacles in the following locations:

1) Baggage and Mail Scanner areas.

2) Training center.

3) Maintenance area.

4) Server room.

b. Equipment Voltage: 480 volts/3-phase/60 Hz.

3. Interior Distribution Transformers: As required to serve building circuits and equipment plus 20 percent spare capacity.

4. Branch Circuit Panel boards: In accordance with code plus 20 percent spare capacity.

B. Uninterruptible Power Supply: Provide uninterruptible power supply (UPS) system as follows:

1. Telephone System: Transfer time of 0.0167 seconds (1 cycle).

a. Duration of 60 minutes.

2. Computer Systems and Auxiliary Equipment: Transfer time of 0 seconds.

a. Duration of 240 minutes.

3. Fire Alarm and Detection Systems: Transfer time of 0 seconds.

a. Duration as required by code.

4. Configuration: Parallel redundant with automatic transfer from UPS power to normal power.

5. Validation:

a. Proposal: Listing of input/output voltage, types of load covered, and generic equipment characteristics.

C. Distribution: Distribute electric power for equipment circuits, lighting circuits, receptacle circuits, and electrical utilization devices.

1. Branch Circuits: Provide adequate electrical power and safe and efficient distribution from panel boards to lighting, wiring devices, equipment, and appliances, based on the project and end user requirements.

D. Grounding: Provide grounding systems that:

1. Provide protection from lightning strikes;

1. Provide protection from shock due to overhead power transmission lines accidentally contacting metal fences.

2. Reduce static electricity and transient and induced current in raised access flooring and electronic equipment cabinets, racks, and supports.

3. Comply with applicable recommendations of IEEE 142 and IEEE 1100.

E. Where electrical elements also must function as elements defined within another element group, meet the requirements of both element groups.

F. Validation:

1. Design Development: Single-line diagrams, showing feeder and equipment sizes; engineering calculations showing input- and output-side capacities and loads and sizes of distribution elements; required electrical room sizes.

2. Construction Documents: Complete system details, riser diagrams, equipment characteristics, and calculations.

3. Construction: Continuity test of wiring systems prior to functional performance testing.

4. Construction and Closeout: Functional performance testing.

3.02 AMENITY AND COMFORT CRITERIA

A. Accessibility: Comply with ADA Standards for Accessible Design.

B. Convenience:

1. Provide convenience receptacles at intervals no greater than 3 m along the base of all wall areas.

C. Appearance:

1. Conceal electrical conduit in walls and behind ceilings in the occupied spaces. See Section D for additional requirements.

2. Conceal grounding conductors and ground terminals wherever possible.

3.03 HEALTH AND SAFETY CRITERIA

A. Fire Hazard:

1. Provide branch circuit elements in compliance with code and that are UL listed or labeled.

3.04 DURABILITY CRITERIA

A. Expected Service Life Span:

1. Electrical:

a. Power Distribution Equipment: Same as building service life.

1. Lightning Protection and Special Grounding Systems: Same as building service life.

2. Expected Service Life Span: Provide UPS systems which will last a minimum of 5 years in service without major repairs or operating expense

3. All Grounding Systems: Life of the building without requiring any more maintenance than annual inspection and minor repairs not more frequently than annually.

B. Electronic Equipment Protection: Provide a signal reference grid or plane for the entire raised floor area as high-frequency ground for electronic equipment.

1. Comply with recommendations of IEEE 1100.

2. Conductor Maximum Impedance: 23 ohms per 305 mm of ground conductor at frequency of 1 kHz.

3. Ground: Multi-point bonding to all metallic objects crossing grid, including structural elements within 1820 mm of grid.

3.05 OPERATION AND MAINTENANCE CRITERIA

A. Power Quality:

1. Uninterruptible Power Supply Systems:

a. Current Distortion: Less than 10 percent total harmonic distortion with included filter.

b. 125 percent for 10 minutes.

B. Load Characteristics:

1. Maximum Harmonic Current Distortion: Plus or minus 2 percent of design current.

2. Transient Suppression: Limit voltage transients below damage curve of the electrical system and connected equipment.

C. Energy Efficiency:

1. Comply with requirements of IEEE Standard 739.

2. Comply with requirements of ASHRAE 90.1.

D. Ease of Use:

1. Configuration: Design wiring and protective devices so that outages caused by local overloads do not affect unrelated areas or systems.

2. Provide main busway centrally located to minimize branch wiring runs.

E. Allowance for Change and Expansion:

1. Branch Circuits: Provide branch circuit wiring with sufficient capacity to accommodate future growth and renovation without major rewiring.

a. All Circuits: Limit design loads to a minimum of 60 percent of capacity permitted by code.

F. Ease of Maintenance:

1. Uninterruptible Power Supply Systems: Provide the following functions:

a. Maintenance Bypass: Provide a maintenance switch to transfer UPS loads to the standby generators.

b. Internal maintenance bypass.

3.06 WARRANTIES AND GUARANTEES

1. All Electrical systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (2) two years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (2) two years commencing on Date of Substantial Completion with the option for extended warranties past the (2) two years.

SECTION 1902 – LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical: Provision and distribution of electrical power to operate all electrically-operated devices, including those included under other services and those provided separately by the Employer; artificial lighting to illuminate spaces and tasks, both interior and exterior, independent of reliance on natural light.

B. Interior Lighting: Comprising the following elements:

1. Luminaires for general illumination.

2. Accent lighting.

3. Illuminated exit signs.

C. Exterior Area Lighting: General lighting of exterior spaces including roadways, driveways, walkways, parking areas, and recreation areas; comprising exterior luminaires, poles, standards, or other means of mounting the luminaires, power supply, and controls.

D. Products: Where specific products are required or allowed, use products complying with the additional requirements specified elsewhere.

1.05 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 400 – Earthworks
- Section 2315 – Mechanical (HVAC)
- Section 2316 – Mechanical (Elevators)
- Section 2310 – Design Procedures and Validation Requirements
- Section 2320 - Electrical
- Section 2330 – ICT
- Section 2335 – Building Management System
- Section 2340 – Plumbing
- Section 2345 – Fire Suppression
- Section 2350 – Commissioning
- Section 2360 – Training
- Section 2370 – Handover Documentation
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

1.06 REFERENCE STANDARDS

- ANSI C63.12 – 2015 Standard Recommended Practice For Electromagnetic Compatibility Limits And Test Levels
- ANSI C80.1 - 2015 Electrical Rigid Steel Conduit
- ANSI C80.3 - 2015 Electrical Metallic Tubing - Steel (EMT-S)

- ANSI C80.6 - 2018 Electrical Intermediate Metal Conduit
- ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- ASHRAE 90.1 - 2019 Energy Standard for Buildings except Low-Rise Residential Buildings
- ASHRAE Standard 202-2018 Commissioning Process for Buildings and Systems
- ICC IFC 2018-2021 International Fire Code
- IEEE 830 Recommended Practice for Software Requirements Specifications
- NFPA 70 – 2020 National Electric Code
- NFPA 72 – 2019 National Fire Alarm and Signalling Code
- NFPA 101 - 2021 Life Safety Code
- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago
- Requirements of the Electrical Inspectorate Division, Ministry of Public Utilities of Trinidad and Tobago
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- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Trinidad & Tobago Electrical Wiring Code Part 2 - High Voltage Installations (TTS 171: Part 2: 2002)
- Trinidad & Tobago Electrical Wiring Code Part 3 – Renewable Energy Systems and Interconnection Requirements (TTS 171: Part 3: 2011)
- Workplace Design – Lighting of Indoor work places – Specification (TTS 611-2008)

PART 2 PRODUCTS

2.01 LIGHTING

A. Interior & Exterior Lighting:

1. Use the following LED types:

    a. Direct lighting units.
    b. Semi-direct lighting units.
    c. General diffuse lighting units
    d. Direct-indirect lighting units.
    e. Semi-indirect lighting units.
    f. Indirect lighting units.

B. Emergency Lighting:

1. Use one of the following types:

    a. Self-contained LED battery-powered lighting units.

PART 3 DESIGN CRITERIA

3.01 BASIC FUNCTION

A. Provide electrical power with the appropriate characteristics to operate all electrically operated devices, including those in other services.

1. Capacity: Calculated in accordance with NFPA 70.

2. Lighting (General, Interior & Exterior) System Voltage: 120 - 277 volts/1-phase/60 Hz.

B. Lighting: Provide artificial means of lighting interior and exterior spaces.

1. Interior Lighting: Provide artificial lighting for all interior spaces that is adequate in quality and distribution for the performance of tasks typical for the type of space and the characteristics of the intended population, regardless of the availability of natural light.

2. Accent Lighting: In addition to general and task illumination, provide lighting on architectural features, displays, and artwork in focal areas to produce luminances that are within the range of 5:1 with respect to ambient background.

C. Where electrical elements also must function as elements defined within another element group, meet the requirements of both element groups.

D. Validation:

1. Design Development: Single-line diagrams, showing feeder and equipment sizes; engineering calculations showing input- and output-side capacities and loads and sizes of distribution elements; required electrical room sizes.

2. Construction Documents: Complete system details, riser diagrams, equipment characteristics, and calculations.

3. Construction: Continuity test of wiring systems prior to functional performance testing.

4. Construction and Closeout: Functional performance testing.

3.02 AMENITY AND COMFORT CRITERIA

D. Accessibility: Comply with ADA Standards for Accessible Design.

E. Artificial Light Levels: Provide maintained ambient illuminance values for various activities based on the primary visual tasks to be accommodated and that are within the ranges specified in the IESNA Lighting Handbook

1. Emergency Lighting: In addition to exit signs and means of egress lighting, provide emergency illumination of not less than 10 lux for a minimum of 1 hour in spaces as follows:

a. Computer room.

b. Lobby.

c. Control room.

d. Emergency generator room.

2. Interior Lighting: Not less than the following, when measured at task height:

a. Category A (Public spaces where reading and visual inspections are performed only occasionally): General lighting throughout space of 30 lux.

b. Category B (Lobbies and other spaces characterized by short stays and the need for simple orientation): General lighting throughout space of 50 lux.

c. Category C (Working spaces where simple visual tasks are performed): General lighting throughout space of 100 lux.

d. Category D (Spaces requiring performance of visual tasks of large size and high contrast): Task illumination of 300 lux.

e. Category E (Spaces requiring performance of visual tasks of high contrast and small size, or low contrast and large size): Task illumination of 500 lux.

3. Local Interior Lighting: In spaces where local task lighting is used to achieve maintained luminance levels, maintain balance with ambient illumination such that general lighting for space provides not less than 20 percent of local lighting level.

F. Artificial Light Quality: Provide luminous environment in each space that is designed to complement the functions and the character of the space.

4. Interior Lighting:

a. Distribution: In keeping with geometry of space and location of visual tasks.

b. Visual Comfort: Provide lighting systems with the following characteristics:

1) VCP: Visual Comfort Probability (VCP) of not less than 70.

2) Luminance Ratio: Maximum luminance of luminaire does not exceed average luminance by ratio of more than 5:1 at 45, 55, 65, 75, and 85 degrees from nadir for crosswise and lengthwise viewing.

3) Maximum luminances of luminaires crosswise and lengthwise do not exceed the following values:

(a) 45 degrees above nadir: 7710 cd/sq m.

(b) 55 degrees above nadir: 5500 cd/sq m.

(c) 65 degrees above nadir: 3860 cd/sq m.

(d) 75 degrees above nadir: 2570 cd/sq m.

(e) 85 degrees above nadir: 1695 cd/sq m.

c. Color of Light: Appropriate for functions accommodated in space and characteristics of interior finishes.

G. Appearance:

1. Conceal electrical conduit in walls and behind ceilings in the occupied spaces.

2. Character of Lighting Fixtures: Coordinated with architecture and other building systems and appropriate to finish level.

3.03 HEALTH AND SAFETY CRITERIA

A. Fire Hazard:

1. Provide branch circuit elements in compliance with code and that are UL listed or labeled.

3.04 DURABILITY CRITERIA

A. Expected Service Life Span:

1 Lighting Fixtures: Minimum 10 years.

B. Electronic Equipment Protection: Provide a signal reference grid or plane for the entire raised floor area as high-frequency ground for electronic equipment.

1. Comply with recommendations of IEEE 1100.

2. Conductor Maximum Impedance: 23 ohms per 305 mm of ground conductor at frequency of 1 kHz.

3. Ground: Multi-point bonding to all metallic objects crossing grid, including structural elements within 1820 mm of grid.

3.05 OPERATION AND MAINTENANCE CRITERIA

A. Power Quality:

1. Lighting Systems:

a. Current Distortion: Less than 10 percent total harmonic distortion with included filter.

b. Power Factor equal to or more than 90%

B. Energy Efficiency:

1. Comply with requirements of IEEE Standard 739.

2. Comply with requirements of ASHRAE 90.1.

C. Ease of Use:

1. Configuration: Design wiring and protective devices so that outages caused by local overloads do not affect unrelated areas or systems.

2. Provide main busway centrally located to minimize branch wiring runs.

D. Allowance for Change and Expansion:

1. Branch Circuits: Provide branch circuit wiring with sufficient capacity to accommodate future growth and renovation without major rewiring.

a. All Circuits: Limit design loads to a minimum of 60 percent of capacity permitted by code.

E. Ease of Cleaning:

1. Interior Lighting: Provide luminaires that do not collect dirt rapidly and are readily cleanable.

a. Luminaire Categories: Provide luminaires of IESNA Category I, II, or V, for minimum dirt accumulation and LDD factors.

F. Ease of Maintenance:

1. Re lamping: Provide luminaires designed for easy re lamping with special tools.

3.06 WARRANTIES AND GUARANTEES

1. All Lighting components and systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (3) years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (3) three years commencing on Date of Substantial Completion with the option for extended warranties past the (3) three years.

SECTION 2001 – ICT

PART 1 GENERAL

SCOPE OF THE WORKS

THE ICT REQUIREMENTS FOR THE PROJECT ARE INCLUDED IN THE RFP and END USER'S REQUIREMENTS.

1.01 SECTION INCLUDES

A. Communications services comprise the following:

1. Voice and Data: Infrastructure for voice and data transmission equipment and accessories.
2. Sound Reinforcement: Public address and music systems.
3. Television: Television distribution, reception, and equipment.

B. Provide internal wiring and outlets; a minimum of one outlet in each room, two incoming lines.

B. Products: Where specific products are required or allowed, use products complying with the additional requirements specified elsewhere.

1.02 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 400 – Earthworks
- Section 2310 – Design Procedures and Validation Requirements
- Section 2350 – Commissioning
- Section 2360 – Training
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

1.03 REFERENCE STANDARDS

- ANSI C63.12 – 2015 Standard Recommended Practice For Electromagnetic Compatibility Limits And Test Levels
- ANSI C80.1 - 2015 Electrical Rigid Steel Conduit
- ANSI C80.3 - 2015 Electrical Metallic Tubing - Steel (EMT-S)
- ANSI C80.6 - 2018 Electrical Intermediate Metal Conduit
- ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- ASHRAE 90.1 - 2019 Energy Standard for Buildings except Low-Rise Residential Buildings
- ASHRAE Standard 202-2018 Commissioning Process for Buildings and Systems
- IEEE 830 Recommended Practice for Software Requirements Specifications
- NFPA 70 – 2020 National Electric Code
- NFPA 101 - 2021 Life Safety Code
- NFPA 110 – 2019-2022 Standard for Emergency and Standby Power Systems

- NFPA 111 – 2019-2022 Standard on Stored Electrical Energy Emergency and Standby Power Systems
- NFPA 780 – 2020 Standard for the Installation of Lightning Protection Systems
- TIA-568-C - Commercial Building Telecommunications Cabling Standard; Rev C, 2012, and latest addenda.
- TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).
- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago
- Requirements of the Electrical Inspectorate Division, Ministry of Public Utilities of Trinidad and Tobago
- Trinidad & Tobago Electricity Commission Wiring for Light & Power 8th Edition
- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Trinidad & Tobago Electrical Wiring Code Part 2 - High Voltage Installations (TTS 171: Part 2: 2002)
- Trinidad & Tobago Electrical Wiring Code Part 3 – Renewable Energy Systems and Interconnection Requirements (TTS 171: Part 3: 2011)

PART 2 PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. The following items are to be provided by End User:

1. End User's operational computer network hardware and software.
2. Television sets.
3. Television reception and distribution equipment.
4. Video projectors.
5. Video recorders.

A. Owner-Furnished Items: Performance requirements that specify characteristics of equipment items do not apply; requirements for accommodating items to the project do apply.

2.02 COMMON COMPONENTS

A. Communication Cabling:

Use one of the following:

a. Ethernet cable: CAT 6A.

b. Fiber optic cable: Single and multimode OM3 minimum.

c. Backbone Cable: minimum OM3 multimode fiber optic.

d. Distribution Cable: minimum OM3 multimode fiber optic.

PART 3 DESIGN CRITERIA

3.01 BASIC FUNCTION

A. Voice: Provide means of conveying voice communication between rooms and spaces in the building and between the building and the Employer's telephone network provider as specified in the program and as follows.

1. Point-to-Point Voice Communications For:

a. Private two-way verbal communication.

b. Group conversations among more than 2 stations, at user's option.

c. Both handset and speaker operation, at user's option.

d. Transfer of live call to another station, at user's option.

1. Connection between internal communications and public telephone system; 2 incoming lines.

B. Data: Provide means of conveying data between computers within the building, outside the building where applicable within the site, and between the data transmission network and the End User's Internet service provider/s as specified in the program and as follows.

B. Sound Reinforcement: Provide the following sound reinforcement functions:

1. Sound transmission to all locations in the facility.

2. Alarm notifications required by code, including pre-recorded emergency messages, user-recorded messages, and live announcements.

3. Speaker Outlets: Required in the following spaces as per RFP and End User requirements documentation.

C. Television: Provide the following television/cable reception and distribution functions:

1. Incoming broadcast television; internal distribution over cabling not broadcast.

2. Cable television reception, via provider hard connection.

3. Video/Audio Outlets: Required as specified in End User requirements documentation

   a. Cafeteria and dining rooms, one for each 20 seats.

   b. Waiting rooms, one each.

   c. Conference rooms, one each.

   d. Video outlet at optimum projection location for each specified projection surface, audio outlet near screen.

D. Where communications elements also must function as elements defined within another element group, meet the requirements of both element groups.

E. Where services elements are located outside the building in the site area, meet applicable requirements of RFP and End User Requirements documentation.

F. Validation:

1. Preliminary Design: Outline description of systems, inter-system interfaces, and functions provided.

2. Construction Documents: Detailed layout of input and output device locations.

3. Construction: Testing of wiring systems for continuity, prior to functional performance testing.

4. Closeout: Complete functional performance testing.

3.02 HEALTH AND SAFETY CRITERIA

A. Electrical Hazards: Design in accordance with all NFPA standards that apply to the occupancy, application, and design.

1. Control access to spaces housing electrical components and allow access only by qualified personnel.

2. Comply with NFPA 70 requirements for hazardous locations applications.

3.03 DURABILITY CRITERIA

A. Expected Service Life Span: Minimum 15 years.

B. Moisture Resistance and Thermal Compatibility: Materials that will resist degradation and failure of signals under ambient conditions expected.

3.04 OPERATION AND MAINTENANCE CRITERIA

A. Power Supplies:

1. Building power with power line conditioner for all systems.

2. Dedicated Battery Backup Power: For:

    a. Emergency communications, 90 minutes.

B. Power Consumption and Efficiency:

1. Comply with requirements for energy efficiency of electrical equipment in ASHRAE 90.1.

C. Transmission Capacity:

1. Within Buildings:

    a. Sound Communication Cabling: 10 megabits per second; RJ45 connectors.

    b. Data and Combined Data/Sound Communication Cabling: 100 megabits per second; RJ45 connectors.

    c. Visual Communication Cabling: Coaxial 75 ohm, plus 2 dB, 100 percent shielded.

D. Ease of Maintenance: Provide communications networks that are logically arranged and well-marked, using terminal panels that provide:

1. Connections between each voice station and hub in server room.

2. Point-to-point connections between each data input and output point and hub location in server room.

3. Connections between each sound input/output station and hub in server room.

E. Allowance for Change and Expansion:

1. Spare Distribution Capacity: 10 percent, minimum.

2. Future Distribution Capacity: 40 percent, minimum.

F. Employer Personnel Training:

1. Operational: Minimum of 8 hours, for 2 persons, for each separate system.

2. Maintenance: Minimum of 8 hours, for 2 persons, for each separate system.

3.05 WARRANTIES AND GUARANTEES

1. All ICT components and systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (2) years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (2) two years commencing on Date of Substantial Completion with the option for extended warranties past the (2) two years.

SECTION 2002 – BUILDING MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Integrated Automation: Elements for centralized monitoring and control/operation of the following services and non-services elements:

1. People-Moving Equipment: Monitoring.
2. Fire Suppression Services: Monitoring and control.
3. Plumbing Equipment: Monitoring and control.
4. HVAC Services: Monitoring and control.
5. Smoke Control and Evacuation: Monitoring and control.
6. Electrical Power Generation: Monitoring and control.
7. Backup and Emergency Electrical Power: Monitoring and control.
8. Communications Services: Monitoring.
9. Fire Detection and Alarm: Monitoring.
10. Electronic Access Control: Monitoring and control.
11. Remote Surveillance: Monitoring.

B. Products: Where specific products are required or allowed, use products complying with the additional requirements specified elsewhere.

1.02 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 400 – Earthworks
- Section 2315 – Mechanical (HVAC)
- Section 2316 – Mechanical (Elevators)
- Section 2310 – Design Procedures and Validation Requirements
- Section 2330 – ICT
- Section 2335 – Building Management System
- Section 2340 – Plumbing
- Section 2345 – Fire Suppression
- Section 2350 – Commissioning
- Section 2360 – Training
- Section 2370 – Handover Documentation
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

1.03 REFERENCE STANDARDS

- ANSI C63.12 – 2015 Standard Recommended Practice For Electromagnetic Compatibility Limits And Test Levels
- ANSI C80.1 - 2015 Electrical Rigid Steel Conduit
- ANSI C80.3 - 2015 Electrical Metallic Tubing - Steel (EMT-S)
- ASHRAE 90.1 - 2019 Energy Standard for Buildings except Low-Rise Residential Buildings
- ASHRAE Standard 202-2018 Commissioning Process for Buildings and Systems
- IEEE 830 Recommended Practice for Software Requirements Specifications
- NFPA 70 – 2020 National Electric Code
- NFPA 101 - 2021 Life Safety Code
- NFPA 110 – 2019-2022 Standard for Emergency and Standby Power Systems
- TIA-568-C - Commercial Building Telecommunications Cabling Standard; Rev C, 2012, and latest addenda.
- TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).
- Requirements of the OSH Authority in accordance with the OSH Act 2004 with amendments of 2006
- Requirements of the Trinidad and Tobago Fire Service (TTFS), Ministry of National Security of Trinidad and Tobago
- Requirements of the Electrical Inspectorate Division, Ministry of Public Utilities of Trinidad and Tobago
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- Trinidad & Tobago Electrical Wiring Code Part 1 - Low Voltage Installations (TTS 171: Part 1: 2015)
- Trinidad & Tobago Electrical Wiring Code Part 2 - High Voltage Installations (TTS 171: Part 2: 2002)
- Trinidad & Tobago Electrical Wiring Code Part 3 – Renewable Energy Systems and Interconnection Requirements (TTS 171: Part 3: 2011)

PART 2 PRODUCTS

2.01 CONTROLS

A. Communications Protocol:

1. Use one of the following:

a. BACnet

b. TCP/IP

B. Control System Types:

1. Use one or more of the following:

a. Direct digital control (DDC) system.

PART 3 DESIGN CRITERIA

3.01 BASIC FUNCTION

A. In addition to the functions described elsewhere for specific systems and equipment, provide a central station where all the systems and equipment to be integrated can be monitored and controlled or operated to the extent specified.

B. Monitoring Functions: Not less than the functions specified for the systems to be monitored.

D. Control/Operation Functions: Not less than the functions specified for the systems to be controlled or operated.

E. Interactions Between Systems

F. Where separate systems must be maintained for code or safety reasons or due to the Employer's preference, provide redundant networks and equipment to accomplish the integrated monitoring, using components at least equal to those specified for the separate systems.

G. Where integrated automation elements also must function as elements defined within another element group, meet requirements of both element groups.

H. Validation:

1. Proposal: Description of systems required.

2. Construction Documents: Complete system details.

3. Construction and Closeout: Functional performance testing.

3.02 OPERATION AND MAINTENANCE CRITERIA

A. Allowance for Change and Expansion:

4. Interchangeability of Parts: Allow for new devices made by a different manufacturer than the original installation.

B. Employer Personnel Training:

5. Operational: Minimum of 8 hours, for 2 persons, for each separate system.

6. Maintenance: Minimum of 8 hours, for 2 persons, for each separate system.

3.03 WARRANTIES AND GUARANTEES

1. All BMS components and systems inclusive of equipment and its associated accessories shall have a minimum warranty for a period of (3) years against faulty workmanship including: installation defects and manufacturer's defects inclusive of the required maintenance to maintain such warranties. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the Design Build Contractor or his/her designated representative.
2. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official for a minimum of (3) three years commencing on Date of Substantial Completion with the option for extended warranties past the (3) three years.

SECTION 2101 – ELEVATORS & LIFTS

PART 1 GENERAL

1.01 SECTION INCLUDES

PASSENGER ELEVATORS

1.07 RELATED REQUIREMENTS

- Section 101 – Preliminaries
- Section 2310 – Design Procedures and Validation Requirements
- Section 2350 – Commissioning
- Section 2360 – Training
- Section 2370 – Handover Documentation
- RFP and End User Requirements (User Brief, Schedules, ICT, Security) Documentation

1.08 REFERENCE STANDARDS

- ASME Ai 7.1 - Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers.
- ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; The American Society of Mechanical Engineers.
- AWS D1.1/DI .1M - Structural Welding Code - Steel; American Welding Society.
- NFPA 70 - National Electrical Code; National Fire Protection Association.

PART 2 PRODUCTS – NOT USED

PART 3 DESIGN CRITERIA

3.01 SUBMITTALS

A. The Design Build Contractor shall seek the approval of the Employer prior to selection and procurement of the proposed elevators. The following submittals (as needed) are required before procurement and installation

B. Shop Drawings: Indicate the following Information:
   - Locations of machine room equipment: driving machines, controllers, governors and other components

- Hoist way components: Car machine beams, guide rails, buffers, ropes, and other components.
- Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
- Individual weight of principal components; load reaction at points of support.
- Loads on hoisting beams and location of trolley beams.
- Clearances and over-travel of car and counterweight.
- Locations in hoist way and machine room of traveling cables and connections for car light.
- Location and sizes of access doors, doors, and frames.
- Expected heat dissipation of elevator equipment in machine room.
- Applicable seismic design data; certified by a licensed Professional Structural Engineer.
- Interface with building security system.
- Electrical characteristics and connection requirements.
- Show arrangement of equipment in machine room so rotating elements, sheaves, and other equipment can be removed for repairs or replaced without disturbing other components. Arrange equipment for clear passage through access door.

C. Product Data: Provide data on the following items:
- Signal and operating fixtures, operating panels, indicators.
- Cab design, dimensions. layout, and components.
- Cab and hoist way door and frame details.
- Electrical characteristics and connection requirements.

D. Maintenance Data: Include:
- Parts catalogue with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
- Technical information for servicing operating equipment

3.02 ELEVATOR SUPPLIERS WITH ACCEPTABLE QUALITY

A. Kone: www.kone.com
B. Otis Elevator Co: www.otis.com
C. Schindler Elevator Corp: www.us.schindler.com.
D. Substitutions: The Design Build Contractor may use an alternative manufacturers with comparable products with the approval of the Employer.

The Design Build Contractor should ensure that the elevator meets the following minimum product requirements and features.

1. All components to be manufactured by same entity, unless otherwise indicated.
2. Elevator: geared electric (or as required by designer).
3. Lifts should be ADA compliant, with braille buttons.
4. Additional Service Controls: In addition, provide:
5. Independent service.
6. Limited access service.
7. Traction Machine Location: Overhead
8. Elevator Controls: Provide landing buttons and hall lanterns.
9. Door Controls:
10. Program door control to open doors automatically when car arrives at floor.
11. Render "Door Close" button inoperative when car is standing at dispatching terminal with doors open.
12. If doors are prevented from closing for approximately ten seconds because of an obstruction automatically disconnect door opening/closing devices, close more slowly until obstruction is cleared. Sound buzzer.
13. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equip with photo-electric light rays.
14. Landing Buttons: Stainless steel type, one for originating UP and one for originating DOWN calls, one button only at terminating landings; marked with arrows.
15. Car Direction Indicators: Illuminating white.
16. Interconnect elevator control system with building fire alarm systems.
17. Provide "Firefighter's Operation" in accordance with applicable code. Designated Landing:
    - Emergency Power
    - Arrange elevator operation to operate under emergency power when normal power supply fails.

- Emergency Power Supply: Building emergency power; provide for emergency power characteristics and phase rotation same as for normal power. Provide transfer switches and auxiliary contacts in accordance with approved design. Install connections to power feeders.
- Provide operational control circuitry for adapting the change from normal to emergency power.
- Upon transfer to emergency power, advance one elevator at a time to a preselected landing, stop car, open doors, disable operating circuits, and hold in standby condition.
- After the above operation has completed one complete cycle, operate one preselected elevator in normal operation from the emergency power supply. If the preselected car fails to operate, automatically select another car to operate.
- Provide manual switch to override the automatic selection procedure.

18. Machine Room Fittings
    - Wail-Mounted Frames: Glazed with clear plastic; sized as required. Provide one for master electric and hydraulic schematic and one for lubrication chart. Install charts.

3.03 WARRANTIES AND WARRANTIES

A. The Design Build Contractor is expected to meet the following minimum maintenance requirements.
B. Provide service and maintenance of elevators system and components for five (5) years from Date of Substantial Completion.
C. Examine system components monthly. Clean, adjust, and lubricate equipment
D. Include systematic examination, adjustment, and lubrication of elevator equipment. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original equipment. Replace wire ropes when necessary to maintain the required factor of safety.
E. Perform work without removing cars during peak traffic periods.
F. Provide emergency call back service at all hours for this maintenance period.
G. Perform maintenance work using competent and qualified personnel.
H. Maintenance service shall not be assigned or transferred to any agent or subcontractor, Design Build Contractor without prior written consent of Client.

SECTION 2200 – PURPOSE MADE JOINERY & CARPENTRY

5.0 GENERAL

1.09 DESCRIPTION

2. This section includes purpose made joinery and built in cabinetry required for the completion of the facility in keeping with the design requirements.

1.02 SCOPE

The works to be completed under this section shall include all labour, equipment, plant and materials necessary to furnish and install the following purpose made joinery and carpentry:

1. Cabinetry
2. Vanities
3. Cabinet doors
4. Shelves
5. Drawers
6. Base and Wall Unit Carcasses and Frames
7. Laminate
8. Countertops
9. Washroom partitioning
10. Wooden Louvers

1.03 PRODUCTS

This section may include a combination of the following products/ elements:

1. Timber: Timber products shall be sound with reasonably straight grain and at least 85% heartwood, free from large shakes, wavy edges splits, loose or dead knots, worm, rot, fungus, decay or infestation.
2. Pitch Pine:
    a. Pitch pine shall be best imported quality of mature growth, free from gross defects, well-seasoned
    b. It should have a minimum density of 673 kgs/m3 and an average equilibrium moisture content of 10% in accordance with BS EN 942:2007 - Timber for workmanship in joinery - Specification for Timber.
3. Hardwood:
    a. Where ‘hardwood’ is specified this shall be either Cedar, Mahogany, Apamate, Cypre or Greenheart and shall be the best quality available and be pressure treated and must be free from gross defects.
    b. The Contractor must exercise care in selecting all timber and shall notify the Architect with regard to the type and sources of the hardwoods he proposes to use and provide samples for approval prior to purchase.
4. Treated Timber:
    a. Softwood and hardwood timber shall be treated against termite (and other) attack and decay damage by Wolmanising or similar pressure/vacuum impregnation with an approved preservative in order to obtain a minimum net chemical retention of 8.01 kgs/m3 of timber in accordance with the manufacturer's instructions and thereafter either air dry or kiln dry all timber to the best practice standards.
    b. Treat all cut surfaces after pre-treatment with surface applied preservative against wood borer attack and against decay by rot or fungus.
5. Plywood:
    a. Plywood shall conform to BS EN 635-2 & BS EN 635-3 – Plywood classification by surface appearance Hardwood/ Softwood
    b. Marine plywood shall conform to BS 1088 – Marine Plywood Requirement.
    c. Where plywood is to have a natural or varnished finish, Grade 1shall be used. Where plywood is to be painted, Grade 2 may be used.
    d. All treated plywood should be further treated with surface application of preservative prior to finishing as an added precaution.
6. Plastic Laminate:
    a. Plastic laminate shall be 1.2mm thick by 'Wilsonart' (or equal and approved by Architect)

   b. It should comply with BS EN 438-1:1991-Decorative high pressure laminates (HPL) sheets based on thermosetting resins – Specifications
   c. It should be bonded to plywood or timber backing with synthetic resin adhesive strictly in accordance with the manufacturer's printed instructions.
7. Solid Surface Countertops: Solid Surface Countertops shall be a minimum of 13mm / ½" thick
8. Glazing: Where cabinet doors are required to include glazing it shall 6mm thk. clear float glass with 10mm (3/8") dressed treated hardwood beads and appropriate sealant as required.
9. Lighting: Where lighting is specified within joinery elements the electrical components/ devices or accessories shall be tested by the Underwriters Laboratory (UL) and shall in compliance with NFPA 70 – The National Electrical Code (NEC) Handbook
10. Fixings: All fixings, plates, shoes or straps shall be formed from galvanized mild steel plate pre-drilled and/ or welded as necessary. Stainless steel (Type 316 L fixings) where requested or specified shall comply with BS EN 10051 – Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and allow steels. Tolerances on dimensions and shape.
11. Bolts, Nails and Screws:
   a. The specification (i.e. type of fixing, diameter, material, length and gauge) and use of all nails and screws shall be in strict accordance with the relevant manufacturer's recommendations.
   b. Annular ringed nails shall be used.
   c. Screws are to be counter sunk into pre-drilled holes and pelleted with dowels in the matching timber to the surrounding joinery.
12. Concealed Cabinet Hinges: All cabinet hinges shall be fully concealed, self-closing 125 degree opening, satin stainless steel finished. A minimum of two (2) shall be supplied hinges per cabinet door.
13. Adhesives: Adhesives shall have a VOC content of less than 70 g/L
14. Frames:
   a. Frames shall be constructed to conform to BS 1567 and BS 4748, Part 1.
   b. Where frames are to be painted, they shall be primed on all faces prior to fixing.

1.04 DESIGN CRITERIA

1. Joinery Work: All joinery work shall be carried out in accordance with BS EN 942:2007 Timber in Joinery – General Requirements- Specification for Timber & BS 1186-2 Timber for workmanship in joinery - Specification for Workmanship.
2. Carpentry Work: All carpentry work shall be carried out in accordance with BS EN 1995-1-1:2004+A2:2014 – Eurocode 5: Design of timber structures. General. Common riles and rules for buildings
   a. Joinery and carpentry works shall be executed in the best and most workmanlike manner.
   b. Joints shall be so placed that knots do not occur in tension zones.
   c. Frames shall be put together by mortise and tenon, dovetail or other suitable jointing methods
   d. All workmanship to comply with BS 1186-2 Timber for workmanship in joinery - Specification for Workmanship.
3. Tolerances: All structural timbers shall be sawn timbers to the section given on the drawings Permissible tolerance on cross section dimensions will be +6mm and -3mm with no allowance for wane.
4. Exposed Faces: Timber which is to be exposed in the finished work shall be 'dressed' unless otherwise described.
5. Nails: Nails, sprigs, etc., shall be punched below the surface; holes shall be stopped with putty or other equal and approved filler specially selected to match colour and texture of timbers which are to be polished.
6. Screws:
   a. Screws (other than Grade 316L stainless steel screws with cups) shall be counter sunk head wood screws driven to 1/2" below the surface.

b. Screws heads for painting shall be stopped in putty or filler before any trace of rust appears
c. All rusted screws shall be replaced before painting.

7. Crossed tongued joints shall be glued.
8. Framed Joinery:
    a. Joinery work described as 'framed' shall be jointed using mortise and tenon, combed or dovetail joints only.
    b. Where joints are not specifically indicated they shall be the recognized forms of joints for each position.
9. Tolerances:
    a. All structural timber shall be sawn timbers to the sections given on the drawings. Permissible tolerances on cross-section dimensions will be +/- 3mm (1/8") with no allowance for wane.
    b. Reasonable tolerance shall be provided at all connections between joinery work and the building carcass to compensate for any irregularities, settlements or other movements.
10. Shrinkage: All joinery work shall be arranged, joined and fixed in such a manner that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work and shall not cause damage to adjoining material or structure.
11. Finishing of Cabinet Doors & Exposed Faces
    a. All bevelled edges of tongues of panels in raised panel cabinet doors and other similar exposed joints shall be pre-finished with one (1) finishing coat of the prepared stain so that
    b. In the event of shrinkage of the panel the material wood colour will remain concealed.
12. Surface Finish on Joinery: The surface finish on joinery shall be such that if properly finished with gloss paint, imperfections in manufacture will not be apparent.
13. Natural Finish: When natural finish or finish for staining, clear polish or varnishing is specified, the timber in adjacent pieces shall be selected and matched to be uniform and symmetrical in colour and grain.
14. Painted Joinery:
    a. All joinery that is to be painted shall be knotted and primed with the primer before being fixed. This applies particularly to the 'covered up' or 'hidden parts of joinery work.
    b. All external joinery work shall be put in a thick mixture of red or white lead and linseed oil or waterproof adhesive.
    c. The arrangement, jointing and fixing of all joinery works shall be such that shrinkage in any part and in any direction shall be compensated in the joints and shall not impair the strength and appearance of the finished work and shall not cause damage to contiguous materials or structures.
    d. All joinery components shall be pre-finished by spray- applied application off site and wrapped and brought on site protected from damage.
    e. Pre-finished joinery components shall be unwrapped and installed on site.
    f. Only final touch-ups are to be carried out on site.
15. Fixing to Block work or Concrete: Where timber is described as plugged allow for supplying and fixing wooden plugs treated with termite fluid. Alternatively, plugs may be an approved proprietary make. The use of any approved system of fixing to block work or concrete with special nails, screws or bolts, inserted with spring cartridges of power tools will be permitted in lieu of plugging.

2.00 APPLICATION

1. This section includes purpose made joinery required for the facility that may include one or more of the following:
    a. Washroom Vanities
    b. Washroom Partitions
    c. Kitchen Cabinetry
    d. Countertops

e. Built in/ Purpose built furniture

3.00 PREFERENCES

3.01 SUBMITTALS

Contractors shall submit for approval:

1. Materials listing and certification indicating that products adhere to standard specifications.
2. Installation methodology
3. Specification/ Cut Sheets
4. Treatment Certificates are to be provided prior to the incorporation of timber into the works.
5. Mockups and samples as follows shall be provided prior to commencement of fabrication for the review and approval of the Architect.
    a. The joinery sub-contractor shall provide one (1) sample of each joinery type
    b. finished wood sample 150mm x 150mm
    c. available laminate finish
    d. countertop finish sample 150mm x150mm

3.25 QUALITY ASSURANCE

1. Contractors shall comply with local governing codes and regulations and contact all relevant statutory bodies before commencing construction.
2. All aspects of work covered in this specification shall be subject to inspection by the Engineer, or his/her representative.
3. The Contractor shall submit a schedule of his/her activities to the Engineer so that the Engineer will be able to work out his inspection program selectively.

3.03 SAFETY, SECURITY, OPERATIONS

1. Contractor shall provide Health and Safety documentation including a Health and Safety risk assessment and a Method Statement

3.03 FABRICATION, PROTECTION & DELIVERY

1. Fabrication: Fabrication of joinery components shall take place in an offsite location at a joinery shop.
2. Joinery Sub-contractor to cross check all as-built masonry openings for joinery items on site prior to fabrication.
3. Protection of Joinery Components: Each joinery component is to be wrapped in protective film and separated during transport to avoid bruising. Large frame components are to be filled with diagonal cross bracing to avoid warping.
4. Once delivered to site, joinery components are to be unwrapped and stored with a designated location uncovered and subject to free ventilation.

4.00 REFERENCED STANDARDS

1. BS EN 942:2007
2. BS 1186-2
3. BS EN 635-2 & BS EN 635-3
4. BS 1088.
5. BS EN 438-1:1991
6. BS EN 10051
7. BS EN 1995-1-1:2004+A2:2014
8. NFPA 70

5.00 DURABILITY

1. Expected service life span: Same as facility as a whole. Minimum 50 years functional and aesthetic
2. Temperature endurance: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 39 degrees C greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage

6.00 WARRANTIES, GUARANTEES AND MAINTENANCE

1. All joinery items shall have a warranty for a period of one year against faulty workmanship including: installation defects. The warranty excludes discoloration, stains caused by foreign substances, Acts of God (flood, wind, etc.), and modifications/ repairs done by anyone other than the contractor or his/her designated representative.
2. The Employer shall be furnished with an extended written guarantee by the joinery sub-contractor for a period of three (3) years against collapse, warping, twisting, swelling and splitting.