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SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SECTION INCLUDES

- A. Contract description.
- B. Contractor's use of site.
- C. Coordination.
- D. Work sequence.
- E. Purchaser occupancy.
- F. Specification conventions.

1.3 CONTRACT DESCRIPTION

- A. Scope:
 - 1. This Project covers the construction and commissioning of "**Chiah Public Garden**", as per the Drawings, Bill of Quantities, and as detailed in the Contract Documents (Special Conditions of Contract, General Conditions of Contract, etc.) and as instructed by the Purchaser and Supervisor.
 - 2. The Contract comprises execution, completion of the works and remedying any defects therein including the provision of all labour, materials, constructional plant, temporary works and everything whether of a temporary or permanent nature required for the execution and completion of the works.
 - 3. The organization of the Specifications into Divisions, Sections and paragraphs and the arrangement of Drawings shall not necessarily control the Contractor in dividing the Work among sub-contractors or in establishing the extent of Work needed to be performed by any trade for the successful completion of the project.
 - 4. The Contractor shall examine any section of the specifications in conjunction with the other sections as well as the rest of the Documents and Drawings which affect the Work of that section.
- B. Description of the Project:
 - 1. The Project scope of work comprises the ***Full construction of a public garden in Chiah including all landscaping, amenities, facilities, and furnishings, etc. in a dedicated plot*** with related civil, architectural, electrical and mechanical works including commissioning and warranty.

- C. Performance and Standards:
 - 1. The performance required of materials and products and the standards to be complied with are specified in relevant sections of the Specifications.
- D. Cross References:
 - 1. The specifications are prepared partly based on the Construction Specifications Institute (CSI) master format.
 - 2. The specifications section numbers and titles are used in the Bill of Quantities as cross-references to help define the part or parts of the Specification which apply to particular kinds or parts of the Work. If the references are to specific clauses or kinds or types of work within a section of the Specifications, they shall be taken as applying to the section as a whole, with all related sections and other relevant information. Cross references should not be taken as excluding other relevant information and requirements stated in other parts or sections of the Specifications. The Specifications as a whole shall be taken as applying to the Work as a whole. The Supervisor shall have a discretionary interpretive role in case of contradiction or ambiguity.

1.4 CONTRACTOR'S USE OF SITE

- A. All construction operations and site establishment facilities shall be confined to within the site boundaries unless otherwise agreed with the Supervisor.
- B. The Contractor shall be responsible for safeguarding all existing structures and neighboring occupancies, facilities, utilities and properties.
- C. The Contractor shall be responsible for arranging its own working space, storage of materials, setting of all temporary accommodations, utilities, services, facilities, etc.
- D. The Contractor shall keep all driveways and entrances serving the site clear and available to Purchaser, Purchaser's employees, third parties, and emergency vehicles at all times. The Contractor shall not use these areas for parking or storage of materials.
- E. The Contractor shall Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- F. The Contractor shall not unreasonably crowd the site with materials or equipment. The Contractor shall confine stockpiling of materials and storage sheds to the areas approved by the Supervisor. If additional storage is necessary, the same shall be arranged at the Contractor's own responsibility and cost.
- G. The Contractor shall lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use.

1.5 COORDINATION

- A. The Contractor shall be responsible for all the scope of work described and shall coordinate any necessary works done by third parties. To this effect, the Contractor shall provide all necessary installation support required by those third parties if and when required.

- B. The Contractor shall ensure that all the works are carried out in proper sequence having regard to the progress of the works, and that all necessary provisions are made for locating, routing, supporting and fixing the engineering services, providing the necessary holes, chases and access for them, and in all respects fully integrating them with the works.

1.6 WORK SEQUENCE

- A. Execute Works in approved stages and phases.
- B. Coordinate construction schedule and operations with Supervisor.

1.7 PURCHASER OCCUPANCY

- A. The Purchaser or its designated Beneficiary will occupy the site and premises at the date indicated in the Contract.
- B. The Contractor shall cooperate with Purchaser to minimize conflict, and to facilitate Purchaser's operations.
- C. The Contractor shall schedule the Work with the Supervisor to accommodate Purchaser or Beneficiary occupancy.

1.8 SPECIFICATION CONVENTIONS

- A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon ":" or semi-colon ";" is used within sentences or phrases.
- B. Related Sections: All "Division 1" specifications sections are general requirement sections and are applicable to all other specifications sections with no need to mention them in the "Related Sections" of each specifications section. In general, "Related Sections" are only the "Technical Related Sections".
- C. The terms "Purchaser", "Client", "Contracting Authority", "Employer" or "Procurer" may be used interchangeably and they shall refer to UNDP.
- D. Reference to "Supervisor" shall mean the UNDP appointed representative either as a consultant or UNDP staff.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Field engineering.
- C. Regulatory Requirements.
- D. Management and Administration Procedures.

1.3 COORDINATION AND PROJECT CONDITIONS

- A. The Contractor shall coordinate scheduling, submittals and Work of various sections to ensure efficient and orderly sequence of execution of interdependent construction elements/trades. The Contractor shall accommodate for the installation of equipment and items by third parties. Such equipment includes but is not limited to the ones shown in the Drawings.
- B. The Contractor shall verify utility requirements and characteristics of operating equipment are compatible with project utilities. The Contractor shall coordinate work of various sections related to the installing, connecting to, and placing in service, of third party equipment.
- C. The Contractor shall coordinate space requirements, supports and execution of all works along with mechanical works and electrical installations. The Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
- D. The Contractor shall complete and clean-up the Work of separate sections in preparation for Substantial Completion.

1.4 FIELD ENGINEERING

- A. Scope:
 - 1. This section covers:
 - a. Survey and field engineering, quality control, submittals and project record documents of the works.
 - b. The Contractor's responsibility for the accurate setting out of the Works both on drawings and on Site.
- B. Related Items:

1. General Requirements: Execution requirements for Project Record Documents.
- C. Performance and Standards:
 1. Employ a Certified Land Surveyor acceptable to the Supervisor to perform survey work of this section.
 2. All setting out, including the setting out and marking of field work requirements shall be measured from agreed data.
- D. Submittals:
 1. Submit name, address, and telephone number of Surveyor before starting survey work.
 2. On request, submit documentation verifying accuracy of survey work.
 3. Submit a copy of site drawing signed by the Certified Land Surveyor, that the elevations and locations of the Work are in conformance with Contract Documents.
 4. Maintain a complete and accurate log of control and survey work as it progresses.
- E. Examination:
 1. Verify locations of survey control points prior to starting work.
 2. Promptly notify Supervisor of any discrepancies discovered.
- F. Survey Reference Points:
 1. Contractor will locate and protect survey control and reference points.
 2. Control datum for survey is that indicated on Drawings or as given by the Supervisor.
 3. Verify set-backs and easements; confirm drawing dimensions and elevations.
 4. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
 5. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Supervisor.
- G. Survey Requirements:
 1. Provide field engineering services. Utilize recognized engineering survey practices.
 2. Establish a minimum of four permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
 3. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - a. Site improvements including pavements; stakes for grading; utility locations, slopes, and invert elevations.
 - b. Grid or axis for garden and structures of existing and new structures.
 - c. Goal locations and elevations.
 4. Periodically verify layouts by same means.
- H. Existing Levels:
 1. The Contractor shall satisfy himself that the levels as shown on the drawings are correct. Should the Contractor wish to dispute any levels he shall submit to the Supervisor a schedule of the position of the levels considered to be in

- error and a set of revised levels. Levels shall not be disturbed during execution without the approval of the Supervisor.
2. Claims brought on discrepancies due to non-compliance by the Contractor of the aforementioned shall not be considered.

1.5 REGULATORY REQUIREMENTS

- A. Scope:
 1. This Specification calls attention to the regulations to be observed by the Contractor and the Standards and Codes of Practice.
- B. Regulations:
 1. The Contractor shall carry out the Works in full observance of the municipal and governmental authorities' requirements and regulations. Special attention shall be also given to:
 - a. All Lebanese legal regulations regarding construction, workmanship, material, general requirements, site administration, safety, health and environmental regulations.
 - b. Municipal regulations and planning requirements.
 - c. Best International standards for safety in recreational areas.
- C. Standards:
 1. Notwithstanding the Specifications of certain Standards and Codes of Practice, all Materials, Products and Workmanship shall comply with the requirements of the latest edition of all relevant Standards, Standard Codes of Practice and all current amendments thereto.
 2. Compliance shall be understood to mean that the standard attained shall not be less than that specified in the Standard or Code of Practice but may well be higher. In particular, where a higher standard is called for in the Specification, that higher standard shall take precedence over the relevant Standard and Code of Practice, even if these are referred to in the text of the Specification. The more stringent requirements shall always govern.
 3. In the case of materials and products which have been produced or manufactured in accordance with a published Standard or Code, that fact shall be brought to the attention of the Supervisor together with full particulars of the standard in question; it is up to the Supervisor to accept the material or product if he is satisfied with the provisions of the standard or code.

1.6 MANAGEMENT AND ADMINISTRATION PROCEDURES

- A. Superintendence:
 1. The Contractor shall assume full responsibility for implementation, coordination, superintendence and administration of the Work including all sub-contracts.
 2. The Contractor shall arrange and monitor a programme with each sub-Contractor, supplier and authority and obtain and supply information as necessary for coordination of the Work.

- B. Sub-Contractor's Site Meeting:
 - 1. The Contractor shall hold meetings with appropriate sub-contractors and suppliers shortly before main site meetings to facilitate accurate reporting of progress.
- C. Weather Record:
 - 1. Keep an accurate record of:
 - a. Daily maximum and minimum air temperature (including overnight)
 - b. Number of hours per day in which Work is prevented by inclement weather.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SECTION INCLUDES

- A. Scope.
- B. Definitions.
- C. Submittal Procedures.
- D. Supervisor's Representative Review of Submittals.

1.3 SCOPE

- A. This section generally specifies procedures regarding submittals. Nevertheless, additional procedures and requirements for submittals are specified in individual sections of the specifications.
- B. Submittals shall include but not limited to the following:
 - 1. Submittal schedule.
 - 2. Coordination and sequencing.
 - 3. Site layout organization chart.
 - 4. Submittal preparation and procedure.
 - 5. Product data.
 - 6. Construction time schedule.
 - 7. Design by Contractor and Design data.
 - 8. Shop drawings and CAD produced drawings.
 - 9. Samples.
 - 10. Certificates.
 - 11. Test and inspection reports.
 - 12. Manufacturer's instructions and manuals.
 - 13. Manufacturer's field reports.
 - 14. Miscellaneous submittals.
 - 15. Progress reports and Photographs.
 - 16. Correspondence.
- C. The requirements of this section do not supersede or take precedence over any provision of the Contract. Should any conflict become apparent between these requirements and the Contract, the requirements of the Contract shall prevail.

1.4 DEFINITIONS

- A. The work related to submittals of this section, in addition to the definitions of the Contract, are further categorized for convenience as follows:
1. Product data shall include manufacturer's latest standard printed literature such as manufacturer's installation instructions, catalog cuts, colour charts, roughing diagrams, wiring diagrams, and performance curves on materials, equipment and systems for this project. Product data shall include references to applicable specification section and item number. Product data shall be in addition to the required shop drawing submittals.
 2. Any design required by the Contractor, where called for in the Contract Documents, shall include calculations, and working and shop drawings (CAD).
 3. Construction time schedule shall be in the form of a Gantt chart incorporating activities for all work to be performed by the Contractor, its Sub-Contractors and suppliers to be employed in or about the Site, prepared in accordance with the principles of Critical Path Method Programming.
 4. Shop drawings shall include specially prepared technical data with diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, plans, sections, details and measurements in standard printed form (A4 size or A0 size for drawings). Shop drawings shall be in addition to the required product data and shall indicate applicable specification section and item numbers.
 5. Samples shall include physical examples of materials, both fabricated and unfabricated, in complete units and as smaller portions of units, for visual inspection. Samples shall indicate applicable section and item numbers within that section.
 6. Certificates shall include statements of suitability, certifying reports from governing agencies, industry standards and testing agencies and applicable certificates specified in each section of the specification.
 7. Test and inspection reports shall include reports specified to be required in each section of the specifications.
 8. Schedules shall include schedule of required submittals organized by related specification section number and sequence of submission, schedule of sequence of work and time schedule, schedule of sequence of application of specific units of work and schedule of materials, equipment and systems as listed in applicable sections of the specifications.
 9. Miscellaneous submittals shall include submittals related directly to the work (non-administrative) including maintenance agreements, physical work records, copies of industry standards, record drawings, garden measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the work and not processed as shop drawings, product data, samples or certificates.

1.5 SUBMITTAL PROCEDURES

- A. General:
1. Transmit each submittal with the required form.
 2. Sequentially number transmittal forms.
 3. Mark revised submittals with original number and sequential alphabetic suffix.

4. Identify Project, Contractor, Sub-Contractor and Supplier and relevant drawing and detail number, and specification section number, appropriate to submittal.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, garden dimensions, adjacent construction Work, and coordination of information are in accordance with requirements of the Work and Contract Documents.
6. Schedule submittals to expedite Project, and deliver to Supervisor at business address instructed. Coordinate submission of related items.
7. Identify variations from Contract Documents and product limitations which may be detrimental to successful performance of the completed Work.
8. Allow space on submittals for Contractor and Supervisor review stamps.
9. When revised for resubmission, identify changes made to previous submission.
10. Distribute copies of reviewed submittals as appropriate.
11. Instruct parties to promptly report inability to comply with requirements.
12. Submittals not requested will not be recognized or processed.

B. Submittal Schedule:

1. All submittals and correspondence shall be submitted to the Supervisor.
2. Any design required by the Contractor, where called for, shall be submitted to the Supervisor for approval.
3. All shop drawings, material and samples submittal schedules shall be submitted to the Supervisor for approval. In addition the Contractor shall submit Material delivery schedule for Supervisor's approval. The Contractor shall adhere to the approved schedules.
4. Schedule submissions to ensure that the Supervisor is given a reasonable time to review each submission within the scheduled period of time.
5. Certify that each submittal has been checked and approved by Sub-Contractors, installers, manufacturers and suppliers. Note any deviations from drawings or specifications. Without such an explicit note, no approval on any submittal shall be deemed a variation or a waiver of the Contractor's responsibility to fully comply with the Contract Documents.
6. No submissions shall be processed without signed & approved certification of Contractor. This certification shall be stated on each submission as follows:
Material submitted for approval has been checked for conformance with drawings and specifications for this project. Any deviation from drawings and specifications has been explicitly and clearly marked on the material or detailed in the transmittal letter.

C. Coordination and Sequencing:

1. Coordinate preparation and processing of submittals with the Construction Program and progress so that the work will not be delayed.
2. Coordinate and sequence submittals for work and work interfaced with other work so that the processing of submittals will not be delayed by the lack of required coordination between submittals.
3. The obligation to coordinate the work indicated on any submittal material with other trades and with field conditions is the responsibility of the Contractor. No claim will be allowed for work that may have to be moved or replaced based on a claim that the work was placed in accordance with dimensions indicated on an approved submittal.
4. No claim for an extension of time will be granted because of Contractor's failure to coordinate submissions.

- D. Site Layout Organization Chart:
1. Submit to the Supervisor's approval, a site layout organization plan, and any modifications thereafter showing the Contractor's proposed layout of its temporary construction facilities and controls stated in section 01500 and its plant/equipment on site where applicable.
- E. Submittal Preparation and Procedure:
1. Contractor shall submit any design required by the Contractor where called for, shop drawings, material and other samples accompanied by "Design, Shop Drawings, Materials and other Samples Transmittal" forms.
 2. The format of transmittal forms shall be to the approval of the Supervisor.
 3. Typed transmittal forms should indicate the following:
 - a. Contract No.
 - b. Name of Contract.
 - c. Contractor's name.
 - d. Submitted by: Contractor's employee responsible for Contractor's review.
 - e. Specification Section: (one specification section in each submittal).
 - f. Transmittal No.: consecutive.
 - g. Date Submitted.
 - h. Submission No.: 1st, 2nd, 3rd, etc.
 - i. Bill of Quantities: Division, item and description.
 - j. Specification Section Paragraph: Specific paragraph under which item is specified.
 - k. Copies and Type: Number of copies submitted and type of material submitted.
 - l. Drawing No., Description and Date.
 - m. Contractor's Remarks: Explicit exceptions or deviations from the Contract Documents with details and reasons.
 4. Resubmission: Re-submittal procedures shall follow the same procedures as the initial submittal (without need to resubmit material or same sample again).
 5. Incomplete or erroneous transmittals will be returned.
 6. Submittal Procedures by Contractor:
 - a. All correspondence and attachments thereto shall be submitted to the Supervisor in one original and three copies and one soft copy.
 - b. Two sepia and three prints and one soft copy (CAD) of each shop drawing with transmittal forms shall be submitted.
 - c. Two samples of each material or prefabricated component with transmittal forms shall be submitted.
 - d. Three copies of brochures, one of which must be an original, with transmittal forms shall be submitted.
- F. Product Data:
1. Within 7 days after the Contract Commencement Date, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product called for under "Submittals" in each individual specification section.
 2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
 3. Submit product data in triplicate for review. Indicate the actual materials being submitted for review when literature contains selections.

4. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- G. Construction time schedule:
1. Program Submittal Procedures and Requirements:
 - a. The Contractor shall submit his initial Construction Program for approval, in three copies and one soft copy, within 2 weeks of the Contract Commencement Date. Such initial Construction Program shall include a scheduling software Gantt chart highlighting the critical path and proving completion within contractual deadlines.
 - b. After approval of the Contractor's initial Construction Program, revisions and updates must be submitted on a monthly basis.
 - c. Revisions and monthly updates to the Construction Program shall be submitted within five (5) working days of the data date for inputting revised/updated information. The data date for the first monthly update shall be one month after approval by the Supervisor of the Contractor's initial Construction Program, and successive data dates shall be at monthly intervals. The said data date should coincide with the date of the site progress meeting at which time the records of progress are verified.
 - d. Each program submitted shall be signed by all principal Sub-Contractors before being submitted to the Supervisor thereby confirming that they have reviewed the said program. If any Sub-Contractor has reservations regarding his ability to comply with the program requirements to which he has appended his signature, the Contractor shall instruct the Sub-Contractor to list such reservations in writing and a copy thereof shall be submitted to the Supervisor with the program submittal for his information. Neither reservation by any Sub-Contractor, nor the fact of informing the Supervisor in respect thereof, shall relieve the Contractor of his responsibilities under the Contract in the time prescribed therein.
 - e. Submit a bi-weekly report detailing the preparation, submittal and approval status of shop drawings, materials and equipment, samples, and the status of materials and equipment procurement, order placed, delivery periods and site delivery dates.
 2. Programming Costs:
 - a. All costs in establishing, maintaining, revising and updating the construction program shall be borne by the Contractor.
 3. Narrative Details:
 - a. The Contractor shall also prepare and submit in narrative form the following supporting data at the same time the initial time schedule is submitted. Such data shall only be resubmit 5 days before any change to them is planned to be applied:
 - b. The planned number of working days per week taking into consideration public holidays and weekends.
 - c. The planned number of shifts per day.
 - d. The number of hours per shift.
 - e. The planned purchasing and delivery of local and imported materials.
 - f. The planned weekly manpower usage for each trade to be employed for the works.
 - g. The planned productivity rates for each major work sequence.

- H. Design by Contractor and Design Data:
1. Any design required by the Contractor, where called for, with all necessary calculations, working and shop drawings, shall be submitted to the Supervisor within 7 days after the Contract Commencement Date.
 2. The design by Contractor, together with all necessary calculations, working drawings and shop drawings shall be prepared by the Contractor and by his principal Sub-Contractors for structural, architectural and electro-mechanical works, proper liaison and coordination between trades shall be attended to and ensured. Contractor shall also allow the Supervisor's access for review and approval during the preparation process.
 3. The design by Contractor shall be prepared after site dimensions have been taken. Shop drawings shall be prepared on Cad and printed on reproducible transparencies; they shall use metric units of measurement.
 4. The Supervisor's review and approval of any design required by the Contractor is for general conformance with the design concept and specifications and shall not relieve the Contractor from responsibility for errors or omissions in respect of the requirements of any standards and codes.
 5. The Contractor shall make any corrections or amendments required by the Supervisor including calculations, working drawings and shop drawings, and shall resubmit until approved. All such corrections or amendments shall be clearly indicated on the resubmitted design with all necessary calculations, working drawings and shop drawings, by the use of revision numbers in circles or triangles, or other method approved by the Supervisor.
 6. No acceptance or approval by the Supervisor of any design by the Contractor submission made by the Contractor, nor any notes, comments, stipulations, requests for clarifications, etc., made by the Supervisor upon such submissions during his review and approval thereof, shall constitute an authorization to any variation in the Contract price or scope or to any extra time for completion of the works.
 7. The Contractor shall submit Design data for Supervisor's knowledge or approval as the case may be.
 8. Submit Design data for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.
- I. Shop Drawings, CAD Drawings and Samples: Shop drawings shall establish actual details of manufactured or fabricated items and of work to be executed; they shall clearly identify materials, dimensions, thicknesses, components, attachments, relation with adjoining work and spaces, and all other pertinent information. Shop drawings shall clarify and amplify the design drawings and other design requirements and shall, subject to the Supervisor's approval, incorporate minor changes in design or construction as may be necessary or otherwise desirable to suit the requirements of the work. Where the Contract Documents require the Contractor to submit samples, the same shall satisfactorily establish that the quality, construction, workmanship, finish, colour, pattern and any other characteristics of the material or equipment to be provided, are in conformance with the Contract requirements and to the Supervisor's reasonable satisfaction.
1. The Contractor shall prepare, review, coordinate and submit to the Supervisor for approval such shop drawings and samples as are required by the Contract Documents or as may be required by the Supervisor during the course of the works.
 2. At the time of making his submission, the Contractor shall inform the Supervisor in writing of any deviation between shop drawings/samples being

- submitted and the requirements stipulated or reasonably implied by the Contract Documents.
3. By submitting shop drawings and samples, the Contractor represents that he has determined and verified all dimensions, relation to existing work, coordination with work and equipment to be installed later, coordination with information in previously submitted shop drawings and has verified their compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing shop drawings and samples, the Supervisor shall be entitled to rely upon the Contractor's representation that such information is correct and accurate. The Contractor shall be responsible for and shall make any alterations in the work due to discrepancies, errors or omissions by the Contractor. The Contractor shall be responsible for the correct locations of his work, irrespective of approval by the Supervisor, and shall pay all costs and expenses incurred by others due to improper location of his work.
 4. Sub-Contractors shall submit their shop drawings and samples through the Contractor who shall review and coordinate with his own and other Sub-Contractor's drawings and/or samples before submitting to the Supervisor. The Contractor shall be responsible in all respects for his Sub-Contractor's shop drawings and samples as if they were his own.
 5. Neither the fabrication of prefabricated items, nor the ordering of any work, materials or equipment, nor the execution of any work on site, shall commence until shop drawings and samples, relevant to the said items, work, etc., and required by the specifications, have been submitted and approved in writing by the Supervisor.
 6. Shop drawings shall be prepared by the Contractor and by his principal Sub-Contractors for structural, architectural and electro-mechanical works. Proper liaison and coordination between trades shall be attended to and ensured. Contractor shall also allow for the Supervisor's access for review and approval during the preparation process.
 7. Shop drawings shall describe accurately the method of fabrication, installation, applied finishes, types and sizes of all members and fixings, and shall, where applicable, indicate methods of marking components for site erection. Shop drawings shall be to scales approved by the Supervisor.
 8. The Contractor shall verify all dimensions and area conditions and shall check and coordinate the shop drawings and samples required in connection with a particular trade or section of the works with the requirements of other trades or section related thereto.
 9. In order to ensure proper coordination, shop drawings and samples for each system or element of work shall be submitted in a single package. The Supervisor may require that all relevant parts of a system or element be submitted before any component item is approved.
 10. Except for finish, pattern, colour and other matters in respect of which the Supervisor's decision is required in accordance with the Contract Documents, the Supervisor's review and approval of shop drawings and samples submitted by the Contractor is for general conformance with the design concept and specifications and shall not relieve the Contractor from responsibility for any deviation from, or errors or omissions in respect of the requirements of the Contract Documents, unless the Contractor has informed the Supervisor in writing of specific deviations and the Supervisor has given written approval thereto.
 11. The Contractor shall direct specific attention in writing or resubmitted shop drawings and samples to revisions other than the corrections requested by the

Supervisor or previous submissions. Unless such written notice has been given, approval of a resubmitted shop drawing or sample shall not constitute approval of any changes not requested on the prior submission.

12. In the event of written rejection by the Supervisor to a particular sample of material, the Contractor shall submit within fourteen (14) calendar days of such rejection, samples of three alternative materials for the Supervisor's approval and the Supervisor shall reject or approve all or any of these materials within fourteen (14) days of their submission. This procedure shall be repeated until such time as a sample of material is approved by the Supervisor. Failure on the part of the Contractor to obtain the Supervisor's approval, which shall not be withheld unreasonably, to all or any one sample or material shall in no way relieve the Contractor of his liabilities and obligations under the Contract.
13. The Supervisor may at any time call upon the Contractor to submit samples of any material used or to be used in the work, including those specified in the Contract by "Brand Name", for comparison with the specification and/or approved sample. Should any such sample fail to meet the requirements of the specification and/or standard of the accepted sample, then all materials from which the sample has been taken shall be removed from the site immediately and all work executed incorporating such material shall be removed and made good to the satisfaction of the Supervisor all at the expense of the Contractor.
14. No acceptance or approval by the Supervisor of any shop drawing or sample submission made by the Contractor, nor any notes, comments, stipulations, requests for clarifications, etc., made by the Supervisor upon such submissions during his review and approval thereof, shall constitute an authorization to any variation in the Contract price or to any extra time for completion of the works.
15. The Contractor shall prepare his shop drawings, progress record drawings, and final as-built drawings using computer aided design and drafting techniques (CAD).
16. All computer hardware, software and computer room necessary for the preparation of drawings using CAD shall be provided by the Contractor at no additional cost.
17. Data indicating inappropriate or unacceptable Work may be subject to action by the Supervisor or by the Purchaser.

J. Certificates:

1. When specified in any specification section under "Submittals", submit certification by manufacturer, installation or application sub-contractor, or Contractor to Supervisor, in quantities specified for Product Data.
2. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
3. Certificates may be recent or previous test results on material or Product, but must be acceptable to the Supervisor.
4. Submit certificates in triplicate for review.

K. Test and Inspection Reports:

1. Submit test and inspection reports called for in each specification section.
2. Submit test reports for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

- L. Manufacturer's Instructions:
 - 1. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Supervisor for delivery to Purchaser in quantities specified for Product Data.
 - 2. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- M. Manufacturer's Field Reports:
 - 1. Submit reports for Supervisor in duplicate.
 - 2. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.
- N. Miscellaneous Submittals:
 - 1. Refer to each individual specification section and the Contract Documents for additional submittal requirements.
- O. Progress Reports and Photographs:
 - 1. The Contractor shall submit to the Supervisor each month a progress report showing actual progress by identifying activities and Works commenced and those completed during the previous week, estimated time required to complete all activities under way in relation to the programme of Works, a detailed programme for activities to be carried out during the following week and progress photographs. Such reports shall be to Supervisor's satisfaction.
 - 2. During the progress of the work, submit in triplicate, colored photographs taken by an approved professional photographer consisting of minimum ten (10) views, all taken where directed by the Supervisor. The prints shall be 130 x 180mm matt finish, unless otherwise stated in the Conditions of Contract. Photographs shall be taken before and after every activity.
 - 3. At the completion of all work final photographs shall be taken as directed by the Supervisor.
 - 4. Identify each print on back. Identify Name of Project, Contract Number, orientation of view, date and time of view, name and address of photographer.
 - 5. All soft copies (digital camera) shall be delivered to the Supervisor in their proper order and shall become the property of the Purchaser. Include typed table of contents of all photographs in chronological sequence.
 - 6. The Contractor shall submit photographs for all works to be covered before covering such works to the approval of the Supervisor.
- P. Correspondence: Except where more are required by the contract, all correspondence shall be through the Supervisor, and shall be submitted as follows:
 - 1. One original and two photocopies of transmittals and letters including attachments/enclosures.

1.6 SUPERVISOR'S REVIEW OF SUBMITTALS

- A. The Supervisor will process the submittal and indicate the appropriate action on the submittal and the transmittal.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Tolerances.
- C. References.
- D. Testing and inspection services.
- E. Manufacturers' field services.
- F. Examination.
- G. Preparation.

1.3 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. The Contractor shall submit a Quality Assurance Program to the Supervisor's approval.
- B. The Contractor shall monitor quality control over sub-contractors, suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- C. The Contractor shall comply with manufacturers' instructions. When manufacturers' instructions conflict with Contract Documents, request clarification from Supervisor before proceeding.
- D. The Contractor shall comply with specified standards as minimum quality requirements for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. The Contractor shall perform Work using persons qualified to produce required and specified quality.
- F. The Contractor shall verify the garden measurements as indicated on shop drawings or as instructed by manufacturer.

- G. The Contractor shall secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.4 TOLERANCES

- A. The Contractor shall monitor fabrication and installation tolerance control of products to produce acceptable Work. Tolerances should not accumulate.
- B. The Contractor shall comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Supervisor before proceeding.
- C. The Contractor shall adjust products to appropriate dimensions at full responsibility. Products shall be positioned in place prior to fixing.
- D. The works are to be set out and constructed in accordance with the tolerances given in BS 5606:1990 or equivalent.

1.5 REFERENCES

- A. Whenever specific standards, brands, trades, etc. are mentioned, equivalent equal are acceptable without having to state "or equivalent" each time.
- B. For products or workmanship specified by association, trades, or other consensus standards, the Contractor shall comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- C. The Contractor shall conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.
- D. The Contractor shall obtain copies of standards where required by product specification sections.
- E. When specified reference standards conflict with Contract Documents, the Contractor shall request clarification from the Supervisor before proceeding.
- F. Neither the contractual relationships, duties, responsibilities of the parties to the Contract, nor those of the Supervisor shall be altered from the Contract Documents by mention or inference otherwise in any reference documents.

1.6 TESTING AND INSPECTION SERVICES

Independent Testing Laboratories – as specified in the respective sections.

1.7 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, the Contractor shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment/products, test and adjust and balance of equipment/products as applicable, and to initiate instructions when necessary.

- B. The Contractor shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. The Contractor shall verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning any new Work, means acceptance of existing conditions at the sole responsibility of the Contractor having acquainted itself with all site and substrate conditions before submitting its bid.
- B. The Contractor shall verify that existing substrate is capable of structural support or attachment of new Work being applied or attached at the sole responsibility of the Contractor having acquainted itself with all site and substrate conditions before submitting its bid.
- C. The Contractor shall examine and verify specific conditions described in individual specification sections.
- D. The Contractor shall verify that utility services are available, of correct characteristics and in the correct locations.

3.2 PREPARATION

- A. The Contractor shall prepare and clean substrate surfaces prior to applying next material or substance.
- B. The Contractor shall seal cracks or openings of substrate prior to applying next material or substance.
- C. The Contractor shall apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SCOPE

- A. The scope of this section covers:
 - 1. Temporary Utilities: Electricity, lighting for construction purposes, site lighting, heating, ventilation, water service, and sanitary facilities.
 - 2. Temporary Controls: Enclosures, security, traffic safety and regulation, water control, dust control, erosion and sediment control, noise control, pest control, pollution control, rodent control, and first aid facilities.
 - 3. Construction Facilities: Parking, progress cleaning and waste removal, project identification, field offices, vehicular access, plant and small tools, and scaffolding and hoisting.
 - 4. Removal of utilities, facilities, and controls.

1.3 PERFORMANCE AND STANDARDS

- A. The Contractor shall abide fully by the provisions and requirements of all Lebanese legal Regulations regarding construction, workmanship, material, safety, etc.
- B. Regulations shall include, but not limited to, laws, decrees and all requirements of governmental and municipal authorities as well as professional codes and standards.
- C. The Contractor shall take all precautions necessary to protect persons and property on or off site from injury or damage resulting from work under this contract.

1.4 RELATED ITEMS

- A. General Requirements: Contractor's use of site, administrative requirements for field engineering, and execution requirements for cleaning.

1.5 STANDARDS AND REGULATIONS

- A. In addition to what is stated in this specification section, all temporary utilities, temporary controls and construction facilities shall comply with relevant authorities' standards for Site Administration and Rules, Safety, Health and Environmental Regulations, and other local authorities' standards and regulations.

1.6 ELECTRICITY

- A. Provide, maintain and pay for power service required for the works from time of project mobilization until handing over to cover any power needs whether of a temporary intermittent nature or of a persistent nature.
- B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required.
- C. Provide main service disconnect and over-current protection at convenient location.
- D. Permanent convenience receptacles may not be utilized during construction.
- E. Provide adequate distribution equipment, wiring and outlets to provide single phase branch circuits for power and lighting for each active work area.

1.7 LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain incandescent lighting for construction operations to achieve acceptable lighting level.
- B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide and maintain lighting to interior work areas after dark.
- D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- E. Maintain lighting and provide routine repairs.
- F. Permanent lighting shall not be utilized during construction.

1.8 SITE LIGHTING

- A. The Contractor shall install temporary site lighting including but not restricted to perimeter fence, name boards, parking areas and for site safety to the satisfaction of the Supervisor and the approval of Municipal and Central Authorities.

1.9 HEATING

Not Applicable.

1.10 VENTILATION

- A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.11 WATER SERVICE

- A. Provide, maintain and pay for suitable quality water service required for construction operations and all purposes from time of mobilization until completion of the works.

This should to cover any water needs whether of a temporary intermittent nature or of a persistent nature.

- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.
- C. Make available clean and hygiene potable water for the use of personnel on site.

1.12 SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide from time of project mobilization until completion of the works.
- B. Sanitary facilities include temporary well aerated toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities.
 - 1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility.
 - 2. Provide covered waste containers for used material.
 - 3. Provide proper sanitation.

1.13 ENCLOSURES

- A. Exterior Enclosures:
 - 1. Provide temporary scaffolding with approved screens to protect from dust and fallout as per Supervisor Requirement.
 - 2. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- B. Interior Enclosures: Provide temporary interior enclosures to the satisfaction of the Supervisor, to separate work areas from areas occupied by third parties or by Purchaser, to prevent penetration of dust and moisture into such other areas, and to prevent damage to finished and completed work.

1.14 SECURITY

- A. Security Program:
 - 1. Protect Work, existing premises and Purchaser's operations from theft, vandalism and unauthorized entry.
 - 2. Initiate program at project mobilization.
 - 3. Maintain program throughout construction period until Purchaser occupancy or when directed by the Supervisor.
- B. Entry Control:
 - 1. Restrict entrance of persons into Project site.
 - 2. Allow entrance only to authorized persons with proper identification.
 - 3. Maintain log of workers & visitors; make available to Supervisor on request.
 - 4. Control entrance of persons.

5. Fully secure the site during and outside working hours.
- C. Security Service: If requirements under (B) above cannot be achieved, the contractor shall (at the supervisor's sole discretion) employ uniformed guard service to provide watchpersons at site twenty four hours a day, seven days a week.
- D. Restrictions: Do not allow cameras on site or photographs taken except by written approval of Purchaser.

1.15 TRAFFIC SAFETY AND REGULATION

- A. General:
 1. The Contractor shall provide, erect and maintain such traffic signs, traffic control signals and such other measures as may be required by the Construction of the Works to the satisfaction of the Supervisor.
 2. The Contractor shall not commence any work which affects public roads until all the traffic safety measures necessitated by the work are fully operational.
 3. The Contractor shall keep clean and legible at all times all traffic signs, lamps, barriers and traffic control signals, and shall position, cover or remove them as required by the progress of the Works.
- B. Signs, Signals and Devices: in compliance with Municipal requirements.
- C. Traffic Signs and Signals:
 1. Provide signs at approaches to site, on site, at crossroads, detours and elsewhere as needed to direct construction and affected public traffic.
 2. Provide, operate and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
 3. Relocate as Work progresses, to maintain effective traffic control.
- D. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- E. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- F. Haul Routes:
 1. Consult with municipal authorities, establish public thoroughfares to be used for haul routes and site access.
 2. Confine construction traffic to designated haul routes.
 3. Provide traffic control at critical areas of haul routes to regulate traffic, and to minimize interference with public traffic.
- G. Mud: The wheels of all vehicles shall be well washed before being allowed to leave the Site, lay-down area or any other area which the Contractor is utilizing for the purposes of this Contract. Any mud which is deposited outside the site boundary is to be removed immediately and the whole area thoroughly cleaned.
- H. Removal:
 1. Remove equipment and devices at Substantial Completion or when directed by the Supervisor.

2. Remove post settings to depth of 600 mm.
3. Repair damage caused by installation.

1.16 WATER CONTROL

- A. Protect site from puddling, running water or rain.

1.17 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations. Since the site is in a populated area, dust must be kept to a minimum.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- C. Should objections raised by third parties cause the halting of operations on site, the same shall be at the sole responsibility of the Contractor who will also be required to remedy any inconvenience caused to third parties due to dust dispersion.

1.18 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Minimize surface area of bare soil exposed at one time.
- C. Provide temporary measures including berms, dikes and drains, and other devices to prevent water flow.
- D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.19 NOISE CONTROL

- A. Provide methods, means and facilities to minimize noise produced by construction operations. Since the site is in a populated area, dust must be kept to a minimum.
- B. Should objections raised by third parties cause the halting of operations on site, the same shall be at the sole responsibility of the Contractor.

1.20 PEST CONTROL

Not Applicable.

1.21 POLLUTION CONTROL

- A. Provide methods, means and facilities to prevent contamination of soil, water and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.
- B. Comply with pollution & environmental control requirements of relevant authorities.

1.22 RODENT CONTROL

- A. Provide methods, means and facilities to prevent rodents from accessing or invading premises.

1.23 FIRST AID FACILITIES

- A. The Contractor shall provide and maintain on site first aid facilities throughout the contract period to the approval of the Supervisor.

1.24 PARKING

- A. Use of designated areas of parking facilities used by Purchaser, Supervisor, and Supervision Consultant personnel is not permitted.
- B. Do not allow heavy vehicles or construction equipment in parking areas.
- C. Maintenance:
 - 1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, etc.
 - 2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.
- D. Removal and Repair:
 - 1. Remove temporary materials and construction at Substantial Completion.
 - 2. Remove underground work and compacted materials to depth of 600 mm; fill and grade site as specified.
 - 3. Repair existing and permanent facilities damaged by use, to original and specified condition respectively.

1.25 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris and rubbish. Maintain site in clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces and other closed or remote spaces, prior to enclosing spaces.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris and rubbish from site periodically, and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.26 PROJECT IDENTIFICATION

- A. Project Identification Sign:

1. Painted sign of construction, design and location as shown on the Drawings or as directed by the Supervisor.
2. Unless otherwise indicated on drawings or directed by the Supervisor, the content of the Project Identification Sign shall include the following:
 - a. Project number and title, logo and name of Purchaser as indicated on Contract Documents.
 - b. Names and titles of Beneficiary.
 - c. Names and titles of Supervisor and Consultants.
 - d. Name of Prime Contractor.
- B. Design sign and structure to withstand 120 km/hr wind velocity.
- C. Finishes, Painting: Adequate to withstand weathering, fading and chipping for duration of construction.
- D. Submit for Supervisor's approval, shop drawings showing content, layout, lettering, color, foundation, structure and all sizes and dimensions.
- E. Sign Materials:
 1. Structure and Framing: Wood or metal.
 2. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 19 mm thick.
 3. Rough Hardware: Galvanized.
 4. Paint and Primers: Exterior quality, two coats; sign background of color as selected by the Supervisor.
 5. Lettering: Exterior quality paint, colors as selected by the Supervisor.
- F. Installation:
 1. Install project identification sign within 7 days after Contract Implementation Commencement Date.
 2. Erect at designated location.
 3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
 4. Install sign surface plumb and level, with butt joints. Anchor securely.
 5. Paint exposed surfaces of sign, supports and framing.
- G. Maintenance: Maintain signs and supports clean, repair deterioration and damage.
- H. Removal: Remove signs, framing, supports and foundations at completion of Project and restore area.

1.27 FIELD OFFICES AND SHEDS

- A. Scope: This section specifies the temporary field offices, services and facilities required in the construction, completion and maintenance of works.
- B. Offices: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- C. Contractor's Site Office Schedule:

1. The Contractor shall make arrangement to provide and maintain throughout the period of construction in a convenient location within the site approved by the Supervisor, adequate office space for the Contractor's use and the use of his Subcontractors.
 2. The Contractor shall not allow any of his employees or those of his Subcontractors to maintain any temporary or permanent living quarters within the construction site.
- D. Storage Areas and Sheds: The Contractor shall provide on site adequate weatherproof sheds and storage facilities for the materials intended for the Works. The Contractor shall maintain and remove the same on completion of the Works.
- E. Preparation: Not Applicable
- F. Installation:
1. Install office spaces ready for occupancy 7 days after Contract Implementation Commencement Date.
 2. Employee Residential Occupancy: Not allowed on Purchaser's property.
- G. Removal: At completion of Work remove site offices, foundations, utility services and debris; restore areas and make good all disturbed surfaces.
- 1.28 VEHICULAR ACCESS
- Not Applicable
- 1.29 PLANT AND SMALL TOOLS
- A. The Contractor shall provide all constructional plant and small tools necessary for the proper execution of the Works.
- 1.30 SCAFFOLDING AND HOISTING
- A. The Contractor shall provide, erect and maintain proper and adequate scaffolding, staging, stairs, ladders, chutes, materials hoist, special rigging and the like required for the Work and shall comply with all requests, safety instructions, etc., issued by the Supervisor relating thereto. The Contractor shall provide all necessary guards, signals, safety devices, etc. required for safety of operations.
- B. Material hoists shall not be used for transporting personnel and only skilled personnel shall be used for the operation and maintenance of hoists. The construction, maintenance and operation of hoists shall conform to the applicable requirements of the applicable Codes in force.
- C. Location and means of operation of hoist shall be subject to the Supervisor's approval and shall in no way hinder the progress of the work and shall not relieve the Contractor from his duties and obligations under the Contract.
- D. Scaffolding shall be of tubular steel construction and designed in accordance with the requirements of BS 5973 and BS 5974.

- E. Hoists, chute, scaffolding and the like shall be so constructed as to prevent damage, staining or marring of the Permanent Work or to third party properties. No materials, rubbish or debris shall be permitted to drop free, but shall be removed by use of hoists or fully enclosed rubbish chutes.
- F. Provide suitable safety railings for stairs, ladders, ramps, etc.
- G. On completion of Work, the Contractor shall clear away and remove all scaffolding and hoisting.

1.31 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

- A. Remove temporary utilities, equipment, facilities and materials prior to Final Application for Payment inspection.
- B. Remove underground installations to minimum depth of 600 mm, unless otherwise directed by the Supervisor.
- C. Restore permanent facilities used during construction to specified condition.
- D. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SCOPE

- A. This section specifies the General Requirements for:
 - 1. Products.
 - 2. Product delivery requirements.
 - 3. Product storage and handling requirements.
 - 4. Product options.
 - 5. Product substitution procedures.
 - 6. Protection.
 - 7. Equipment electrical characteristics and components.
- B. The requirements of this section are augmented by specific clauses specifying quality throughout all sections of the Specification.

1.3 PERFORMANCE AND STANDARDS

- A. All products shall perform as specified and the handling, transportation and storage thereof shall be as specified and such that the ultimate performance of the products shall in no way be impaired.
- B. The quality of products and reference to Standards and Codes of Practice is covered in the "Administrative Requirements" section as well as in respective divisions.
- C. Where, in the course of the Project, materials, products, assemblies, equipment or techniques, are required which are not named, definitively described or implied in the Specification, they shall nonetheless conform to all relevant standards as regards Materials, Workmanship, quality, suitability and performance which are not less than implicit in this Specification and to the satisfaction of the Supervisor.
- D. The Contractor shall at all time use its best endeavors to produce materials and work of a consistent and high quality and standard, whether or not such standard is identifiable in the Specification.
- E. The Contractor shall abide by the Supervisor's interpretation of the Specification and shall comply with his decisions regarding the quality of Materials and Workmanship.

1.4 RELATED ITEMS

- A. General Requirements: Administrative regulatory requirements, submittal procedures, and execution requirements.

1.5 SUBMITTALS

- A. General Requirements: Submittal procedures.

1.6 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials removed from existing premises, unless otherwise stated.

1.7 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.8 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide off-site storage and protection when site does not permit.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.9 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards, equivalent standards, or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.10 PRODUCT SUBSTITUTION PROCEDURES

- A. The Supervisor will consider requests for Substitutions only within 15 days after Contract Implementation Commencement Date.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Purchaser.
 - 3. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 4. Will reimburse Purchaser and Supervisor for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 - 3. Supervisor will notify Contractor in writing of decision to accept or reject request.

1.11 PROTECTION

- A. The Contractor shall provide and maintain until practical completion all necessary protection to be installed work and equipment to prevent damage or deterioration.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SECTION INCLUDES

- A. Closeout procedures.
- B. Cleaning.
- C. Starting of systems.
- D. Demonstration and instructions.
- E. Testing, adjusting and balancing.
- F. Protecting installed construction.
- G. Project record documents.
- H. Operation and maintenance data.
- I. Manual for materials and finishes.
- J. Manual for equipment and systems.
- K. Instruction of Purchaser personnel.
- L. Spare parts and maintenance products.
- M. Product bonds.
- N. Maintenance service.
- O. Protection and making good.

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Supervisor's review.
- B. Provide submittals to the Supervisor required by authorities.

- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments and sum remaining due.
- D. Purchaser will occupy all or portions of the completed works as directed.

1.4 CLEANING

- A. General
 - 1. Execute cleaning during progress of the work and at completion of the work.
 - 2. If the Contractor fails to clean up during or at completion of work, the Purchaser may do so, and the cost thereof shall be charged to the Contractor.
 - 3. Conduct cleaning and disposal operations to comply with codes, ordinances, and anti-pollution laws.
 - 4. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
 - 5. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- B. Cleaning during Construction
 - 1. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulations of waste material, rubbish and windblown debris, resulting from construction operations.
 - 2. Provide on-site containers for the collection of waste materials, debris, etc.
 - 3. Remove waste materials, debris and rubbish from the site periodically and dispose off at legal disposal areas away from the site.
 - 4. Perform cleaning activities as to preserve the wellbeing of adjacent/neighboring properties and occupants and eliminate any cause of objections or protests.
- C. Dust Control
 - 1. Clean interior spaces to the start of finish painting and continue cleaning on and as-needed basis until painting is finished.
 - 2. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.
 - 3. Perform dust control activities as to preserve the wellbeing of adjacent/neighboring properties and occupants and eliminate any cause of objections or protests.
- D. Final Cleaning
 - 1. Employ skilled workmen or specialized firm for final cleaning.
 - 2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials from sight-exposed interior and exterior surfaces.
 - 3. Clean interior and exterior glass, and surfaces exposed to view; remove temporary labels, stains and foreign substances, wash and shine glazing, and polish transparent and glossy surfaces.
 - 4. Wax and polish finish floors.
 - 5. Clean all hardware with cleaning materials appropriate to surface and material being cleaned.
 - 6. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

7. Ventilating System: Replace filters of operating equipment; clean ducts, blowers and coils if units were operated without filters during construction.
8. Clean debris from roofs, gutters, downspouts, and drainage systems.
9. Clean site; sweep paved areas, rake clean landscaped surfaces.
10. Comply with all special cleaning instructions contained in the specifications.
11. Remove temporary services, construction equipment, tools and construction facilities, temporary structures, surplus materials, debris, waste, and rubbish from site.
12. Put site in neat, orderly condition, ready for use. Leave all spaces clean and free from debris.
13. Prior to final completion, conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

1.5 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems as applicable.
- B. Notify the Supervisor seven days prior to start-up of each item, unless otherwise specified in individual specification Sections.
- C. Verify each piece of equipment/system has been checked for proper lubrication, drive rotation, belt tension, control sequence and for conditions which may cause damage.
- D. Verify tests, meter readings and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report as specified in the "Submittal Procedures" section of the General Requirements, that equipment or system has been properly installed and is functioning correctly.

1.6 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Purchaser's personnel two weeks prior to date of substantial completion and/or final inspection.
- B. Demonstrate Project equipment and instruct in a classroom environment located at site and instructed by qualified applicable personnel or manufacturer's representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Purchaser's personnel in detail to explain all aspects of operation and maintenance.
- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time and at equipment location.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- G. Required instruction time for each item of equipment and system is specified in individual sections.

1.7 TESTING, ADJUSTING AND BALANCING

- A. Contractor will appoint, employ and pay for services of an independent firm approved by the Supervisor, to perform testing, adjusting and balancing.
- B. The independent firm will perform services stated in the Specifications
- C. Reports will be submitted by the independent firm to the Supervisor indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.8 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills and soffit of openings.
- D. Protect floors, stairs and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.9 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.

5. Reviewed Shop Drawings, Product Data and Samples.
6. Manufacturer's instruction for assembly, installation and adjusting.
- B. Ensure entries are complete and accurate enabling future reference by Purchaser.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Measured depths of foundations in relation to finish floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on original Contract drawings.
- G. Submit documents to the Supervisor with claim for final Application for Payment.

1.10 OPERATION AND MAINTENANCE DATA

- A. Format:
 1. Prepare instructions and data by personnel experienced in maintenance and operation of described projects.
 2. Prepare data in the form of an instructional manual.
 3. Submit data bound in A4 text pages.
 4. Binders: Commercial quality binders with durable plastic covers. When multiple binders are used, correlate data into related consistent groupings.
 5. Cover: Identify each binder with printed title "Operation and Maintenance Instructions", title of project and subject matter of binder when multiple binders are required.
 6. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
 7. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 8. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - a. Part 1: Directory, listing names, addresses and telephone numbers of Supervisor, Contractor, Subcontractors and major equipment suppliers.
 - b. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify

names, addresses and telephone numbers of Subcontractors and suppliers. Identify the following:

- 1) Significant design criteria.
- 2) List of equipment.
- 3) Parts list for each component.
- 4) Operating instructions.
- 5) Maintenance instructions for equipment and systems.
- 6) Maintenance instructions for special finishes including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

c. Part 3: Project documents and certificates, including the following:

- 1) Shop drawings and product data.
- 2) Air and water balance reports.
- 3) Certificates.
- 4) Originals of bonds.

B. Contents, Each Volume:

1. Table of Contents: Provide title of Project; names, addresses and telephone numbers of Supervisor and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
2. For each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
3. Product Data: Mark each sheet to clearly identify specific products and components parts, and data applicable to installation. Delete inapplicable information.
4. Drawings: Supplement product data to illustrate relations of components parts of equipment and systems, to show control and flow diagrams.
5. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in the "Quality Requirements" section of the General Requirements.
6. Bonds: Bind in original of each.

1.11 MANUAL FOR MATERIALS AND FINISHES

- A. Submit four copies of preliminary draft or proposed formats and outlines of contents before start of Work. The Supervisor will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Purchaser, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy will be reviewed and returned after final inspection, with the Supervisor's comments. Revise content of document sets as required prior to final submission.
- D. Submit four sets of revised final volumes within 10 days after final inspection.
- E. Products, Applied Materials and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition and details of installation. Include recommendations for inspections, maintenance and repair.
- H. Additional Requirements: As specified in individual product specification sections.
- I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.12 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit four copies of proposed formats and outlines of contents before start of Work. The Supervisor will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Purchaser, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy will be reviewed and returned after final inspection, with the Supervisor's comments. Revise content of document sets as required prior to final submission.
- D. Submit four sets of revised final volumes in final form within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.
- G. Include color coded wiring diagrams as installed.
- H. 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 special operating instructions.
- I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- J. Include servicing and lubrication schedule, and list of lubricants required.
- K. Include manufacturer's printed operation and maintenance instructions.
- L. Include sequence of operation by controls manufacturer.

- M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- N. Include control diagrams by controls manufacturer as installed.
- O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- R. Include test and balancing reports as specified in the "Quality Requirements" section of the General Requirements.
- S. Additional Requirements: As specified in individual product specification sections.
- T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.13 INSTRUCTION OF PURCHASER PERSONNEL

- A. Before final inspection, instruct Purchaser's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instructions.

1.14 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed by Purchaser; obtain receipt prior to final payment.

1.15 PRODUCT BONDS

- A. Obtain bonds executed in duplicate by responsible subcontractors, suppliers and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable bonds from subcontractors, suppliers, and manufacturers.

- C. Verify documents are in proper form, contain full information and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Purchaser's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten 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 ten days after acceptance, listing date of acceptance as beginning of bond period.

1.16 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust and lubricate as required.
- C. Include systematic examination, adjustment and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of the Purchaser.

1.17 PROTECTION AND MAKING GOOD

- A. The Contractor shall protect all completed Works from damage until the completion and handing over of the Works to the approval of the Supervisor.
- B. Should any Works be damaged before handing over of Works, the Contractor shall at his expense make good or replace as required, to the satisfaction of the Supervisor.
- C. Warranty (Defects Liability) obligations shall be as set in the Contract Documents unless longer periods of coverage are specified in these specifications.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris, and designated trees, shrubs and other plant life.
 - 2. Removing designated paving, curbs and the like.
 - 3. Removing abandoned utilities.
 - 4. Excavating topsoil and compaction of surfaces.
- B. Related Sections:
 - 1. Section 02315 - Excavation.
 - 2. Section 02320 - Backfill.

1.2 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the drawings and to Supervisor's satisfaction.
- B. Conform to applicable code for environmental requirements, disposal of debris, etc.
- C. Obtain all necessary permits required in connection with the works.
- D. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Herbicide: Type approved by authority having jurisdiction.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify existing plant life designated to remain is tagged or identified.
- C. Identify salvage areas for placing removed materials designated to remain.

3.2 PREPARATION

- A. Notify local utility information service three working days before performing Work. Request underground utilities (if any) to be located within construction areas.

3.3 PROTECTION

- A. Locate, identify and protect utilities indicated to remain from damage.
- B. Protect trees, plant growth and features designated to remain as final landscaping.
- C. Protect bench marks, survey control points and existing structures designated to remain from damage or displacement.

3.4 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs. Remove stumps, main root ball, surface rock and the like.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

- A. Remove debris, rock and extracted plant life from site.
- B. Remove paving, curbs and the like as indicated on Drawings. Neatly saw cut edges at right angle to surface.
- C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- E. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from entire site without mixing with foreign materials for use in finish grading down to natural ground level. Do not excavate wet topsoil.
- B. Compact surfaces to required density in areas that do not need further excavation; perform compaction in accordance with Section 02320.
- C. Remove topsoil from site and cart away to approved dumping areas.

END OF SECTION

SECTION 02311

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sub-grade preparation comprising the following:
 - 1. Excavating topsoil.
 - 2. Excavating subsoil.
 - 3. Cutting, grading, filling, rough contouring, and compacting site for play areas, roadwork, site structures, foundations and the like.
- B. Related Sections:
 - 1. Section 02320 - Backfill.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (5,600 kN.m/m³).
 - 3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN.m/m³).
 - 5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - 7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
 - 8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 4.5 kg sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.

- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.
- B. Perform Work in accordance with the drawings and to the satisfaction of the Supervisor.
- C. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fill: Conforming to the standards of the Municipality or Ministry of Public Works; excavated and reused material or imported borrow materials from approved pits outside the site; selected, graded and free of clay, silt, roots, rocks, debris, large weeds and foreign matter.

2.2 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services, Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil and Topsoil Materials: Perform in accordance with ASTM D698, ASTM D1557 and/or AASHTO T180.
- C. When tests indicate materials do not meet specified requirements, change material and retest.
- D. Furnish materials of each type from approved same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify site conditions under provisions of relevant authorities' standard.
- C. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

- A. Inform utility relevant authority not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours and datum.
- C. Notify utility company to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

- A. Excavate topsoil from entire site without mixing with foreign materials for use in finish grading down to natural ground level.
- B. Do not excavate wet topsoil.
- C. Remove topsoil from site and cart away to approved dumping areas.

3.4 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.
- B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.
- C. When excavating through roots, perform Work by hand and cut roots with sharp axe.
- D. Remove subsoil from site and cart away to approved dumping areas.
- E. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.
- F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

- A. Fill areas to contours and elevations with unfrozen materials.
- B. Place fill material in continuous layers and compact to achieve specified density; perform compaction in accordance with Section 02320.
- C. Maintain optimum moisture content of fill materials to attain required compaction density.
- D. Slope grade away from building minimum 1.5%, unless noted otherwise.

- E. Make grade changes gradual. Blend slope into level areas.
- F. Repair or replace items indicated to remain damaged by excavation or filling.
- G. Install Work in accordance with the drawings and to the satisfaction of the Supervisor.

3.6 TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Top Surface of Subgrade: Plus or minus 30 mm from required elevation.

3.7 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and inspection services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698 and/or AASHTO T180.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.8 SCHEDULES

- A. Sub-Grade Preparation: Compact uniformly to minimum 95 % of maximum density.

END OF SECTION

SECTION 02315

EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil densification.
 - 2. Excavating for foundations, paving, roads and parking areas, slabs-on-grade, garden spaces, site structures, and for landscaping.
- B. Related Sections:
 - 1. Section 02320 - Backfill.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (5,600 kN.m/m³).
 - 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- B. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

- A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.
- B. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the drawings and to the satisfaction of the Supervisor.
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Prepare excavation protection plan under direct supervision of Professional Supervisor experienced in design of this Work and approved by the Supervisor.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

- A. Request underground utilities to be located and marked within and surrounding construction areas not less than five working days before performing Work.
- B. Identify required lines, levels, contours and datum.
- C. Remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, etc. from excavating equipment and vehicular traffic.

3.3 SOIL DENSIFICATION - VIBRO-COMPACTION (IF REQUIRED)

- A. Vibro-compact substrates below footing bearing surfaces for footings as indicated on Drawings before excavating site.
- B. Densify existing subsoils with relative density rating of compact to dense to attain relative density rating of very dense.
- C. Densification Equipment:
 - 1. Depth Vibrator: Poker type with follower tubes with visible marking every 300 mm to enable insertion depth measurement.
 - 2. Motion: radial in horizontal plane.
 - 3. Data Acquisition System: Record amps or pressure of the vibrator motor over time and depth.
- D. Perform densification in presence of an approved Geotechnical Supervisor directly under each footing with vibrator inserted in grid pattern at maximum 1800 mm on center.
 - 1. Arrange compaction grid for each footing for maximum number of insertion points and with outermost insertion points within the bearing area of footings.
 - 2. Adjust compaction grid arrangement and spacing as directed by the approved Geotechnical Supervisor to achieve required densification.

- E. Insert vibrator to maximum specified depth. Densify soils for 30 seconds or other time as directed by the approved Geotechnical Supervisor. Withdraw vibrator every 300 mm increments and repeat densification at each increment.
 - 1. When subsurface obstruction prevents vibrator insertion to specified depth, request instructions from the approved Geotechnical Supervisor to compensate for obstruction.
- F. Tolerances:
 - 1. Maximum Deviation from Center of Completed Compaction: 200 mm from indicated position.
 - 2. Maximum Deviation from Vertical: 4 degrees during vibrator insertion.

3.4 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil to accommodate foundations, slabs-on-grade, garden spaces, drainage, paving and site structures and construction operations.
- C. Coordinate excavation requirements with Drawings and geotechnical report for working elevation to install foundations.
- D. Excavate to working elevations.
- E. Compact disturbed soil in accordance with Section 02320.
- F. Compact surfaces to required density; perform compaction in accordance with Section 02320.
- G. Slope banks with machine to angle of repose or less until shored.
- H. Do not interfere with 45 degree bearing splay of foundations.
- I. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- J. Trim excavation. Remove loose matter.
- K. Remove lumped subsoil, boulders and rocks up to 0.25 m³ measured by volume, and remove larger solid mineral material with volume in excess of 0.25 m³ material as follow:
 - 1. Excavate and remove rock by an approved mechanical method. Drill holes and use wedges and mechanical disintegration compound to fracture rock.
 - 2. Cut away rock at bottom of excavation to form level bearing.
 - 3. Remove shaled layers to provide sound and unshattered base for foundations.
 - 4. In utility trenches, excavate to 150 mm below invert elevation of pipe and 600 mm wider than pipe diameter.
 - 5. Remove excavated materials from site to approved dumps.
- L. Notify the Supervisor of unexpected subsurface conditions.
- M. Correct areas over excavated with lean concrete, cyclopean concrete and/or as directed by the Supervisor at no additional cost.

- N. Remove excess and unsuitable materials from site to approved dumps outside the site.
- O. Remove all excavated material (soils, rock, etc.) from site to approved dumps outside the site.
- P. Repair or replace items indicated to remain damaged by excavation.

3.5 FIELD QUALITY CONTROL

- A. Request visual inspection of bearing surfaces by an approved inspection agency before installing subsequent work.

3.6 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earth operations.

END OF SECTION

SECTION 02320

BACKFILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backfilling perimeter to subgrade elevations.
 - 2. Backfilling area to subgrade elevations.
 - 3. Fill under perimeter, paving, gardens paces and structures.
 - 4. Fill for over-excavation.
- B. Related Sections:
 - 1. Section 02923 - Landscape Grading: Filling of topsoil to finish grade elevation.
 - 2. Section 03300 - Cast-in-Place Concrete: Concrete materials.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (5,600 kN.m/m³).
 - 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN.m/m³).
 - 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 7. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- C. Samples: Submit, in air-tight containers, 4.5 kg sample of each type of fill to testing laboratory.
- D. Materials Source: Submit name of imported fill materials suppliers.

- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Structural Fill: Conforming to the standards of the Municipality or Ministry of Public Works; excavated and reused material or imported borrow materials from approved pits outside the site; selected, graded and free of clay, silt, roots, rocks, debris, large weeds and foreign matter.
- B. Concrete: Lean concrete, cyclopean concrete or structural concrete as specified in Section 03300 with class and compressive strength as directed or as indicated on the drawings.
- C. Agricultural Top Soil for Landscaping: Fertile capable of sustaining vigorous plant growth.

2.2 ACCESSORIES

- A. Filter Fabric (Geotextile): Non-woven; non-biodegradable; made from polyolefin, polyester, or polyamide; 200 g/m²; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength (ASTM D 4632) 490 N.
 - 2. Tear Strength (ASTM D 4533) 178 N.
 - 3. Puncture Resistance (ASTM D 4833) 222 N.
 - 4. Water Flow Rate (ASTM D 4491) 100 l/s/m².
 - 5. Apparent Opening Size (ASTM D 4751) 0.3 mm.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.
- D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

- C. Scarify subgrade surface to depth indicated on drawings.
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric over fill prior to placing next lift of fill.
- D. Place fill material in equal continuous layers not exceeding 200 mm thick and compact.
- E. Employ placement method that does not disturb or damage other work.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported foundations.
- H. Backfill simultaneously on each side of unsupported foundations until supports are in place.
- I. Slope grade away from building minimum 50 mm in 3 m, unless noted otherwise.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Remove surplus backfill materials from site.
- L. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

- A. General: Finished excavation and fill for Permanent Works shall be to the lines, levels, and profiles shown on the Contract Drawings with the tolerances specified herein.
- B. Tolerances for Fill (except fill for road embankment):
 - 1. General Fill $\pm 100\text{mm}$.
 - 2. Fill to be covered with concrete in foundations or linings, or drainage or filter layers of artificial or selected natural materials, or any layer of other material: $+0\text{mm}$, -75mm .
 - 3. The surface tolerance requirements:
 - a. Tolerances along the top edge of any slope steeper than 1 vertical to 30 horizontal shall not vary by more than 10% of the specified slope inclination at any point on the slope.
 - b. Slopes steeper than 1 vertical to 30 horizontal shall not vary by more than 10% of the specified slope inclination at any point on the slope.

- C. Tolerances for Road Excavation and Road Embankment Fill:
1. No point on excavation slopes shall vary from the plane of the design slope by more than 100mm measured at right angles to the slope except for excavation in rock where no point shall vary by more than 500mm.
 2. In no case shall any portion of the excavation slope encroach on the roadbed.
 3. No point on the completed embankment slope within 1.0 meter below shoulder grade shall vary from the plane of the design slope by more than 100 mm measured at right angles to the slope. Slopes more than 1.0 meter below shoulder grade shall not vary from than 200 mm measured at right angles to the slope.
 4. No point on the completed median and side slopes which are on 1 vertical to 6 horizontal or flatter slopes, whether in excavation or embankment, shall vary from the plane of the design slope by more than 60 mm measured at right angles to the slope. Flow lines within medians shall be graded to drain and shall not vary more than 30 mm from the required grade line.
- D. Section 01400 - Quality Requirements: Tolerances.

3.5 SETTLEMENT PERIOD

- A. Where a settlement period is shown on the Contract Drawings or otherwise specified, the permanent fill shall be constructed to full height and to the order limits shown or specified and shall remain in place for the required settlement period before commencing construction of foundations or placing other layers of materials on the fill surface.
- B. Where a settlement period for a surcharged permanent fill is shown on the Contract Drawings or otherwise specified, the surcharge fill shall be constructed to the height and to the limits shown or specified. The surcharge fill shall remain in place until the end of the settlement period shown or specified.

3.6 DUST CONTROL

- A. The contractor shall use all means necessary to control dust on and near the Work and on and near all borrow areas.
- B. Thoroughly moisten all surfaces as required to prevent dust being a nuisance or a hazard to the public and affect the performance of other work on the site.

3.7 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and inspection services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698, and/or AASHTO T180.
- C. Perform in place compaction tests in accordance with the following:
1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: At the discretion of the Supervisor.

F. Proof roll compacted fill surfaces under slabs-on-grade, and paving.

3.8 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.9 SCHEDULE

A. Compact uniformly to minimum 95 % of maximum density.

END OF SECTION

SECTION 02535

SYNTHETIC TURF

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of 3cm Synthetic Turf for recreational purposes. The work shall be comprised of the full subsurface and surface preparation including grading and installation of new synthetic turf surface as specified herein, as well as the proper fixing of the same and other related work to finish the new installations.
2. The Turf system shall allow for both vertical and horizontal drainage.
3. Installation of 3cm Synthetic Turf as a cover to collective and individual benches as shown on drawings.
4. The synthetic turf surfacing system shall be GREEN and suitable for children activities of recreational purposes.

B. Related Sections:

1. Section 02311 – Rough Grading.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

A. In addition to References cited below in the relevant sections:

B. American Society for Testing & Materials (ASTM)

1. ASTM F1551 Standard Test Methods for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials.
2. ASTM D5848 Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings.
3. ASTM D5823 Standard Test method for Tuft height of Pile Floor Coverings.
4. ASTM D789 Standard test Method for Determination of Relative Viscosity and Moisture Content of Polyamide.
5. ASTM D1577 Standard Test Methods for Linear Density of Textile Fibres.
6. ASTM D1335 Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
7. ASTM D5034 Standard Test method for Breaking Strength of Textile Fabrics.
8. ASTM D3218 Standard Test method for Specification of Polyolefin Monofilaments.
9. ASTM F355 Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.

- B. Submit shop drawings for review and approval including synthetic turf material, inlaid lines detail (as required) and dimensioning, edging details, insert details, seam details, seam layout, gluing patterns and edge anchoring details.
- C. Product Data Submittal: Submit manufacturer's specifications and technical data for all of the proposed materials pertaining to the synthetic turf surfacing. The synthetic turf product manufacturer shall provide evidence of a minimum of 5 monofilament installations in the past five years with each in excess of \$5,000 which comply with these specifications.
- D. Sample: Submit 2x1 m sample of the turf for approval.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Construction Submittals:
 - 1. Submit a written sequencing plan to the Supervisor for approval prior to commencing with any activity. The plan shall also include:
 - 2. Sequencing of all activities, Proposed equipment to be utilized, Surface water diversion and control,
 - 3. Proposed protection methods for stockpiled materials, Soil drying procedures, and
 - 4. Any other information pertinent to the manner in which the work will be performed.
- G. Submit the following information for the field base to the Supervisor for approval prior to commencing with the field construction:
 - 1. Equipment and procedures to be utilized for the installation of the entire field, including the required laser grading equipment.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Procedures for submittals.
- C. Submit turf warranty of not less than 5 years.
- D. Submit Turf maintenance manual. Provide descriptions of any equipment recommended for maintenance and repair, citing specific vendors for each unit. Provide a separate page stating approved activity usage for the turf and activities not recommended relative to warranty. Include maintenance recommendations including recommended coverings for special events, small repair procedures, minor seam repair, discussion of precautions to be practiced, general maintenance, and uses to avoid to protect turf surface and to maintain installation's warranty.

1.5 QUALITY ASSURANCE

- A. Furnish turf from single source throughout the Work.
- B. Perform Work in accordance with the drawings and to the approval of the Supervisor.

PART 2 PRODUCTS / MATERIALS

2.1 SYNTHETIC TURF

- A. The synthetic turf and all other components should provide for a tight, secure and hazard free recreational area. The artificial turf surfacing system shall be designed and constructed to maximize dimensional stability, to resist damage through normal wear and tear from its designated use, and to minimize degradation through exposure to the local environment.
- B. The materials as hereinafter specified, should be resistant to insect infestation, rot, fungus and mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow through-drainage allowing free movement of surface run-off through turf where such water may flow to the sub-base and into the garden drainage system.
- C. The finished garden surface shall appear as mowed grass with no irregularities and shall afford an excellent safe recreational area. The finished surface shall resist abrasion and cutting from normal use. The system shall be ideal for recreational use.
- D. The artificial turf surfacing system shall be easily and quickly cleaned by washing and sweeping as necessary and shall not be damaged by cleaning methods.
- E. Monofilament fiber to be a straight, non-fibrillating, single extrusion fiber. The fiber shall consist of polyethylene extruded monofilaments. The fiber geometry shall feature a rib, spine, diamond cross cut, or concave and ridged construction on each fiber.
- F. Synthetic turf shall be of 100 to 250 cm in width and of sufficient length to permit full cross installation with no cross or head seams.
- G. Glue for gluing seams shall be as recommended by the synthetic turf manufacturer.
- H. Resilient infill shall consist of a green/black color synthetic granule or cryogenic rubber specifically designed and manufactured for athletic use that shall exhibit low thermal absorption and low thermal capacity. It shall be heavy metals free, Polynuclear Aromatic Hydrocarbons (PAH) free, aromatic amines free, black carbon free, sulfur free and odorless. The infill material shall be placed as to avoid burying the fiber. The infill shall not vary from a true plane by more than 6mm beneath a 30m straightedge at any position and in any direction.

2.2 DYNAMIC CUSHIONING REQUIREMENTS OF THE SYNTHETIC TURF SYSTEM

- A. The dynamic cushioning of the turf shall not exceed a maximum value of 130 G's at 70° F. per ASTM 1936-98, F355, procedure A at any location upon installation.

2.3 PERMEABILITY REQUIREMENTS OF THE SYNTHETIC TURF SYSTEM

- A. The turf system shall drain vertically- at any location- a minimum of 120mm of precipitation per hour without visible surface ponding.

2.4 ADHESIVE MATERIAL PROPERTIES

- A. Adhesive material to adhere the synthetic turf shall be polyurethane 34 adhesive and designed specifically for synthetic turf application. Adhesive material shall be resistant to moisture, bacterial and fungus attacks, and resistant to ultraviolet rays. Turf shall be installed in accordance with recommendations and standards to produce a complete installation and to satisfy manufacturer's warranty requirements.

2.5 SYNTHETIC TURF PILE SURFACE

- A. The pile surface shall provide good traction in all types of weather with the use of conventional shoes.

2.6 SYNTHETIC TURF FABRIC SURFACE

- A. The fabric surface shall be constructed and installed in minimum 100-250mm widths with no longitudinal or transverse seams within a finished roll assembly. Rolls that do not lay evenly and with full dimension width will be rejected. No fitted pieces will be allowed to true alignment. The color shall be uniform with no visible deviations in shade permitted. Rolls which do not meet this requirement will be rejected.

2.7 SYNTHETIC TURF SYSTEM MATERIAL COMPONENTS

- A. Pile fibers for the field shall resemble freshly-grown green natural grass in appearance, texture and colors.
- B. Pile surface shall be nominally uniform in length.
- C. All turf seams shall be constructed of reinforced backing material and glued with materials recommended by the synthetic turf manufacturer.

2.8 SYNTHETIC TURF PERFORATIONS

- A. All synthetic turf with tufted fibers and a fully coated backing must include perforations in the backing for vertical drainage.
- B. If a fully coated backing is utilized, perforations must be included in the turf backing with a minimum of 5mm diameter clear opening and shall be spaced a maximum of 100mm uniformly on-center. The turf shall be perforated with a minimum of 95% integrity over entire surface. Holes must be full diameter, completely through the underside of the turf backing with no material residue or fragmented fibers remaining.
- C. If a permeable backing is utilized perforations are not required. Certified independent test results indicating a minimum drainage rate of 1,000 mm per hour must be provided.
- D. The turf perforations shall be inspected prior to shipment, upon delivery onsite, or during on-site perforating operations as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify grading and levelling and compaction compliance to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.
- C. The final finished grade of the garden spaces will be based upon the drawings and final grading plans. Finished grade elevations are based upon a general thickness of the synthetic turf at a 3cm height at the top of the grass fibers.

3.2 PREPARATION

- A. Hand trim surfaces to required elevations. Correct over excavation with natural soil as directed by the Supervisor.
- B. Remove large stones or other hard matter which could damage the turf or cause injuries or impede consistent backfilling or compaction.
- C. Compact natural soil surface to 95% of maximum density.
- D. Where the turf is to be installed over collective benches or individual ones, the contractor shall verify that the surfaces and finishes are ready to receive the turf without subjecting the turf to any damage and the users to any potential harm.

3.3 STOCKPILING

- A. Packing and Shipping: Deliver products in original unopened packaging with legible manufacturer's identification.
- B. Stockpile materials on site at locations indicated or designated by the Supervisor.
- C. Stockpile in sufficient quantities to meet Project schedule and requirements.
- D. Storage and Protection: Comply with manufacturer's recommendations. Store in dry place out of direct sunlight. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Protect from damage by the elements and construction procedures.
- F. Bulk Materials: Deliver materials in clean, washed and covered trucks to eliminate contamination during transportation. On site stockpiling location to be coordinated with Supervisor. Stockpile only in areas free of debris and away from drainage routes. Cover with plastic or geotextile if material is to be stockpiled more than 24 hours.

3.4 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.5 EQUIPMENT MOVEMENT

- A. No trucks or equipment will be allowed to drive over the base course

3.6 FINAL GRADE

- A. Verify finished grade elevation and depth of natural soil utilizing laser operated survey instruments.
- B. Final grading of the natural soil leveling course shall be accomplished utilizing dual plane or conical laser operated equipment capable of the following tolerances:
 - 1. Finished grade elevations of the areas shall be within plus 0.00 or minus 2mm with no variations of more than 6.5 mm in 7.5 m of the designed elevations.
 - 2. Provide certified record drawings of final finished grade elevations to Owner's representative upon completion of and **prior** to the installation of the infill synthetic turf.
- C. Keep up to date red-lined record documents, as the job progresses and make available to Supervisor for inspection at all times. Revise drawings as required to indicate field changes made during installation. Final record documents shall be provided to the Owner upon completion of the project and in AutoCAD format.
- D. The surface areas of benches shall be free from any dents and shall be completely smooth and safe for the intended use.

3.7 SYNTHETIC TURF INSTALLATION

- A. Perform all work in strict accordance to the drawings, shop drawings and manufacturer's specifications and instructions.
- B. Verification: The Contractor is responsible for inspecting, verifying, and accepting all installed work of this section.
- C. Environmental Conditions: **Do not work when:** Ambient air temperature is below 10 degrees C; Material temperatures are below 10 degrees C; Conditions exist, or are pending, that will be unsuitable to the installation of the system.
- D. Commencement of the base work and synthetic grass installation shall only begin after total acceptance of the underlying base. Acceptance of the underlying base shall not be considered as grounds for invalidating any of the conditions of warranty on the surface system.
- E. Lay grass in long lengths. No lateral join lines in the main field of play will be permitted. Fixing method shall be by all-weather adhesives as specified above, with sufficient adhesive to ensure that the surface is permanently fixed in position. Joins shall be butt joined with continuous adhesive on both sides of the join.
- F. Bonding of Material Surfaces: The bonding or fastening of all system material components shall provide a permanent, tight, secure and hazard-free, playing surface.
- G. Turf installed to cover benches shall be laid in uniform directions.

3.8 TURF FIXING AND NAILING

- A. The Turf shall be securely fastened to the perimeters of the recreational areas using methods approved by the Supervisor. It is the sole responsibility of the Contractor to ensure secure and safe fixation of the turf around the perimeter of each area.
- B. Start fastening the fabric to the fastening strip not before 75% completion of the placement of the infill material.
- C. The fabric shall be attached to the perimeter edge detail in accordance with shop drawings provided by the Contractor and approved by the Supervisor.
- D. All fasteners that are to be employed in fastening the edges of the turf must ensure permanent adhesion and ultimate safety.
- E. Turf installed over benches shall be firmly bonded to the subsurface using suitable material and adhesive to prevent deterioration, sliding or damage under use. Fixing shall be permanent.

3.9 INSPECTION OF SYNTHETIC TURF MATERIALS

- A. Prior to installation, and immediately upon delivery of synthetic turf system materials to the project site, the Contractor shall inspect material as follows:
- B. For damaged or defective items;
 - 1. Measure turf pile height and thickness of each roll;
 - 2. Reject damaged materials and all materials out of tolerance with this specification.
 - 3. After installation, inspect project area for acceptable seaming, adhesive bonding, and uniformity of color of turf, field lines and markings, insert installations, edge details.
 - 4. Remove and/or repair deficient workmanship prior to requesting the Supervisor's inspection pursuant to completion and acceptance of the work.

3.10 OWNER'S TEST OF SYNTHETIC TURF MATERIALS

- A. Owner may have samples of the turf submitted and tested for verification of conformance to specifications. Turf system acceptance is subject to the results of these tests.
- B. Any material so tested and found not conforming to specification will be rejected and replaced with material conforming to the specification at Contractor's expense. Resubmittal will be required.

3.11 SYNTHETIC TURF IN-FILL INSTALLATION

- A. The in-fill material shall be applied in a dry condition and when the synthetic turf is dry.
- B. The in-fill material shall be applied in uniform layers. After application of each layer the synthetic turf shall be dragged to distribute the in-fill material uniformly to the backing.

3.12 SYNTHETIC TURF TESTING AND QUALITY CONTROL

- A. Submit to the Supervisor results certified by an independent testing laboratory experienced in synthetic turf testing for the following tests performed on the synthetic field surfacing system:

| | |
|----------------------------|------------|
| Pile Yarn Type | |
| Yarn Denier | ASTMD1577 |
| Yarn Breaking Strength | ASTM D2256 |
| Yarn Melting Point | ASTM D789 |
| Pile Height | ASTM D418 |
| Pile Weight | ASTM D418 |
| Total Weight | ASTM D418 |
| Backing Perforations | |
| Tuft Bind (without infill) | ASTM D1335 |
| Grab Tear Strength | ASTMD1682 |
| Impact Attenuation | ASTM D355 |
| Pill Burn Test | ASTM D2859 |

3.13 FIELD CLEANING

- A. Remove all excess materials of all types, equipment, debris, etc., from the site immediately after completion of the work.
- B. Remove all stains and other blemishes from all finished surfaces.
- C. Leave work in clean, new appearing condition, ready for use by Owner.

3.14 PROTECTION

- A. Adequate protection of materials and work from damage will be the responsibility of the installer during installation and until acceptance of their work. Contractor will be responsible for protection after the acceptance of the work until final acceptance of all contract work by the Owner.
- B. All material damaged prior to acceptance by the Owner shall be replaced at no cost to the Owner.

3.15 EXTRAMATERIALS

Not Applicable.

3.16 INSTALLATION

- A. Install Work in accordance with the drawings, to the manufacturer's instructions and to the satisfaction of the Supervisor.
- B. Refer to Section 02320 for compaction requirements.

3.17 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and inspection services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

3.18 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.

3.19 WARRANTY

- A. The Contractor warrants to Owner, subject to the limitations and conditions set forth below, that its synthetic turf system consisting of synthetic turf- as described in this specification- and the adhesives used in the installation are free from defects in material and workman-ship and shall, for a period of a minimum of 5 years from the date of acceptance by the Owner. The Contractor warrants to the Owner that its synthetic turf materials shall not fade, fail, shrink, wrinkle, or reflect excessive wear.
- B. The Contractor shall, at its sole expense and cost, replace such areas of the synthetic turf system not performing to these standards for the life of the warranty.
- C. The Contractor warrants to the Owner that the permeable synthetic system shall drain vertically a mini- mum of 120 mm precipitation per hour without visible surface ponding. Contractor shall replace with new materials, at its sole expense, any damage to the synthetic turf system which extends more than one meter beyond the location of foreign combustibles which may ignite and fire-damage the synthetic turf system.
- D. In the event the Contractor does not respond to the Owner's written notice within 10 days of receipt of notice or does not submit, schedule and execute corrective work within 30 days, the Owner has the option of having the work performed at the expense of the Contractor.

3.20 SCHEDULE

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 02721

AGGREGATE SUB-BASE AND BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes aggregate sub-base and aggregate base courses.
- B. Related Sections:
 - 1. Section 02230 - Site Clearing.
 - 2. Section 02320 - Backfill.
 - 3. Section 02535 – Synthetic Turf
 - 4. Section 02740 - Flexible Pavement: Binder and finish asphalt courses.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
 - 2. AASHTO T193 - The California Bearing Ratio.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (5,600 kN.m/m³).
 - 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN.m/m³).
 - 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight bags, 4.5 kg of each aggregate type to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 MATERIALS

2.2 COARSE AGGREGATE MATERIALS

- A. Conforming to standards of the Ministry of Public Works; crushed or uncrushed gravel or crushed stone; structurally and chemically stable; free of shale, clay, friable material, debris, impurities, organic matter, or dust; graded in accordance with ASTM C136; within the following limits:

| 1. <u>Sieve Size</u> | <u>Percent Passing</u> |
|----------------------|------------------------|
| 50 mm | 100 |
| 25 mm | 95 |
| 19 mm | 95 to 100 |
| 16 mm | 75 to 100 |
| 9 mm | 55 to 85 |
| 4.75 mm | 35 to 60 |
| 1.18 mm | 15 to 35 |
| 425 micro m | 10 to 25 |
| 75 micro m | 5 to 10 |

2.3 FINE AGGREGATE MATERIALS

- A. Conforming to standards of the Ministry of Public Works; clean sharp, coarse natural sand or sand obtained by crushing suitable gravel or stone stable in composition (sand from beach, dredging and other sea sources is not allowed); washed; free of organic matter, chemical impurities, silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM C136; within the following limits:

| 1. <u>Sieve Size</u> | <u>Percent Passing</u> |
|----------------------|------------------------|
| 4.75 mm | 100 |
| 1.40 mm | 10 to 100 |
| 300 micro m | 5 to 90 |
| 150 micro m | 4 to 30 |
| 75 micro m | 0 |

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Sub-base and base materials shall have a 4-day soaked CBR of not less than 30% and 80% respectively when compacted at 100% modified Proctor (AASHTO T180-D) and tested in accordance with AASHTO T193.
- C. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, AASHTO T180, ASTM D4318, or ASTM C136.
- D. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, AASHTO T180, ASTM D4318, or ASTM C136.
- E. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify substrate is dry and has been inspected and gradients and elevations are correct

3.2 PREPARATION

- A. Correct irregularities in substrate by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to required total compacted thickness.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine to coarse aggregates as appropriate to assist compaction.
- D. Maintain optimum moisture content of fill to attain required compaction density.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Flat Surface: 6 mm measured with 3 m straight edge.
- C. Maximum Variation from Thickness: 4 mm.
- D. Maximum Variation from Elevation: 6 mm.

3.5 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and inspection services, and section 01700 - Execution Requirements: Testing, adjusting and balancing.
- B. Compaction testing will be performed in accordance with ASTM D1556, D1557, D698, D2167, D2922 or D3017, or AASHTO T180.

3.6 SCHEDULES

- A. Under Asphalt and Concrete Pavement: Compact placed aggregate materials uniformly to achieve minimum 95 % of maximum density.

END OF SECTION

SECTION 02783

PRECAST CONCRETE PAVERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete paver units.
 - 2. Concrete curbs.
 - 3. Detectable warning pavers.
 - 4. Sand bed and sand joint.
 - 5. Cementitious bed and mortar joints.
 - 6. Edging.
- B. Related Sections:
 - 1. Section 02320 - Backfill: Compacted fill for pavers.
 - 2. Section 02923 - Landscape Grading: Preparation of subsoil for pavers, and/or Topsoil fill for pavers.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 3. ASTM C150 - Standard Specification for Portland Cement.
 - 4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
 - 5. ASTM C936 - Standard Specification for Solid Concrete Interlocking Paving Units.

1.3 SYSTEM DESCRIPTION

- A. Paving and Setting Bed: To accommodate pedestrian traffic and to support gross vehicular loads.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate on shop drawings layout of pavers, special design layout, dimensions of paved areas, control joints, expansion joints, elevations and affected adjacent construction.
- C. Product Data: Submit characteristics of paver/curb dimensions and special shapes.
- D. Samples: Submit two samples of each type and size of pavers and curbs, illustrating style, size, color range and surface texture of units being provided.
- E. Manufacturer's Installation Instructions: Submit substrate requirements and installation methods.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.
- B. Maintain cementitious materials and substrate surface to minimum of 10 °C prior to, during, and 48 hours after completion of Work.
- C. At end of working day or during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 PAVER MATERIALS

- A. Pavers Units: Unless otherwise indicated on drawings, precast concrete of 25 MPa at 28 day compressive strength; air entrained of 5 to 7 %; moisture content of 7 %; type, size and shape as indicated on drawings; color: as selected by the Supervisor.
- B. Curbs: Cast-in-situ or precast concrete of 25 MPa at 28 day compressive strength, as indicated on drawings; size and shape as indicated on drawings; color as selected by the Supervisor.

2.3 SAND BED AND TOPSOIL MATERIALS

- A. Sand for Setting Bed and Joint Filler: ASTM C33 and/or ASTM C144, clean washed river or bank sand.
- B. Topsoil (If Required): Specified in Section 02923.

2.4 CEMENTITIOUS MATERIALS

- A. Portland Cement: ASTM C150 Type I, unless otherwise stated, white or grey color.
- B. Sand: ASTM C144 and ASTM C33; sharp, coarse, clean, screened sand, free of organic material.
- C. Premixed Grout Mortar: As per manufacturer's recommendations.
- D. Water: Potable, not detrimental to mix.
- E. Admixtures: As per manufacturer's recommendations.
- F. Color: Mineral type, non-fading, color as selected.

2.5 ACCESSORIES

- A. Edging: Formed galvanized steel.

- B. Cleaning Solution: As per manufacturer's recommendations.

2.6 MIXES

- A. Cementitious Bed: Portland cement mix conforming to the following:

| <u>Property</u> | <u>Value</u> |
|-------------------------------|----------------|
| Compressive Strength (28 day) | 15 MPa |
| Slump | 75 to 100 mm |
| Air Entrainment | 5 to 7 percent |

- B. Joint Mortar: Portland cement mix conforming to the following:

| <u>Property</u> | <u>Value</u> |
|-------------------------------|----------------|
| Compressive Strength (28 day) | 20 MPa |
| Slump | 25 to 50 mm |
| Air Entrainment | 5 to 7 percent |

- C. Add admixtures to cementitious mixes.
- D. Thoroughly mix ingredients in quantities needed for immediate use.
- E. Use cementitious mixes within two hours after mixing. Do not re-temper.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive Work of this section.
- C. Verify concrete substrate has cured at least 28 days.
- D. Verify gradients and elevations of substrate are correct.

3.2 PREPARATION

- A. Treat soil with herbicide to retard plant growth.

3.3 INSTALLATION WITH SAND SETTING BED

- A. Spread sand evenly over prepared substrate to a maximum thickness of 100 mm.
- B. Dampen and roller compact sand to level and even surface.
- C. Screed and scarify top 12 mm of sand.
- D. Place paver units in pattern as indicated on drawings, from straight reference edge.
- E. Place half units, special shaped units or edging at edge and interruptions. Maintain evenly spaced joints of 9 mm, unless otherwise indicated on the drawings.

- F. Place topsoil over paver surface and sweep into joints and hollow areas of pavers. Moisten joints and recover with additional soil until firm placement is achieved. Remove excess soil.
- G. Tamp and level paver units with mechanical vibrator until units are firmly bedded, leveled and to correct elevation and gradients. Do not tamp unrestrained edges.
- H. Recover with additional sand or topsoil, sweep into joints and hollow areas of pavers. Remove excess sand or soil.

3.4 INSTALLATION WITH MORTAR SETTING BED

- A. Coordinate placement of snow melting system.
- B. Set curbs/pavers in full cementitious mortar bed of indicated thickness, to support curbs/pavers over full bearing surface.
- C. Place curbs/pavers in pattern as indicated on drawings.
- D. Maintain uniform joint width of 9 mm between curbs/pavers, unless otherwise indicated on drawings, and at abutting vertical surfaces and protrusions. To accommodate mortar, rake out joints 6 to 9 mm deep.
- E. Fill joints with mortar. Pack and work into voids. Neatly tool surface to concave or flush joint. Wet cure.
- F. Form control and expansion joints as detailed on approved shop drawings.

3.5 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Do not clean pavers and curbs until pavers, curbs and mortar are dry.
- C. Clean soiled surfaces using cleaning solution. Do not harm pavers, curbs, joint materials, or adjacent surfaces.
- D. Use non-metallic tools in cleaning operations.
- E. Rinse surfaces with clean water.
- F. Broom clean paving surfaces. Dispose off excess sand or mortar.

END OF SECTION

SECTION 02923

LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Final grade topsoil for finish landscaping.
 - 2. Final grade colored gravel for finish play area.
- B. Related Sections:
 - 1. Section 02320 - Backfill.

1.2 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures
- B. Samples: Submit, in air-tight containers, 4.5 kg sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials source.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Furnish each topsoil material from single source throughout the Work.
- B. Perform Work in accordance with the drawings and to the approval of the Supervisor.
- C. Maintain one copy on site.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Topsoil: Fill Type as specified in Section 02320 (alternatively, natural soil).
- B. Colored Crushed Stone: mixed colors of size 0.4-1 cm machine crushed marble, granite and sandstone.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify playing areas have been inspected.

- C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

- A. Protect landscaping and other features remaining as final Work.
- B. Protect existing structures, fences, sidewalks, utilities, paving and curbs (if any).

3.3 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, stones, in excess of 13 mm in size. Remove contaminated subsoil.
- C. Scarify surface to depth of 150 mm where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL OR GRAVEL (as indicated)

- A. Place topsoil in areas where seeding, sodding and planting is required and to the required thickness. Place topsoil during dry weather.
- B. Place mixed colored gravel in the area indicated on drawings in dry weather. Use round edged machine crushed stone suitable for kid play areas to prevent injuries and accidents. Stone shall be marble, granite and sandstone of size 0.4-1 cm.
- C. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- D. Remove roots, weeds, rocks and foreign material while spreading.
- E. Manually spread topsoil close to plant material or to building to prevent damage.
- F. Lightly compact or Roll placed topsoil as directed by the Supervisor.
- G. Remove surplus subsoil and topsoil from site.
- H. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Top of Topsoil: Plus or minus 13 mm.

3.6 PROTECTION OF INSTALLED WORK

- A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.
- B. Prohibit construction traffic over topsoil.

3.7 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 02930

EXTERIOR PLANTS

PART 1 GENERAL

1.1 SUMMARY

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.
- B. Section Includes:
 - 1. Preparation of subsoil and topsoil.
 - 2. Topsoil bedding.
 - 3. Trees, plants and ground cover.
 - 4. Mulch.
 - 5. Fertilizer.
 - 6. Pruning.
 - 7. Maintenance.
- C. Related Sections:
 - 1. Section 02320 - Backfill: Rough grading of site.
 - 2. Section 02923 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American National Standards Institute:
 - 1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
 - 2. ANSI Z60.1 - Nursery Stock.

1.3 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.

- C. Submit minimum 280 g sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Include pruning objectives, types and methods; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

- A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.
- B. Perform Work in accordance with the drawings, to the instructions of the supplier and manufacturer, and to the approval of the Supervisor.
- C. Maintain one copy of each document on site.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing and protecting products.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis and name of manufacturer.
- C. Protect and maintain plant life until planted.
- D. Deliver plant life materials immediately prior to placement. Keep plants moist.
- E. Plant material damaged as a result of delivery, storage or handling will be rejected.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install plant life when ambient temperature is below 5°C or above 35°C.
- C. Do not install plant life when wind velocity exceeds 48 km/hr.

1.9 MAINTENANCE SERVICE

- A. Section 01700 - Execution Requirements: Requirements for maintenance service.
- B. Maintenance to Certificate of Completion:
 - 1. All planted areas shall be maintained and guaranteed from the time of planting until the handing over of the site after acceptance.
 - 2. Maintenance shall include but not be limited to watering, weeding, cultivating, control of insects, or diseases by means of spraying with approved insecticides, herbicide, fungicide, pruning, adjustment and repair of anchors and wire, repair of minor washouts and other horticultural operations

- necessary for the proper growth of plants and for keeping the contract area neat in appearance.
3. Where planting is extended over more than one season, during summer months or at any other period when weather conditions do not permit planting to be carried out, all areas where planting soil mix has been spread shall be maintained. This shall include, where necessary, watering and shall apply to all incomplete work.
- C. Maintenance after Certificate of Completion:
1. After Certificate of Completion has been issued, all planted areas shall be maintained and guaranteed through the maintenance/guarantee period.
 2. Maintenance operations shall be performed during this period as specified and as required, and to the satisfaction of the Supervisor.
- D. Tree Maintenance Operations:
1. Irrigation:
 - a. Water as necessary at approved rate and time, preferably at night or early or late in the day. Avoid inadequate and excessive applications of irrigation water and limit to quantities required for plant development. Leach as necessary at approved timing and rate subject to site and species.
 2. Pruning:
 - a. Under the direction of the Supervisor allow for cutting back of certain types of trees to encourage formation of crow. Limit amount of pruning to minimum necessary to encourage proper growth, to remove dead or injured twigs and branches, and to compensate for result of transplanting operations. Prune in such a manner as not to change natural habit or shape of tree unless otherwise authorized. Make cuts flush leaving no stub.
- E. Shrub, Vine and Ground Cover Maintenance Operations:
1. Irrigation:
 - a. Water as necessary at approved rate and timing, preferably at night or early or late in the day. Avoid excess applications of irrigation water and limit to quantities required for plant development. Leach as necessary at approved timing and rate subject to site and species.
 2. Fertilizer Application:
 - a. Apply balanced liquid fertilizer and if necessary combine with a slow release fertilizer. Apply to manufacturer's instructions in September and December.
 - b. Give annual application of 25g/m² of approved phosphate fertilizer and if necessary, combined fertilizer each at specified rate. Apply dry and water in well. To be applied in February or March each year.
 3. Weeding and Hoeing:
 - a. All vine pockets and shrubs borders shall be hoed, forked or hand weeded where appropriate and all areas kept clear of weeds. Remove all debris or other refuse. Trodden ground to be hoed, forked or raked over as necessary.
 4. Pruning:
 - a. Cut back shrubs in early Spring to encourage bushiness. With the exception of hedges and ground cover plants, shrubs shall be pruned to maintain natural shape. Shrub species with a significant display of

- flowers shall not be pruned after the formation of lower buds until completion of the flowering season.
- b. Shrubs will generally be pruned to encourage a good bushy effect in keeping with their natural characteristics. Where there is a tendency, natural or otherwise, for the plant to develop leggy, coarse growth, it can generally be hard pruned at the outset of the main growing season, all to encourage strong new growth. Consideration must be given to situations where shrubs are fulfilling a screening purpose and here they should be pruned less hard. In general, all dead growth must be removed as it appears.
 - c. On all cuts over 25mm in diameter and on bruises or scars on bark, trace back injured cambium to living tissue and remove. Smooth wounds with a sharp knife to avoid retention of water and coat treated area with approved tree sealant in accordance with BS 3998 or equal.
 - d. Pruning shall generally be carried out in the winter or period of dormancy, and only by skilled horticulturists or under their direct supervision. At no time shall the terminal leader of trees be removed and if this is damaged, the Contractor should endeavor to train a replacement.
 - e. Climbing plants will usually only be pruned to remove dead wood and to control their growth in the direction/manner that is required. Where growth is too vigorous, plants can usually be pruned hard to control them and to encourage fresh new growth.
5. Protection:
- a. Maintain all fencing around plantations, screens or protection to individual trees as necessary. Maintain Hessian wrapping to trees as necessary.
6. Hard Areas Bordering Trees:
- a. Maintain paving or other hard surfaces that may become removed or loosened by growth of trunk or root system of trees.
7. Tree Ties:
- a. Loosen or remove tree ties in accordance with growth of trunk to avoid constriction of growth.
8. Replacement Stakes, Canes or Ties:
- a. Replace stakes and fix new ties to climbers as described.
9. Pest and Disease Control:
- a. Specific checks for pests and disease to be carried out every month by a trained member of staff.
 - b. All equipment should be surface sterilized (with methylated spirits) after use on the plants which are known, or suspected to be diseased. All diseased wood, fungi, prunings, etc., to be burned after removal from diseased plants. (Methods and location of burning must be approved by the Purchaser).
10. Micro-Nutrients:
- a. Corrective foliar sprays of the micro-nutrients shall be applied to plants on the identification of deficiency symptoms. 1/12 kg/ha of manganese or manganese sulphate to be sprayed to deficient plants and sprays re-applied at intervals of approximately two weeks until deficiency is alleviated. 100g of chelated iron/100 liters of water to be sprayed to counteract iron deficiency and be repeated at two-weekly intervals. A foliar spray of zinc at 265 g of zinc /100 liters of water shall be sprayed at intervals only with proper safeguard and at

such times to ensure that there is no human contact with the spray. The Contractor shall ensure that the spray does not contaminate any food crops. The Contractor shall be responsible for ensuring that the micro-nutrient concentrations and methods of application are not hazardous to human or animal health and shall present his Spraying Programme and necessary precautions to the Purchaser for approval prior to commencement of operations.

11. Herbicide:
 - a. Contact herbicide shall be based on paraquat/ diaquat and systemic herbicide based on glyphosphate, for all planted areas.
12. Chemicals:
 - a. Fertilizers, pesticides, herbicides and fungicides to be used must have Purchaser approval. Products must conform to the agricultural chemicals and the agricultural departments of the country of manufacture. Chemicals will be applied according to the manufacturer's recommendations ensuring safety at all times to humans and animals and to avoid contamination to any water source, food crops or surrounding areas.

F. Maintenance Operations of Grass Areas:

1. General:
 - a. Maintenance shall consist of watering, weeding, cutting, repair to all erosion and settlement, and replanting as necessary to establish a uniform and healthy stand of the specified grasses.
2. Mowing:
 - a. Mow grass with an approved machine at intervals, not less than every 14 days. In the summer the interval between mowing shall be 5-7 days or as required to avoid sun scorch. Cutting height shall avoid a scalped appearance and minimize thatch build-up. Grass height as directed by Supervisor. All grass clipping should be collected.
3. Replanting:
 - a. All grassed areas, subject to die back from tree shading as trees mature, shall be re-sodded.
4. Fertilizer Application:
 - a. Prior to irrigation, give top dressing of 25g/m² every three months of approved quantities of nitrogen fertilizer applied dry, evenly and mixed with fine washed sand. Apply, in alternation, approved compound fertilizer every three months.

G. General Maintenance:

1. Fertilizer Application:
 - a. Apply fertilizer as necessary to particular site. Normally give annual application of phosphate fertilizer and if necessary combined slow release fertilizer each at specified rate. Apply dry and water well. To be applied in February or March.
 - b. The following rates and timings are subject to adjustment based on analysis and the Contractor's judgment. Analysis is to be carried out quarterly starting in January of each year. Soil samples will be taken in the accepted manner and at interval distances as necessary to provide a true picture of nutrient levels over a given area.
 - c. Compound Fertilizers:
 - 1) Compound Slow Release Fertilizer (drilled) 18/11/10, 9 month formulation, or similar. Applied in February and

- September at rate of 50 grams per m² and lightly cultivated into top 50mm of soil.
- 2) Compound Slow Release planting tablets (urea formaldehyde base) placed directly into soil at 100-200 mm depth in direct vicinity of irrigation emitters (if any). One 10 gram tablet per 1 cm of tree diameter and two 10 gram tablets per m² of foliage cover for shrubs, flowers and groundcover. Tablets should be 10/10/5 (or similar), two year formulation and shall be applied in March.
- d. Nitrogen Supplements:
 - 1) Urea formaldehyde, minimum 50% water soluble, broadcast as required at rate of 30 grams per m² and cultivated into surface soil. Alternatively applied as a foliar spray at rate of 2 grams per liter.
 - 2) Ammonium sulphate 21/0/0, broadcast as required at rate of 40 grams per m² and watered in by hosepipe. Alternatively applied as a liquid feed at rate of 2 grams per liter.
 - e. Phosphatic Fertilizer:
 - 1) Single superphosphate 0/18/0, applied at rate of 120 grams per m².
 - f. Iron Supplement:
 - 1) Sequestrene applied overall in February and June at rate of 2 grams per m² or as a foliar spray at 1 gram per liter.
 - 2) Iron chelate applied as a solution to chlorotic plants as required.
 - g. Zinc Supplement:
 - 1) As foliar spray of zinc at 265gm of zinc per 100 liters of water as required.
 - h. Management Supplement:
 - 1) 1.12kg/ha of manganese or manganese sulphate to be sprayed to deficient plants and sprays re-applied after intervals of approximately two weeks until deficiency is alleviated.
2. Weeding and Hoeing:
 - a. Maintain areas close to base of trees from weed within one meter of plants. Maintain soil surface and control weeds by regular cultivation at approximately 3 month intervals.
 - b. Paths and areas to be kept free of all vegetation can be controlled by weedkiller based on "Simazine" or equal.
 - c. Pesticides and Fungicides:
 - 1) Pest control sprays must contain only chemicals acceptable for use in amenity horticulture (e.g. Pyrethrum).
 - 2) Fungicide sprays must contain only chemicals acceptable for use in amenity horticulture, such as copper or sulphate. This need not apply to fungicide drenches.
 - d. Disease and Pest Control:
 - 1) The Contractor will instigate a pest control programme from the beginning of his contract. Spraying is advisable only very early in the day, to prevent damage to plants. It is also a time when movement of people is at minimum. Due consideration must be given at all times to protecting people and surfaces from ill effects of spraying.

- 2) Specific checks for pests and disease shall be carried out every month by a trained member of staff.
- 3) All equipment should be surface sterilized (using an approved disinfectant such as methylated spirit) after use on the plants which are known, or suspected to be diseased. All diseased wood, fungi, pruning, etc., shall be burned after removal from diseased plants. (Methods and location of burning must be approved by Supervisor).
- 4) Approved fertilizers, pesticides, herbicides and fungicides only shall be used. Chemicals will be applied according to manufacturer's recommendations, ensuring safety at all times to humans and animals, and shall avoid contamination of any water source, food crops or surrounding areas.
- 5) Control of disease will be largely affected by general cleanliness in operations and by consistent observation of plants.
- 6) As soon as any disease symptoms are noted the Contractor should carry out drenching or spraying to prevent the disease spreading to healthy plants.
- 7) All plants which do not respond to treatment shall be removed and burned, and the soil mix excavated and replaced before replanting. All prunings, rubbish and suspect plant material should be removed from site quickly at all times and burned at a location approved by the Supervisor.
- e. Weed Control:
 - 1) Areas close to base of plants shall be kept free from weeds within 1m of plants. Maintain soil surface and control weeds by regular cultivation at approximately one monthly interval.
 - 2) Generally, Contractor will rely on hand cultivations close to and round trees and plants and throughout close planted areas. In the lawn area, like shelter-belts, chemical weed control can be carried out if permitted.
- f. Mulch:
 - 1) Control by mulching is an integral part of the landscape programme and all mulches must be kept up to specification.
3. Removal of Shoots and Dead Twigs:
 - a. Remove any dead twigs or shoots occurring on all trees, shrubs and ground cover plants.
 - b. Remove all water shoots.
- H. Replacements:
 1. Replacement plants shall be of the same size and species as originally specified and shall be planted as specified.
 2. The Contractor shall be responsible for replacing all plant material that is dead, dying or not in vigorous condition at the beginning of the planting season following practical completion. At this time a schedule shall be prepared by the Contractor of all dead and dying material. This shall be submitted for approval to the Supervisor.
 3. Replacements, with the exception of palm trees, shall be planted only between November and the end of March. If the final inspection at the end of the maintenance period occurs between these dates and additional replacement planting is directed, the planting shall be done between mid and the end of October, and be maintained six months from November.

- I. Cleanup and Protection:
 - 1. During planting, keep pavements clean and work area in an orderly condition.
 - 2. Protect planting and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged planting as directed.
- J. Final Planting Inspection and Acceptance:
 - 1. Final inspection for acceptance shall be made at the conclusion of the period of maintenance and guarantee provided that all project improvements and corrective work has been completed. If improvements are not completed, maintenance shall be continued until completion of such work.
 - 2. Prior to being considered ready for inspection, Contractor shall have done a final weeding and raking of all planted areas, replenishing of all mulch where necessary, removing all debris, leaving the site in a clean orderly appearance.

PART 2 PRODUCTS

2.1 PLANTING - GENERAL

- A. Planting shall take place only before 10:00 O'clock and after 16:30 O'clock.
 - 1. The normal planting season for trees, shrubs and herbaceous plants will be between November and March inclusive, except for date palms which will be planted in March or April. Alternative planting times may be allowed only with the approval of the Supervisor.
 - 2. Before beginning planting complete all grading and ripping, finish paving, laying of services and other building work; complete soiling of shrub, herbaceous and annual planting areas.
 - 3. Planting shall not be done in excessively windy conditions.
- B. Layout:
 - 1. Lay out individual tree and shrub locations for multiple plantings by scaling from the landscape site plans and stake locations and outline areas. Make minor adjustments as may be requested.
 - 2. The Supervisor reserves the right to approve the setting out of plants before planting: see planting schedule and setting out drawings. He also reserves the right to alter the position of any which is planted.
 - 3. Space ground covers and vines as shown on schedule and drawings.
 - 4. The Supervisor is to be notified 3 days minimum for the planting layout to be approved prior to planting.
- C. Planting is to be carried out in accordance with the specification and drawings. The number of each species and variety is to be distributed over the area allocated in an even manner, making due allowance for adjacent groups.
- D. Plants shall be set plumb and at such a level or elevation that after the settlement they will bear same relation to level of surrounding ground as they bore to ground from which they were dug. All plants shall be planted on and in soil mix. The soil mix will be properly compacted before the placement of trees with a heavy root ball.
- E. Earthballed and Hessian covered plants shall have all cloth, ropes, etc., removed from tops of the earthballs but no cloth shall be pulled out from under the earthballs.

- F. Bare-rooted plants shall have their roots spread out in a natural position and prepared top soil shall be carefully placed under and among them to fill all voids. Any roots which are broken or frayed shall be cleanly cut off from the plant.
- G. Disturbance to the roof system or ball of earth shall be prevented in removing plants from containers. Can cutters shall be used on metal containers.
- H. Dig planting pits to sizes as specified allowing for the depth of gravel drainage layer and cart away excavated material; remove soil to approved dumping areas.
- I. Lay the anti-capillary liner where specified over gravel taking care that 150mm overlaps occur and that the hole for the stake is no larger than necessary.
- J. Spread 200 mm layer of planting soil mix over the bottom of the pit and firm by foot. Place the plant and fill around it with planting soil mix in layers of 200 mm each separately firmed until final soil level is reached. The area of the plant pit should then be firmed around so the plant is stable. Apply slow release fertilizer where specified, at the rate of 300 gm/tree, 100 gm/plant, and 35 gm/m² of grass.
- K. During and after planting, the plants shall be thoroughly watered in to eliminate air voids around the roots and watered regularly as required for the planting to become established.
- L. Apply a 50mm deep layer of stone mulch as specified to planting beds and tree pits. Depth of stone mulch to be 50mm only.
- M. Check all plants one week after planting for wind shake and loosening due to soil subsidence and firm and make good soil as necessary. Then check all plants at a maximum of two weekly intervals until the end of the maintenance period, making good as necessary.

2.2 TREE PLANTING

- A. Trees be planted in locations shown. Trees shown on plans at spacing shall be accurately and evenly spaced in true lines.
- B. The tree pits for Standard Trees generally shall allow for a 1000 x 1000 x 1500 mm depth of growing medium unless otherwise shown, plus a 200 mm deep gravel drainage layer. Where such tree pits are located above rock, bore holes will be drilled by the main Contractor prior to planting to a depth of 1m.
- C. After planting, a tree stake shall be inserted into the tree pit with a minimum of one third below ground and two thirds above ground. The stake shall be located on the windward side of the tree. For balled-root trees and those grown-on and in containers, a crowbar or similar tool should be used to probe through the root system, to make a pilot hole, into which the stake can be driven with minimum disturbance. Care shall be taken not to puncture the semi-permeable membrane. The tree shall be secured to the tree stake by two rubber tree ties.
- D. Apply slow release tablet fertilizer as specified herein.

2.3 PALM TREE PLANTING

- A. Large palms shall be planted during the period of optimum root growth from March to April unless otherwise agreed upon with the Supervisor. All palms scheduled to be planted on the site shall be inspected in their original growing location before lifting is authorized for delivery to the site.
 - 1. Prior to transporting for transplanting, palm fronds are to be sprayed with anti-desiccant during transplanting and shall be wrapped with burlap to enclose the growing tip and upper trunk. The roots shall be balled and the Hessian tied with wire.
 - 2. Palms shall be planted in prepared pits, size as specified, and backfilled and firmed in.
 - 3. Fertilizer shall be applied as for trees.
 - 4. Trunk burlap, frond wrapping and dead fronds to be removed again after new growth indicates adequate recovery or after second growing season.
 - 5. Guy palms immediately after planting.
 - 6. The tree pits for palms generally shall allow for a 1000 x 1000 x 1500 mm depth of growing medium unless otherwise indicated on the drawings plus a 200 mm deep gravel drainage layer.

2.4 SHRUB PLANTING

- A. Shrubs shall be positioned in the location and numbers shown on plan and placed to achieve even spacing and proper matching of shapes related in a random fashion at approximately equal centers to obtain a natural dense cover.
 - 1. Pits for shrubs and small trees generally shall allow for a depth of 900mm of growing medium, unless otherwise shown, plus a 200 mm deep gravel drainage layer.
 - 2. Planting pits shall be backfilled with planting soil mix, thoroughly firmed around the roots to eliminate air voids.
 - 3. Tablets fertilizer shall be applied.

2.5 VINE PLANTING

- A. Vines shall be planted in a similar manner to shrubs, all as described above.
- B. Pits for vines shall allow for a 900 x 900 x 600 mm depth of growing medium plus a 200 mm deep gravel drainage layer.

2.6 GROUND COVER PLANTS

- A. Ground cover plants shall be planted in beds of growing medium 500mm deep plus a 200 mm deep gravel drainage layer. Planting should be done with a hand trowel, taking care to firm soil around the roots.
- B. Herbaceous plants should be set out according to the planting plan to ensure correct spacing.
- C. Smaller plants and annuals should be planted with a hand trowel, taking care to firm around the roots. Larger plants will require a spade to excavate hole, and firming should be done by treading. The depths of planting will depend upon the species.

2.7 GRASS

- A. Previously established grades shall be on the areas to be treated in a true and even condition, and necessary repairs shall be made to previously graded areas. All surfaces shall be left in a smooth condition to prevent formation of depressions. Areas having inadequate drainage as indicated by the ponding of water near foundations, walks, driveways, or on other areas shall be filled or graded to drain as directed by the Supervisor. Ruts, deep tracks, dead furrows, and ridges shall be eliminated and the necessary replanting accomplished prior to acceptance of the completed work. The finished grade shall be such that after sodding operations, the sodded grade will be level with the adjacent surface grade of walks, drives and curbs. All debris and stones larger than 25mm remaining on the surface after grading and tillage operations shall be removed.
- B. After the areas have been brought to the previously established grades, tillage shall be accomplished in such manner as to prepare an acceptable sod bed. Contractor shall utilize a tractor-mounted or walk behind root-tiller type machine capable of tilling the soil and incorporating the soil amendments to the specified depth. After completion of tillage, lawn areas shall be raked smooth and stone and debris removed.
- C. Prior to commencing tillage operation, Contractor shall spread organic matter to a uniform depth of 25mm. Organic matter shall then be incorporated into the top 15cm of the turf bed to establish a uniform planting soil consisting of 5 parts existing topsoil and 1 part organic matter.
- D. Prior to tillage for planting NPK fertilizer shall be applied at the rate of 560 kg per hectare. Fertilizer shall be distributed with a fertilizer distributor equipped with baffle plates to prevent downward movement of fertilizer when operated on a slope. Fertilizer shall be uniformly distributed.
- E. Installation of sod shall be done by experienced staff. Each sod-roll will be hand held till laid down; no sod-rolls shall be accepted when thrown to the ground from truck or wheel barrow. When rolls are laid out, they shall be "tucked in" close, no gaps (space) to be left between rows of sod. A "walk-behind" water-filled metal roller shall be utilized to press the sod firmly down on the soil, to the Supervisor's approval.
- F. The sodded areas shall be refertilized three weeks after commencement of maintenance operations and thereafter at four week intervals throughout the growing season. Fertilizer for refertilizing shall be applied at the rate of 280kg of 16-16-16 per hectare. Fertilizer shall be applied only when vegetation is dry. The refertilized areas shall be irrigated within 4 hours following refertilizing operation.
- G. Sodding shall not be done:
 - 1. when the ground is in an unsatisfactory condition for planting or when the sod is not acceptable to Supervisor;
 - 2. in winter: when soil is too wet, or too cold, top 10cm of soil should not be less than 20°C.
 - 3. in summer: when soil is too dry; no installation of sod between 10 am and 3 pm unless approved by Supervisor, in both cases, Supervisor's approval to commence is required.

Sod shall be installed as soon as possible after delivery to site.

Sod shall be transported during night time, up to 8 am, or late afternoon after 5 pm.

All sod shall be inspected and approved by Supervisor before unloading. It is the Contractors responsibility if the sod is inspected after unloading and rejected.

- H. Sod shall originate from approved regional sod farms and each load shall have a certificate of the approved sod farms indicating time of lifting and loading and the type of grass (e.g. Cynadon & Variety).
- I. Irrigation shall commence within 2 to 4 hours of completing sodding planting. Irrigation system shall be the Contractor's responsibility during maintenance period. Irrigation water shall be applied as necessary to maintain the top 4 inches (10cm) of soil in a moist condition. Irrigation shall be accomplished in a manner that will not create erosion or runoff. All areas damaged shall be repaired immediately at no cost to the Purchaser.
- J. After the sod is installed, irrigation shall be applied daily to maintain soil moisture between 100 percent and 70 percent of field capacity. Irrigation shall be applied in early morning or evening to enable the soil to absorb a maximum of water with minimum evaporation. The Contractor shall continue to irrigate and maintain the turf during the Establishment Period, until final acceptance.
- K. Sod rolls shall be Buffalo natural grass rolls of 50x200 cm each.

2.8 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; phosphorus to exceed 150 units; potassium to exceed 120 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/cm in soil.

2.9 SOIL AMENDMENT MATERIALS

- A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
 - 1. Tree Fertilizer: Containing fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.
- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- E. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of plants.
- F. Herbicide: As instructed by the supplier.

- G. Pesticide: As instructed by the supplier.

2.10 MULCH MATERIALS

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

2.11 ACCESSORIES

- A. Wrapping Materials: Burlap.
- B. Stakes: Softwood lumber, pointed end, or mild steel angle, galvanized, pointed end.
- C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
- E. Plant Pot: As indicated on drawings.
- F. Grates: As indicated on drawings.
- G. Decorative Cover: As indicated on drawings.
- H. Membrane: 0.5 mm thick, clear or black polyethylene, and/or water permeable polyolefin fabric.
- I. Wrapping: Waterproof fabric.
- J. Tree Protectors: Metal or Plastic with galvanized rings.
- K. Wire Mesh: Light weight and durable wire mesh fixed to walls where climbing trees are to be planted.

2.12 TOPSOIL AND/OR PLANT SOIL MIX

- A. Topsoil and/or Plant Soil Mix: Uniform mixture of 1 part peat and 3 parts topsoil by volume.

2.13 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Test and analyze imported and existing topsoil.
- C. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; and pH value.
- D. Provide recommendation for fertilizer and soil amendment application rates for specified planting as result of testing.

- E. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify prepared subsoil and planters are ready to receive work.
- C. Saturate soil with water to test drainage.
- D. Verify required underground utilities are available, in proper location, and ready for use.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to depth of 75 mm where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Dig pits and beds three times wider than plant root system.

3.3 PLACING DRAINAGE LAYER

- A. Fill and spread gravel materials as a drainage layer at bottom of pits and under ground cover to required thickness.

3.4 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 150 mm over area to be planted. Rake smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- E. Install topsoil into pits and beds intended for plant root balls, to minimum thickness of 150 mm.

3.5 FERTILIZING

- A. Apply starter fertilizer at rate instructed by supplier.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 50 mm of topsoil.
- D. Lightly water soil to aid dissipation of fertilizer.

3.6 PLANTING

- A. Place plants for best appearance for review and final orientation by the Supervisor.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers.
- D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth of 150 mm unless otherwise indicated on Drawings under each plant. Remove loosen burlap, ropes and wires from top half of root ball.
- E. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 150 mm layers. Maintain plant life in vertical position.
- F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.7 PLANT RELOCATION AND RE-PLANTING

- A. Relocate plants as indicated on drawings and/or directed by the Supervisor.
- B. Ball or pot removed plants when temporary relocation is required.
- C. Replant plants in pits or beds, partly filled with prepared topsoil mixture, at minimum depth of 150 mm unless otherwise indicated on Drawings under each plant. Remove and loosen burlap, ropes, and wires, from top half of root ball.
- D. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 150 mm layers. Maintain plant materials in vertical position.
- E. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.8 INSTALLATION OF ACCESSORIES

- A. Place decorative cover, membrane, gravel, or stone as indicated on Drawings.
- B. Place grates at base of trees where indicated on Drawings.
- C. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.9 PLANT SUPPORT

- A. Brace plants vertically with plant protector wrapped guy wires or stakes as following:

| <u>Tree Caliper</u> | <u>Tree Support Method</u> |
|---------------------|----------------------------|
| 25 mm | 1 stake with one tie |
| 25 - 50 mm | 2 stakes with two ties |

50 - 100 mm
Over 100 mm

3 guy wires with eye bolts and turn buckles
4 guy wires with eye bolts and turn buckles

3.10 TREE PRUNING

- A. When pruning trees is required and permitted, lightly prune trees in accordance with ANSI A300 Maintenance Pruning Type: Crown Cleaning.

3.11 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and inspection services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.12 PROTECTION

- A. Immediately after planting, the area shall be protected against traffic and others by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.
- B. Excess and waste material shall be removed daily to approved waste disposal site. When planting in an area has been completed, the area shall be cleaned of all debris and excess materials. Adjacent paving shall be cleaned when work in adjacent areas is completed.

END OF SECTION

SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Architectural form liners.
 - 4. Form accessories.
 - 5. Form stripping.
- B. Related Sections:
 - 1. Section 03200 - Concrete Reinforcement.
 - 2. Section 03300 - Cast-in-Place Concrete.
 - 3. Section 05500 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Concrete Institute:
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 318M - Metric Building Code Requirements for Structural Concrete.
 - 4. ACI 347 - Guide to Formwork for Concrete.
- B. American Forest and Paper Association:
 - 1. AF&PA - National Design Specifications for Wood Construction.
- C. The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- D. American Society of Mechanical Engineers:
 - 1. ASME A17.1 - Safety Code for Elevators and Escalators.
- E. ASTM International:
 - 1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- F. West Coast Lumber Inspection Bureau:
 - 1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings:
 - 1. Submit formwork and shoring shop drawings.
 - 2. Indicate the following:
 - a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
 - b. Means of leakage prevention for concrete exposed to view in finished construction.
 - c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
 - d. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
 - e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318M , Section 6.3.
- C. Product Data: Submit data on void form materials and installation requirements.
- D. Design Data: Indicate design data for formwork and shoring. Include structural calculations to support design.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347, ACI 301 and ACI 318M.
- B. For wood products furnished for work of this Section, comply with AF & PA.
- C. Perform Work in accordance with the drawings and to the approval of the Supervisor,
- D. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Design formwork under direct supervision of Professional Supervisor experienced in design of this Work and approved by the Supervisor.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Products storage and handling requirements.
- B. Deliver void forms and installation instructions in manufacturer's packaging.

- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.8 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Plywood: Sound undamaged sheets with clean, true edges.
- B. Lumber Forms:
 - 1. Application: Use for edge forms and unexposed finish concrete.
 - 2. Boards: 150 mm or 200 mm in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.
- C. Plywood Forms:
 - 1. Application: Use for exposed finish concrete.
 - 2. Forms: Conform to PS 1; full size 1200 x 2400 mm panels; each panel labeled with grade trademark of APA/EWA.
 - 3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 16 mm thick; APA/EWA "B-B Plyform Structural I Exterior" grade.
 - 4. Plywood where "Smooth Finish" is required, as indicated on Drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 19 mm thick.

2.2 PREFABRICATED FORMS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. Preformed Steel Forms: Minimum 1.5 mm matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- D. Pan Type: Steel or Glass fiber of size and profile required.
- E. Tubular Column Type: Round; spirally wound laminated fiber, wood or glass fiber material; surface treated with release agent, non-reusable, sizes as indicated on Drawings.

- F. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; thickness as indicated on drawings.
- G. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.
- H. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.
- I. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 ARCHITECTURAL FORM LINERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. Architectural Form Liners: Polystyrene, Acrylonitrile butadiene styrene (ABS) and/or Polyurethane; reusable; pattern as indicated on Drawings and/or as selected.

2.4 FORMWORK ACCESSORIES

- A. Form Ties: Removable or Snap-off type, galvanized metal, adjustable length, cone type, with waterproofing washer, free of defects capable of leaving holes larger than 25 mm in concrete surface.
- B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 25 mm of concrete face. Wire ties, wood spreaders or through bolts are not permitted.
- C. Form Anchors and Hangers:
 - 1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
 - 2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
 - 3. Penetration of structural steel members is not permitted.
- D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
 - 1. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- E. Corners: Chamfer, rigid plastic or wood strip type; size as directed by the Supervisor; maximum possible lengths.
- F. Dovetail Anchor Slot: Galvanized steel, 0.8 mm thick, foam filled or non-filled, release tape sealed slots, anchors for securing to concrete formwork.
- G. Flashing Reglets: Galvanized steel, 0.8 mm thick, longest possible lengths, with alignment splines for joints, foam filled or non-filled, release tape sealed slots, anchors for securing to concrete formwork.

- H. Vapor Retarder: Where indicated on Drawings, 0.25 mm thick polyethylene sheet.
- I. Bituminous Joint Filler: ASTM D1751.
- J. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.
- K. Water Stops: Polyvinyl chloride, minimum 12 MPa tensile strength, minimum +10 °C to +79 °C working temperature range, width as indicated on drawings but not less than 250 mm wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

2.5 COATINGS

- A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from the Supervisor.

3.2 INSTALLATION

- A. Earth Forms:
 - 1. Earth forms are not permitted.
- B. Formwork - General:
 - 1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
 - 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
 - 4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 - 5. Complete wedging and bracing before placing concrete.
- C. Forms for Smooth Finish Concrete:
 - 1. Use steel, plywood or lined board forms.
 - 2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.

3. Install form lining with close-fitting square joints between separate sheets without springing into place.
 4. Use full size sheets of form lines and plywood wherever possible.
 5. Tape joints to prevent protrusions in concrete.
 6. Use care in forming and stripping wood forms to protect corners and edges.
 7. Level and continue horizontal joints.
 8. Keep wood forms wet until stripped.
- D. Architectural Form Liners:
1. Erect architectural side of formwork first.
 2. Attach form liner to forms before installing form ties.
 3. Install form liners square, with joints and pattern aligned.
 4. Seal form liner joints to prevent grout leaks.
 5. Dress joints and edges to match form liner pattern and texture.
- E. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.
- F. Framing, Studding and Bracing:
1. Space studs at 400 mm on center maximum for boards and 300 mm on center maximum for plywood.
 2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
 3. Construct beam soffits of material minimum of 50 mm thick.
 4. Distribute bracing loads over base area on which bracing is erected.
 5. When placed on ground, protect against undermining, settlement or accidental impact.
- G. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- H. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- I. Obtain Supervisor's approval before framing openings in structural members not indicated on Drawings.
- J. Chamfer strips on external corners of beams, joists, columns and etc.
- K. Install void forms in accordance with manufacturer's recommendations.
- L. Reuse formwork after approval of the Supervisor. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.
- C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Position recessed reglets for brick veneer masonry anchors in accordance with spacing and intervals specified in Section 04810 and/or as indicated on Drawings.
- E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- F. Install water stops continuous without displacing reinforcement and in accordance with manufacturer's instructions.
- G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- I. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 - 2. Place ties at least 25 mm away from finished surface of concrete.
 - 3. Leave inner rods in concrete when forms are stripped.
 - 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
- J. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- K. Construction Joints:
 - 1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.

3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 4. Arrange joints in continuous line straight, true and sharp.
- L. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
 2. Do not embed wood or uncoated aluminum in concrete.
 3. Obtain installation and setting information for embedded items furnished under other Specification sections.
 4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
 5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318M, Section 6.3.
- M. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
 2. Coordinate work to avoid cutting and patching of concrete after placement.
 3. Perform cutting and repairing of concrete required as result of failure to provide required openings.
- N. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
 2. Slope slabs to drain where required or as shown on Drawings.
 3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.
- O. Screenshot Supports:
1. For concrete over waterproof membranes and vapor barrier membranes, use cradle, pad or base type screenshot supports which will not puncture membrane.
 2. Staking through membrane is not permitted.
- P. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
 2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by the Supervisor.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.
- C. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.
- D. Camber slabs and beams 2 mm/m and in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements and Section 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Notify the Supervisor after placement of reinforcing steel in forms, but prior to placing concrete.
- D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars.
 - 2. Welded wire fabric.
 - 3. Reinforcement accessories.
- B. Related Sections:
 - 1. Section 03100 - Concrete Forms and Accessories.
 - 2. Section 03300 - Cast-in-Place Concrete.
 - 3. Section 03350 - Concrete Finishing.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 315 - Details and Detailing of Concrete Reinforcement.
 - 3. ACI 318M - Metric Building Code Requirements for Structural Concrete.
 - 4. ACI SP-66 - ACI Detailing Manual.
- B. ASTM International:
 - 1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - 3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - 4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 5. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 - 7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- C. American Welding Society:
 - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute:
 - 1. CRSI - Manual of Standard Practice.
 - 2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, ACI SP-66, and ACI 318M.
- B. Maintain one copy of each document on site.
- C. Arrange with access to fabrication plant to facilitate Supervisor's inspection of reinforcement. Notify the Supervisor of commencement and duration of shop fabrication in sufficient time to allow inspection.

1.5 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel:
 - 1. To ASTM A706/A706M, 420 MPa yield strength; deformed low-alloy steel bars, unfinished.
 - OR**
 - 2. To ASTM A615/A615M, 420 MPa yield grade; deformed steel bars, unfinished and provided the following:
 - a. The strength based on mill tests does not exceed 420 MPa by more than 124 MPa and retests shall not exceed this value by more than an additional 20 MPa.
 - b. The minimum acceptable ratio of actual ultimate tensile stress to the actual yield strength is 1.25.
- B. Reinforcing Steel Plain Bar Stirrups and Rod Mats: ASTM A704/A704M, ASTM A615/A615M, 280 MPa; steel bars or rods, unfinished.
- C. Welded Steel Wire Fabric: To ASTM A497 Deformed Type.
- D. The weight of steel bar reinforcement for each bar diameter shall be in accordance with BS 4449: 1997: "Specification for Carbon Steel Bars for the Reinforcement".

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel type 316; size and shape to meet Project conditions.
- D. Reinforcing Splicing Devices: Mechanical set screw, swaged or threaded type; full tension and compression; sized to fit joined reinforcing.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice, ACI SP-66, ACI 318M, and/or ASTM A184/A184M.
- B. Weld reinforcement in accordance with AWS D1.4.
- C. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with the Supervisor.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcement as indicated on drawings.
- E. Splice reinforcing where indicated on Drawings in accordance with splicing device manufacturer's instructions.
- F. Bond and ground reinforcement in accordance with requirements of Division 16.

3.2 REINFORCEMENT TESTS

- A. The manufacturer's test certificate for ultimate strength, elongation and cold bending together with the chemical analysis of the steel may be called for by the Supervisor for any consignment or reinforcing steel direct from the manufacturer. Where steel is obtained from an indirect supplier, the Supervisor may require tests in an approved laboratory to prove compliance with the appropriate American Standards.
- B. The frequency of testing shall be as set out in the American Standards. The Contractor shall carry out additional tests as instructed by the Supervisor.

- C. Any reinforcement which does not comply with the Specification shall be immediately removed from site.

3.3 STORAGE OF MATERIALS

- A. Reinforcement of all types shall be stored on site in racks above ground in an approved manner so as to avoid damage.
- B. All reinforcement shall be free from loose scale, rust, oil, grease or any other material that may impair the bond between the concrete and the reinforcement. Any reinforcement which has become corroded or pitted to an extent which, in the opinion of the Supervisor, will affect its properties shall be removed from site.
- C. Mild steel reinforcement shall be stored separately from high yield reinforcement.

3.4 CUTTING AND BENDING

- A. Reinforcement shall be bent to the dimensions given in the bar schedules in accordance with latest editions of ASTM A 184, ACI 318 CRSI 63 and CRSI 65 unless otherwise stated. The Contractor should check that schedules have been provided for each part of the structure.
- B. No reinforcement shall be heated before bending.
- C. Cold worked bars and hot rolled high yield bars shall not be straightened or bent again once having been bent. Where it is necessary to bend mild steel reinforcement already cast in the concrete, the internal radius of bend shall not be less than twice the diameter of the bar.
- D. After bending, bars shall be securely tied together in bundles or groups and legibly labeled as set out in CRSI 63 and CRSI 65.

3.5 SPLICING AND WELDING

- A. Reinforcement shall not be welded except where required by the Contract or agreed by the Supervisor. If welding is employed the procedures shall be as set out in AWS D1.4. Details of all welding techniques to be used shall be submitted for approval and such trials made as are required to demonstrate the effect of the welding. No welding or splicing shall be made to the reinforcement except where described on the drawings, or where approved by the Supervisor.

3.6 CLEANING OF REINFORCEMENT

- A. Reinforcement shall be free of all loose mill scale, rust, oil, grease, concrete or other harmful matter at the time of concreting.

3.7 FIXING OF REINFORCEMENT

- A. All reinforcement shall be accurately placed with the correct cover and securely fixed in the positions shown on the drawings and to the satisfaction of the Supervisor, who shall be given reasonable notice of the intention to pour and that the reinforcement fixing is complete.

- B. At intersections the reinforcement bars shall be bound together with tying wire and the loose ends of the wire shall be turned towards the inside of the member.
- C. The Contractor shall supply and fix all chairs required to support the top mat of slab reinforcement or space the mats of all reinforcement adequately. In particular slab chairs must be close enough to prevent the reinforcement being bent or sagging.
- D. The actual concrete cover shall be not less than the required nominal cover minus 5mm. No metal part of any device used for connecting bars or for maintaining reinforcement in the correct position shall remain within the specified minimum cover. The Contractor shall provide adequate mortar or plastic spacers to ensure the correct cover is achieved. The use of spacer blocks will not generally be permitted against a concrete face which is to be permanently exposed in the finished works.

3.8 PROJECTING REINFORCEMENT

- A. The Contractor shall protect projecting reinforcement without affecting its bond properties and shall ensure that it does not cause rust staining to any part of the works.

3.9 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete for all concrete structures, frames, members, elements and beds shown on drawings and where described and directed by the Supervisor. Section also includes fair-faced concrete and stamped concrete.
- B. Related Sections:
 - 1. Section 02320 - Backfill.
 - 2. Section 03100 - Concrete Forms and Accessories: Formwork and accessories for fair faced concrete finish, and Placement of construction joint device and anchors in formwork.
 - 3. Section 03200 - Concrete Reinforcement.
 - 4. Section 03350 - Concrete Finishing.
 - 5. Section 03390 - Concrete Curing.
 - 6. Section 04810 - Unit Masonry Assemblies.
 - 7. Section 07140 - Fluid Applied Waterproofing.
 - 8. Section 07535 - Single Ply Roofing Protected Membrane.
 - 9. Section 07900 - Joint Sealers.
 - 10. Division 15 - Mechanical Works: Mechanical items for casting into concrete.
 - 11. Division 16 - Electrical Works: Electrical items for casting into concrete.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 305 - Hot Weather Concreting.
 - 3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 4. ACI 318M - Metric Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM C150 - Standard Specification for Portland Cement.
 - 5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 6. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 - 7. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
 - 8. ASTM C595M - Standard Specification for Blended Hydraulic Cements (Metric).
 - 9. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

10. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
11. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
12. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
13. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
14. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type.
15. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
16. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
17. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
18. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Submit shop drawings showing proposed location of construction joints for Supervisor's approval.
- C. Product Data: Submit data on joint devices, attachment accessories, and admixtures.
- D. Design Data:
 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - b. Air entrained concrete work.
 2. Identify mix ingredients and proportions, including admixtures.
- E. Samples: Submit two 250 x 250 mm long samples of expansion and contraction joints, and for control joint.
- F. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.

- B. Maintain one copy of each document on site.
- C. Acquire cement and aggregate from sources approved by the Supervisor for Work.
- D. Conform to ACI 305 when concreting during hot weather.
- E. Conform to ACI 306.1 when concreting during cold weather.

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.7 DELIVERY AND STORAGE OF AGGREGATES

- A. Aggregates shall be delivered to site in clean and suitable vehicles. Different types or sizes of aggregates shall not be delivered in one vehicle.
- B. Aggregates shall not be stored in contact with the ground and shall be protected against the intrusion of the ground and other foreign matter. There shall be a physical partition between the store heaps of fine and coarse aggregates and between separate heaped sizes of coarse aggregate which may have been segregated for mix control. When concreting is not being carried out, the store heaps shall be covered to prevent contamination by wind blown material.
- C. Aggregates, which in the opinion of the Supervisor are not clean or which have become mixed due to defective storage, shall be removed from site immediately.

PART 2 PRODUCTS

2.1 CEMENT

- A. Cement shall generally be Ordinary Portland Cement (OPC) Type I, complying with ASTM C150, for all works. White or coloured cement shall comply with ASTM C150.
- B. Moderate-heat Portland cement Type II, complying with ASTM C150, will be used in large concrete sections, where necessary, to reduce temperature development.
- C. For work below ground level cement shall be Sulphate Resisting Cement (SRC) Type II or Type V as indicated in the "Concrete Mix" stated below, complying with ASTM C150.
- D. The cement shall be obtained directly from an approved manufacturer or an approved supplier and shall be delivered either in bulk by purpose built vehicles or in sealed bags. All cement shall be free flowing and free of lumps.
- E. The total alkali content of the cement expressed as the sodium oxide equivalent shall not exceed 0.6% by weight.

- F. The tricalcium aluminates (C3A) cement of any cement shall not exceed 8% and for sulphate resisting cement shall not exceed 5%.
- G. The sulphuric anhydride (SO₃) content shall not exceed 2.3%.
- H. The heat of hydration shall not exceed values listed in ASTM C150.
- I. The initial setting time shall be not less than 45 minutes and the final setting time shall be not more than 10 hours.
- J. Certificates of cement tests by the manufacturer will be called for by the Supervisor. If such certificate is not made available, or if the Supervisor considers that the manufacturers tests are inadequate, samples for testing shall be taken from different consignments as the Supervisor may direct. Such samples shall weigh not less than 7 kg and shall be selected and tested.
- K. Storage of Cement:
 - 1. Storage of bulk cement shall be in weatherproof silos which shall bear a clear indication of the types of cement contained in them. Different types of cement shall not be mixed in the same silo. Storage silos shall be drawn frequently to prevent cement caking.
 - 2. Cement in bags shall be stored in a suitable weatherproof structure of which the interior shall be dry and well ventilated at all times. The floor shall be raised above the surrounding ground level and shall be so constructed that no moisture rises through it. Each delivery of cement in bags shall be closely stacked but shall not be stacked against an outside wall. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stocks. Cement in bags shall be used in the order in which they are delivered. Cement from broken bags shall not be used in the Permanent Works.
 - 3. The Contractor shall provide sufficient storage capacity on site to ensure that his anticipated programme of work is not interrupted due to lack of cement.

2.2 AGGREGATES

- A. Aggregates for concrete shall conform to the requirements for fine and coarse aggregates in ASTM C33.
- B. Aggregates shall consist of crushed or naturally occurring materials having hard, durable, strong particles. All aggregates are to be washed with clean water. The use of marine aggregates will not be approved.
- C. At least 45 days before concreting operations are due to commence, the Contractor shall submit for approval the names of the pits, quarries or manufacturing plants from which he proposes to obtain aggregates, together with evidence showing that the material complies with the requirements of ACI 221.
- D. Fine aggregate shall either consist of natural sand or be obtained by crushing clean hard rock or be a mixture of these. Fine aggregate shall conform to ASTM C 33 in order to achieve and acceptable grading it may be necessary to blend materials from more than one source.

- E. Fine aggregate shall contain no excessive quantities of dust, soft or flaky particles, shells, congealed lumps, shale or other contaminations likely to adversely affect the strength or durability of the concrete or to attack the reinforcement.
- F. Coarse aggregates shall consist of naturally occurring crushed rock and shall not contain harmful materials in sufficient quantity to affect adversely the strength or durability of the concrete or to attack the reinforcement.
- G. Coarse aggregates shall be supplied in the nominal sizes specified and shall be graded in accordance with ASTM C 33 for single sized aggregates.
- H. Aggregates shall comply with the mechanical properties in ASTM C 33 and in addition the flakiness index, when determined by the sieve method described in ASTM C 136, shall not exceed 40 for 40mm aggregates, nor shall it exceed 35 for 20mm aggregates. In construction specified on the drawings as watertight the coarse aggregates shall not have combined indices for flakiness and elongation exceeding 35, nor shall the flakiness index exceed 15.
- I. The sulphate content (SO_3) of both fine and coarse aggregates shall not exceed 0.4% by weight. The total sulphate content of all the ingredients in a mix including cement, water and admixtures shall not exceed 4.0% of the weight of cement within the mix.
- J. The chloride content (as Na Cl) shall not exceed 0.05% by weight. The total chloride content arising from all ingredients in a mix including cement, water and admixtures shall not exceed the following limits expressed as a percentage of the weight of the cement in the mix:
 - 1. For prestressed concrete, steam cured concrete or concrete containing sulphate resisting cement: 0.05%.
 - 2. For any other reinforced concrete: 0.25% in 95% of all test results providing no result is more than 0.4%.
- K. The coarse aggregate when tested shall have a water absorption as defined in ASTM C 33. If the proposed aggregate has an absorption of more than specified, the Contractor shall demonstrate by trial mixes and tests that the strength and durability of the concrete are not adversely affected and the adequate workability can be maintained during the placing and compacting processes.
- L. The “10% Fines” values shall be determined in accordance with ASTM C 33. Where aggregates are to be used for concrete wearing surfaces, the “10% Fines” value shall be as specified in ASTM C 33.
- M. After the magnesium sulphate soundness test, the weight loss shall not be more than 15% for the fine aggregate and 18% for the coarse aggregate.
- N. No part of the aggregates shall contain any mineral known to have a potential to cause alkali silica, alkali silicate, alkali carbonate or any other damaging chemical reactions between alkalis and aggregates.
- O. The grading of all aggregate, when analyzed, shall be as per ASTM C 33 for the nominal size of aggregate specified.
- P. The Contractor shall carry out routine testing of aggregates for compliance with the specification during the period in which concrete is being produced for the Permanent

Works. The routine tests include but are not limited to grading, silt and clay content, moisture content, check an organic impurities and chloride content. These tests shall be performed on aggregates from each separate source on the basis of one set of tests for each day on which aggregates are delivered to site provided that no set of tests shall represent more than 250 tones of coarse aggregate and provided also that the aggregates are of uniform quality.

2.3 WATER

- A. The water to be used in mixing concrete shall be clean and free from all harmful matter in suspension or solution and shall satisfy the recommendations given in ASTM C94. If directed by the Supervisor, the Contractor shall carry out tests in accordance with ASTM C 94 to establish compliance with the Specification.

2.4 ADMIXTURES

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. Suitable admixtures may be used only with the prior written approval of the Supervisor. Both the proposed dosage and method of use shall be submitted to the Supervisor together with the following data:
 - 1. The typical dosage and detrimental effects of under-dosage and over-dosage.
 - 2. The chemical name(s) of the main active ingredient(s) in the admixtures.
 - 3. Whether or not the admixtures contain chlorides and, if so, the chloride content of the admixture expressed as a percentage of equivalent anhydrous calcium chloride by weight of admixture.
 - 4. Whether or not the admixture leads to the entrainment of air when used at the manufacturer's recommended dosage.
- C. Unless otherwise agreed on, an admixture shall comply with one of the following standards:
 - 1. ASTM C 618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 2. ASTM C 260 - Air-Entraining Admixtures for Concrete.
 - 3. ASTM C 494 - Chemical Admixtures for Concrete
 - 4. ASTM C1240 - Amorphous Silica (Cementitious material other than Portland cement) Micro Silica. Limit percentage by weight in concrete to 7%.
 - 5. ASTM C1017 - Plasticizing

2.5 ACCESSORIES

- A. Bonding Agent: Two component modified epoxy resin bonding agent, mineral filled polysulfide polymer epoxy, unless otherwise indicated on drawings.
- B. Vapor Retarder: ASTM E1745; 0.25 mm thick clear polyethylene film; type recommended for below grade application. Furnish joint tape recommended by manufacturer.
- C. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 17 MPa in 48 hours and 48 MPa in 28 days.

- D. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 896 MPa; toughness 103 MPa; 19 mm long fibers, 34 million per 0.6 kg/cu m fiber count.

2.6 PLASTIC SHEETING

- A. The plastic or polythene sheeting material for placing, where shown, immediately below concrete slabs, foundations, etc., and for other uses as defined elsewhere in the specification, shall be a film of 300 microns nominal thickness and a minimum thickness of 250 microns meeting the requirements of ASTM C171. The material shall be chemically inert and unaffected by subsoil acids and alkalis. The sheeting shall be stored out of the direct rays of the sun. All joints in the plastic sheeting shall be made with jointing tape and minimum laps shall be 300 mm.

2.7 WATERPROOFING MEMBRANE

- A. Where indicated on the drawings, waterproofing membrane to roof and to top of roof shall conform to Section 07535 - Single Ply Roofing Protected Membrane.

2.8 WATERPROOFING PAINT

- A. Where indicated on the drawings, waterproofing paint to horizontal and vertical concrete surfaces below ground level (basements, underground tanks, planters, etc.) shall conform to Section 07140 - Sheet Waterproofing.

2.9 WATERSTOPS

- A. Waterstops shall conform to the requirements of Section 03100: Concrete Forms and Accessories.

2.10 REJECTED MATERIALS

- A. All materials which have been damaged or are contaminated or unidentifiable or do not in all respects comply with the Specification shall be rejected and removed immediately from the site at the Contractor's expense.

2.11 TESTING LABORATORY AND EQUIPMENT

- A. The Contractor shall submit for approval the name of the Testing Authority he proposes to employ in accordance with Section 01400 - Quality Requirements: Testing Services. He shall, in addition maintain at the site the following apparatus which shall be kept in good repair throughout the Contract:
 1. Apparatus for assessing workability in accordance with ACI 304.
 2. Apparatus for making concrete cylinders in accordance with ASTM C470.
 3. A maximum and minimum thermometer to be kept on the Site close to the Works for measuring atmospheric shade temperature.
 4. Two soil thermometers for measuring concrete and ground temperature.
 5. A wet and dry bulb thermometer for measuring relative humidity.

2.12 TESTS

- A. All tests and checks carried out on site shall be in the presence of or as directed by the Supervisor. The Contractor shall be responsible for carrying out all tests required by

the Specification or called for by the Supervisor. Unless otherwise specified the costs of all tests required are to be met by the Contractor whether the test results show the material or workmanship to be satisfactory for the work or not.

- B. If the Contractor proposes to adopt a designed concrete mix then he shall be responsible for carrying out the preliminary tests in accordance with this section of the Specification and send the results to the Supervisor before placing any structural grade concrete made from the materials to be tested. No structural concrete shall be placed in the works until the relevant mix has been approved by the Supervisor. The preliminary tests shall be carried out at the start of the contract on samples of the materials the Contractor intends to use on structural concrete grades. The preliminary tests shall be repeated whenever the Contractor proposes to change his source of supply and whenever in the opinion of the Supervisor there was sufficient variation from the previously approved sample that new tests are required.

2.13 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler: ASTM D1751 and/or ASTM D994; Asphalt impregnated fiberboard or felt, 6 mm thick; tongue and groove profile.
- B. Construction Joint Devices: Integral galvanized steel; formed to tongue and groove profile, knockout holes spaced at 150 mm, ribbed steel spikes with tongue to fit top screed edge.
- C. Expansion and Contraction Joint Devices: ASTM B221M, extruded aluminum; resilient elastomeric, vinyl or neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum or vinyl cover plate, of longest manufactured length at each location, mounted as indicated on drawings; color as selected.
- D. Dowels: As specified in section 03200; diameter and length as shown on drawings.
- E. Waterstops shall conform to the requirements of Section 03100: Concrete Forms and Accessories.
- F. Prefabricated Filling Materials: Type "Celotex" or similar approved; thickness as joint width.
- G. Fire Retardant Filler: Fireproof seals as per manufacturer's recommendations and of approved type.
- H. Backing Rod: As per manufacturer's recommendations and of approved type.
- I. Sealant and Primer: Type as specified in Section 07900.
- J. Staifix Dowels: Stainless steel type 316, conforming to ASTM A276; minimum tensile strength 850 N/mm²; spaced at 400mm center to center; of the following types:
1. DSD 50, DSD 65, DSD 75, DSD 100, DSD 130 and DSD 150.
 2. DSDQ 30, DSDQ 50, DSDQ 100, and DSDQ 130.

2.14 CONCRETE MIX

- A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301.
- C. Select aggregate proportions for light weight concrete in accordance with ASTM C330, ACI 301 or ACI 318M.
- D. Prepare and submit Mix Design and Test Results of Mix Trials to the approval of the Supervisor for the following different types and classes of concrete:

| Structures and Beds | ASTM C 150 Cement | Minimum Compressive Strength at 28 days on: | | Slump (±25mm) (mm) | Water to Cement Ratio | Cement Content (kg/m³) |
|-------------------------------|-------------------------|--|----------------|--------------------------|-----------------------------|------------------------------|
| | | cylinders (MPa) | cubes (MPa) | | | |
| Blinking for foundation beds. | Type I | 15 | 18 | 180 | 0.60 | 250 |
| Walls and columns. | Type I | 30 | 36 | 180 | 0.42 | 350 |
| All other concrete works. | Type I | 25 | 30 | 180 | 0.42 | 350 |

- E. Concrete with only fine aggregate (less than or equal to 9 mm) may be used for highly reinforced elements or for elements with small thicknesses.
- F. The concrete slump of the different classes of concrete shall be measured in accordance with ASTM C 143.
- G. Admixtures: Include admixture types and quantities indicated in concrete mix designs approved through submittal process:
1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
 2. Use calcium chloride only when directed by the Supervisor.
 3. Use set retarding admixtures during hot weather.
 4. Add air entraining agent to normal weight concrete mix for work exposed to exterior.
 5. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete as required for workability.
 6. Use water-reducing admixture for concrete required to be watertight and concrete with a water-cement ratio below 0.50.
 7. Limit water-soluble chloride content in hardened concrete to 0.05 percent by weight of cement.

2.15 CYCLOPEAN CONCRETE

- A. Cyclopean concrete shall comprise 60% of the specified concrete and 40% "spalls" ranging in size from 100 to 250 mm.
- B. Stone and concrete shall be placed in alternate layers and in such a way that no stone shall be in contact with another or with shuttering sides. All faces of the cyclopean concrete shall show sound well compacted concrete.
- C. Spalls or boulders shall be free from sharp or angular edges, clean and free from dirt or earth, and soaked in water prior to incorporated into the concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.3 QUALITY CONTROL OF CONCRETE PRODUCTION

- A. Three ready mix concrete suppliers shall be submitted for the Supervisor one of which will be approved. The Contractor shall submit, for each proposed supplier, plant and mix results of full scale trial mixes. The average strength obtained in 28 days tests from these trials shall exceed the specified cylinder strength by at least the value given in 5.3.2.2 of ACI 318-95. The average strength (f^l_{cr}) of delivered concrete shall have an average strength (f^l_{cr}) equal or exceed the average strength (f^l_{cr}) of the approval design mixes.
- B. The Contractor shall submit standard deviations for each supplier and plant, derived from results tested by an independent agency, on a recent construction project of similar size. All records shall be made available to the Supervisor upon request.
- C. For each class of concrete in production at each plant for use in the Permanent Works, sample of concrete shall be taken at the point of discharge from the mixer or the ready mix delivery vehicle as instructed by the Supervisor and in the presence of a representative of the Supervisor, all in accordance with the sampling procedures described in ASTM C31. Slump test shall be carried out in accordance with the requirements of ASTM C 143 whenever the Supervisor may require it.
- D. Concrete cylinder shall be 150mm diameter. Samples shall be taken for every 20 cubic meters of concrete placed with a minimum of one sample taken every day on which the mix is used. From each sample three cylinders shall be made, one for testing seven days after casting and two for testing 28 days after casting. The average strength of the two cylinders crushed at 28 days shall be referred to as one test result.
- E. Field cured samples shall be provided conforming to ASTM C 31 as directed by the Supervisor.
- F. Concrete shall be deemed to comply with the strength specified if both of the following requirements are met:
 - 1. Every arithmetic average of any three consecutive strength tests equals or exceeds the average strength (f^l_{cr}) at 28 days, and
 - 2. No individual strength test (average of two cylinders) falls below the specified average strength (f^l_{cr}) at 28 days by more than 3.5 N/mm².

- G. If any strength test of laboratory-cured cylinders falls below specified value (f^l_{cr}) by more than 3.5 N/mm² or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized.

If the likelihood of low-strength concrete is confirmed and calculations indicate that load-carrying capacity is significantly reduced, tests of cores drilled from the area in question in accordance with ASTM C42 shall be carried out. In such cases, three cores shall be taken for each strength test more than 3.5 N/mm² below the specified strength value of (f^l_c).

If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 15 to 25°C, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 40 hr and be tested wet.

Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of (f^l_c) and if no single core is less than 75 percent of (f^l_c). Additional testing of cores extracted from locations represented by erratic core strength results shall be permitted.

If the above criteria are not met and if the structural adequacy remains in doubt, the Supervisor's decision for the appropriate action shall be followed.

- H. Cylinders shall be clearly marked with the date of casting and accurate records shall be supplied to the Supervisor, stating dates of taking and testing of samples, together with the results of tests and the exact position from which the sample was taken.

3.4 MIXING CONCRETE

- A. Unless otherwise agreed by the Supervisor concrete shall be mixed in an approved type of mechanical weigh-batcher. No hand mixing will be allowed.
- B. The weighing and water-dispensing mechanisms shall be maintained in good order.
- C. The weights of cement and each size of aggregate as indicated by the mechanisms employed shall be within a tolerance of +/- 2 percent of the respective weights per batch agreed by the Supervisor. The weight of the fine and coarse aggregates shall be adjusted to allow for the free water contained in the fine and coarse aggregates which shall be determined by the Contractor by a method approved by the Supervisor immediately before mixing begins, and further as the Supervisor requires.
- D. The materials shall be mixed until they are uniformly distributed and the mass is of uniform consistency and colour, but in no case shall the mixing time be less than two minutes after all the materials have been added to the drum. The drum on all mixers shall revolve at the speeds recommended by the manufacturer.
- E. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
- F. Delivery notes with each batch delivered shall record the following:

1. Date and time of arrival
2. Time and place of mixing
3. Registration of truck and depot
4. Time and place of adding water
5. Mix class
6. Details of any approved additives

3.5 TRANSPORT AND PLACING OF CONCRETE

- A. The method of transporting and placing concrete shall be to the approval of the Supervisor. Concrete shall be so transported and placed that contamination, segregation or loss of constituent materials does not occur.
- B. All formwork and reinforcement contained in it shall be clean and free from standing water immediately before the placing of the concrete.
- C. Concrete shall not be placed in any part of the structure until the Supervisor's approval has been given.
- D. If concreting is not started within 24 hours of approval being given, approval shall again be obtained from the Supervisor. Concreting shall then proceed continuously over the area between construction joints. Fresh concrete shall not be placed against in situ concrete which has been in position for more than 30-minutes unless a construction joint is formed in accordance with this specification. When in situ concrete has been in place for 4 hours no further concrete shall be placed against it for a further 20 hours.
- E. Concrete when deposited shall have a temperature of not less than 5°C and not more than 28°C except with the approval of the Supervisor.
- F. Except in the case of columns or where otherwise agreed by the Supervisor, concrete shall be deposited in horizontal layers to a compacted depth not exceeding 300 mm and each layer shall be well consolidated before the subsequent layer is placed.
- G. Except in the case of columns or unless otherwise agreed by the Supervisor, concrete shall not be dropped into place from a height exceeding 2 meters. When trunking or chutes are used they shall be kept clean and used in such a way as to avoid segregation.
- H. Concrete shall not be pumped or discharge through aluminum or alloy conduits. Concreting shall be carried out continuously and no concrete shall be placed on concrete which has sufficiently set as to cause the formation of seams or planes of weakness with the section. Where concrete cannot be placed continuously, construction joints as specified shall be formed, only where shown on the drawings or approved by the Supervisor.
- I. The time elapsing between mixing and placing a batch of concrete shall be as short as practicable. The time should be no longer than will permit completion of placing and compaction before the onset of initial set and in any case no longer than one hour from the time the water is added to the mix.

3.6 PLACEMENT OF CONCRETE IN LARGE SECTIONS

- A. The Contractor shall submit his proposals for the casting of the large concrete sections, where the minimum dimension is greater than 500mm, which shall include, but not limited to, proposed methods for controlling generated heat of hydration with supporting calculations, temperature monitoring and curing. Proposals shall comply with the recommendations of ACI 207.1, ACI 207.2, ACI 207.4, ACI 211.1 and ACI 224.3. All proposals shall be subject to the Supervisor's approval.
- B. The temperature of the concrete in large sections shall be monitored through the section by the use of thermocouples. The Contractor shall ensure that the temperature of the concrete does not exceed 70°C and that any temperature differential (centre to surface) across the section does not exceed 30°C. Temperature monitoring shall be continued until the temperature in the hottest part of the section is less than 20°C greater than the minimum daily ambient temperature, unless otherwise agreed with the Supervisor.

3.7 INTERRUPTIONS TO PLACING

- A. If concrete placing is interrupted for any reason and the duration of the interruption cannot be forecast or is likely to be prolonged, the Contractor shall immediately take the necessary action to form a construction joint so as to eliminate as far as possible feather edges and sloping top surfaces and shall thoroughly compact the concrete already placed. All work on the concrete shall be completed while it is still plastic and it shall not thereafter be disturbed until it is hard enough to resist damage. Plant and materials to comply with this requirement shall be readily available at all times during concrete placing.
- B. Before concreting is resumed after such an interruption the Contractor shall cut out and remove all damaged or uncompacted concrete, feather edges or any other undesirable features and shall leave a clean sound surface against which the fresh concrete may be placed.
- C. If it becomes possible to resume concrete placing without contravening the Specification and the Supervisor consents to a resumption, the new concrete shall be thoroughly worked in and compacted against the existing concrete so as to eliminate any cold joints.

3.8 PUMPED CONCRETE

- A. If it is the Contractor's intention to transport concrete by pumping he is to obtain the Supervisor's written approval at the commencement of the Contract. When submitting his proposals to the Supervisor the Contractor must furnish the Supervisor with full details of the mix design, the area and volume of concrete that he intends to place in an operation and the distance over which the concrete is to be pumped. The foregoing Clause on mix design will apply equally to a concrete that is designed to be "pumped".

3.9 PLACING CONCRETE - GENERAL

- A. Place concrete in accordance with ACI 301 and/or ACI 318M.
- B. Notify the Supervisor minimum 24 hours prior to commencement of operations.

- C. Ensure reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.
- D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 150 mm and seal watertight by adhesive applied between overlapping edges and ends or by taping edges and ends.
- E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 150 mm and seal watertight.
- F. Separate slabs on grade from vertical surfaces with joint filler as instructed by the manufacturer.
- G. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- H. Extend joint filler from bottom of slab to within 13 mm of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.
- I. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- J. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- K. Install joint covers in longest practical length, when adjacent construction activity is complete.
- L. Apply sealants in joint devices in accordance with Section 07900.
- M. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- N. Place concrete continuously between predetermined expansion, control, and construction joints.
- O. Do not interrupt successive placement; do not permit cold joints to occur.
- P. Place floor slabs in pattern as indicated.
- Q. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- R. Screed floors level, maintaining surface flatness of maximum 6 mm in 3 m.

3.10 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping where required, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers and other items to be cast in.

- C. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.
- D. Place concrete floor toppings to required lines and levels.
- E. Screed toppings level, maintaining surface flatness of maximum 3 mm /3 m.

3.11 COMPACTION OF CONCRETE

- A. All concrete shall be compacted to produce a dense homogeneous mass. Unless otherwise agreed by the Supervisor, it shall be compacted with the assistance of mechanical vibratory, and sufficient mechanical vibrators in serviceable condition shall be on site so that spare equipment is always available in the event of breakdown.
- B. Mechanical vibrators shall be of the immersion type capable of operating at between 7,000 and 10,000 cycles per minute.
- C. No vibrator shall be operated by a workman who has had insufficient training in its use.
- D. With immersion vibrators the tubular part of the tool shall be inserted vertically into the full depth of the concrete to be vibrated at points 600mm apart and at least 100mm away from any formwork. The vibrators shall be kept constantly moving whilst in action to prevent segregation. Vibration shall not be applied directly or through the formwork or reinforcement to sections or layers of concrete which have taken their initial set or to concrete which has ceased to become plastic under vibration. Vibration shall be stopped after the decrease in volume is no longer apparent or before localized areas of grout or laitance are formed. Should the supply of concrete from the mixer be interrupted the vibrators should be lifted clear from the work.
- E. Care shall be taken to ensure that concrete is fully compacted around waterstops without distorting, displacing or damaging the waterstops.

3.12 CONCRETE FINISHING

- A. Provide formed concrete surfaces to be left exposed as indicated on drawings and/or as scheduled.
- B. Wood float surfaces receiving quarry tile, ceramic tile, and/or terrazzo with full bed setting system.
- C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set quarry tile, and/or thin set ceramic tile.
- D. Steel trowel surfaces that are indicated to be exposed.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.
- F. Where indicated on drawings, concrete shall be fair faced offering a very smooth texture using plywood as formwork and proper surface treatment.

- G. Stamped concrete as shown on drawings shall be surface treated and stamped using the designs shown in the drawings.

3.13 PROTECTION OF FRESH CONCRETE

- A. Freshly placed concrete shall be protected from rainfall and from water running over the surface until it is sufficiently hard to resist damage from this cause.
- B. No traffic shall be allowed on any concrete surface until such time as it is hard enough to resist damage by such traffic.
- C. Concrete placed in the Permanent Works shall not be subjected to any structural loading until it has attained at least its minimum average strength as defined previously.

3.14 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure concrete floor surfaces to requirements of Section 03390.
- D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.
- E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.15 CONCRETING IN HOT WEATHER

- A. On exposed concrete surface in high sun temperatures and/or strong drying wind conditions the Contractor shall use a curing method which also shields the concrete and this shall be placed in position no later than half an hour after final tamping. If the surface exhibits cracking while the concrete is still plastic then it shall be retamped to close the cracks.
- B. The Contractor shall plan the day's concreting in such a manner as to ensure that each bay or panel is completed at a proper construction joint before the temperature rises above the permissible limit.
- C. The temperature of fresh mixed concrete at the point of placement shall not exceed 28°C and the Contractor should take all necessary precautions to ensure that the limit is not exceeded. Concrete with a temperature less than 28°C can be produced by combinations of the following methods:
 - 1. Use of sliced, flaked or crushed ice to reduce temperature of mixing water. All ice shall be melted before adding to concrete.
 - 2. Night casting (subject to the prior approval of the Supervisor)
 - 3. Shading of aggregates
 - 4. Moistening of aggregates with potable water
 - 5. Cooling of formwork and reinforcement
 - 6. Using cement with a temperature of less than 77°C

7. Use of white or light reflective paints on mixer drums and water storage tanks.
8. Shading of the mixing area.

3.16 PROTECTION TO SUBSTRUCTURE

- A. Roofing membrane in accordance with the requirements of Section 07535 - Single Ply Roofing Protected Membrane.
- B. Bituminous coating shall be applied with approved primer to concrete surfaces in contact with soil excluding surfaces receiving waterproofing membrane. Bituminous coating shall be applied in accordance with the requirements of Section 07140.
- C. Waterstops shall be installed in accordance with Section 03100: Concrete Forms and Accessories.
- D. Except where indicated otherwise on the drawings or agreed by the Supervisor, all buried concrete surfaces, exposed after the removal of formwork, shall be protected using a bituminous paint-on material. It shall consist of bitumen priming coat and a finishing coat of fiber reinforced bitumen. This membrane shall be applied before and in addition to the polythene sheet.

3.17 LIQUID CONTAINING CONSTRUCTION

- A. All liquid containing construction shall be tested to ensure no leakage or damp penetration. The testing shall be carried out before waterproofing backing or other finishes are applied to the construction and before back-filling any excavation.
- B. The Contractor shall seal completely all drains and fill the construction with clean water to a predetermined level. One filled the level is to be recorded at daily intervals for a period of fourteen days or as otherwise directed by the Supervisor. Measures shall be taken by the Contractor to ensure that the level of water is not affected by rainfall or undue evaporation.
- C. Should it be apparent from the test results, external inspection or any other source that leakage or damp penetration has occurred then remedial work to make the construction completely watertight shall be carried out at the Contractors expense and to the Supervisors approval. The construction shall be retested until the results are satisfactory.

3.18 PATCHING

- A. Allow the Supervisor to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify the Supervisor upon discovery.
- C. Patch imperfections in accordance with ACI 301.

3.19 DEFECTIVE WORK

- A. Any remedial treatment to surfaces shall be agreed with the Supervisor following inspection immediately after removing the formwork and shall be carried out without delay.
- B. Any concrete, the surface of which has been treated before being inspected by the Supervisor, shall be liable for rejection.
- C. Any concrete which in the opinion of the Supervisor is damaged or is in any way defective due to lack of compliance with any of the foregoing Clauses, or is not true to an acceptable line or level compatible with the requirements of second fixings and finishes, then this work will be deemed unacceptable and rejected.
- D. Where rejected work has to be cut out or re-built, the operation shall be carried out by the Contractor at his own expense and without delay.
- E. The extent of the work to be removed and the methods to be used in the removal and replacement of this work shall be proposed by the Contractor for the Supervisor's approval.
- F. The Supervisor's approval must be obtained before any cutting of concrete is carried out. If such cutting of concrete is carried out without the Supervisor's approval the affected areas shall be classified as defective. The Contractor is responsible for ensuring that a copy of this clause is given to each of his subcontractors, nominated or otherwise, and that they abide by it.
- G. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of the Supervisor for each individual area.

3.20 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01400.
- C. Provide free access to Work and cooperate with appointed firm.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- E. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- F. Three concrete test cylinders will be taken for each 57 m³ of each class of concrete placed.
- G. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
- H. One slump test will be taken for each set of test cylinders taken.
- I. One air content test will be made for each set of test cylinders taken.

- J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.21 SCHEDULE - CONCRETE TYPES AND FINISHES

- A. As indicated on drawings and where directed by the Supervisor.

3.22 SCHEDULE - JOINT FILLERS

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 03350 CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Finishing concrete surfaces.
 - 2. Surface treatment.
- B. Related Sections:
 - 1. Section 03300 - Cast-in-Place Concrete.
 - 2. Section 03390 - Concrete Curing.
 - 3. Section 07900 - Joint Sealers.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
- B. ASTM International:
 - 1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on concrete hardener, sealer, curing compounds and slip resistant treatment, compatibilities, and limitations.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.1.
- B. Perform Work in accordance with the drawings and to the satisfaction of the Supervisor.
- C. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.

- B. Deliver materials in manufacturer's packaging including application instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.
- B. Temporary Lighting: Minimum 200 W light source, placed 2500 mm above floor surface, for each 40 m² of floor being finished.
- C. Temporary Heat: Ambient temperature of 10 degrees C minimum.
- D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.8 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with concrete floor placement and concrete floor curing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPOUNDS - HARDENERS AND SEALERS

- A. Chemical Hardener: Magnesium fluorosilicate and zinc fluorosilicate blend, dry powder or liquid type.
- B. Metallic Hardener: Premixed, dry powder, colored, static disseminating, light reflective, oxidizable metallic, and/or spark resistant hardener.
- C. Non-Metallic Hardener: Premixed or dry powder, colored or clear, emery aggregate or quartz aggregate, abrasion resistant hardener.
- D. Colored Sealer: type as per manufacturer's recommendations.
- E. Exposed Aggregate Retarder for Flat Surfaces: color as selected from manufacturer's standard range, type as per manufacturer's recommendations.

2.3 SLIP RESISTANT TREATMENT

- A. Slip Resistant Finish: Aluminum oxide or Silica sand type, color as selected from manufacturer's standard range.
- B. Abrasive Aggregate: 95 percent minimum fused homogeneous aluminum oxide, Crushed emery, minimum 45 percent aluminum oxide, ferric oxide, minimum 25 percent, and/or Silicone carbide.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify floor surfaces are acceptable to receive the Work of this section.

3.2 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.
- B. Wood float surfaces receiving quarry tile, ceramic tile and cementitious terrazzo with full bed setting system.
- C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, and thin set terrazzo, quarry tile and ceramic tile.
- D. Power float surfaces which are indicated to be exposed and all surfaces which are directed by the Supervisor:
 - 1. Consolidate surface with power driven floats as soon as topping can support equipment and operator.
 - 2. Re-straighten, cut down high spots, and fill low spots.
 - 3. Repeat float passes and re-straightening until surface is smooth and uniform in texture, and to the satisfaction of the Supervisor.
- E. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on Drawings.

3.3 FLOOR SURFACE TREATMENT

- A. Apply dry shake or liquid hardener on floor surfaces where indicated on drawings.
- B. Apply slip resistant finish on floor surfaces where indicated on drawings.
- C. Apply sealer on floor surfaces where indicated on drawings.
- D. Apply retarder to exposed aggregate or troweled finish on floor surfaces where indicated on drawings.

3.4 TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation of Surface Flatness for Exposed Concrete Floors: 3 mm in 3 m.
- C. Maximum Variation of Surface Flatness under Seamless Resilient Flooring: 3 mm in 3 m.
- D. Maximum Variation of Surface Flatness under Carpeting: 3 mm in 3 m.
- E. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

3.5 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 03390 CONCRETE CURING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes initial and final curing of horizontal and vertical concrete surfaces.
- B. Related Sections:
 - 1. Section 03300 - Cast-In-Place Concrete.
 - 2. Section 03350 - Concrete Finishing.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
 - 3. ACI 308 - Standard Practice for Curing Concrete.
- B. ASTM International:
 - 1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on curing compounds, mats, paper, film, compatibilities, and limitations.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.1.
- B. Perform Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.
- C. Maintain one copy of each document on site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Deliver curing materials in manufacturer's packages; include application instructions.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. Membrane Curing Compound: ASTM C309.
- C. Non-Membrane Forming Curing Compound: Liquid, penetrating silicate based type; combination curing, hardening and dustproofing compound.
- D. Absorptive Mats: ASTM C171.
- E. Waterproof Paper: ASTM C171, treated to prevent separation during handling and placing, standard or white color.
- F. Polyethylene Film: ASTM C171 and/or ASTM D2103, 0.15 mm thick, color as selected.
- G. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces are ready to be cured.

3.2 INSTALLATION - HORIZONTAL SURFACES

- A. Cure surfaces in accordance with ACI 308.
- B. Ponding: Maintain 100 percent coverage of water over concrete areas, continuously for 4 days.
- C. Spraying: Spray water over areas and maintain wet for 7 days.
- D. Membrane Curing Compound: Apply curing compound in two coats with second coat applied at right angles to first.
- E. Non-Membrane Forming Curing Compound: Apply curing compound in one coat. Maintain surface wet with curing compound, without ponding for time recommended by manufacturer.
- F. Polyethylene Film: Spread over floor slab areas, lap edges and sides, seal with pressure sensitive tape and cover with plywood, unless otherwise directed; maintain in place for 7 days.

3.3 INSTALLATION - VERTICAL SURFACES

- A. Cure surfaces in accordance with ACI 308.
- B. Spraying: Spray water over surfaces and maintain wet for 7 days.
- C. Membrane Curing Compound: Apply compound in two coats with second coat applied at right angles to first.
- D. Non-Membrane Forming Curing Compound: Apply curing compound in one coat. Maintain surface wet with curing compound, without ponding for time recommended by manufacturer.

3.4 PROTECTION OF FINISHED WORK

- A. Section 01700 - Execution Requirement: Protecting finished Work.
- B. Do not permit traffic over unprotected floor surface.

3.5 SCHEDULES

- A. As indicated on drawings and/or directed by the Supervisor.

END OF SECTION

SECTION 04065

MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes mortar and grout for masonry.
- B. Related Sections:
1. Section 04810 - Unit Masonry Assemblies: Installation of mortar and grout.
 2. Section 08115 - Standard Steel Frames.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
1. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
 2. ASTM C91 - Standard Specification for Masonry Cement.
 3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 4. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
 5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 6. ASTM C150 - Standard Specification for Portland Cement.
 7. ASTM C199 - Standard Test Method for Pier Test for Refractory Mortars.
 8. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 9. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
 10. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
 11. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
 12. ASTM C476 - Standard Specification for Grout for Masonry.
 13. ASTM C595M - Standard Specification for Blended Hydraulic Cements (Metric).
 14. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 15. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
 16. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
 17. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
 18. ASTM C1329 - Standard Specification for Mortar Cement.

19. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

B. The Masonry Society:

1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- D. Test Reports: Not Applicable.
- E. Manufacturer's Installation Instructions: Submit premix mortar manufacturer's installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.
- B. Maintain one copy of each document on site.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Hot and Cold Weather Requirements: TMS MSJC Specification.

PART 2 PRODUCTS

2.1 MORTAR AND MASONRY GROUT

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Portland Cement: ASTM C150, Type I, gray color.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Grout Aggregate: ASTM C404, fine and/or coarse.

- D. Water: Clean and potable.
- E. Calcium chloride is not permitted.

2.3 MIXES

- A. Mortar Mixes:
 - 1. Mortar for Structural Masonry: ASTM C270, Type M, S, and/or N, using Proportion specification.
 - 2. Mortar for Non-Structural Masonry: ASTM C270, Type M, S, N, and/or O, using Proportion specification.
 - 3. Pointing Mortar: ASTM C270, Type N and/or O, using Proportion specification.
 - 4. Stain Resistant Pointing Mortar: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.
 - 5. Mortar for Glass Unit Masonry: ASTM C270, Type S and/or N, using Proportion specification.
 - 6. Pointing Mortar for Glass Unit Masonry: ASTM C270, Type O, using Proportion specification; with maximum 2 percent ammonium stearate or calcium stearate per cement weight with beach or silica sand aggregate.
- B. Mortar Mixing:
 - 1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
 - 2. Achieve uniformly damp sand immediately before mixing process.
 - 3. Add admixtures in accordance with manufacturer's instructions to achieve uniformity of mix and coloration.
 - 4. Re-temper only within two hours of mixing.
- C. Grout Mixes:
 - 1. Grout for Non-Structural Masonry: 14 MPa strength at 28 days; 200 to 280 mm slump; mixed in accordance with ASTM C476 Fine and/or Coarse grout.
 - 2. Grout for Structural Masonry: 14 MPa strength at 28 days; 200 to 280 mm slump; mixed in accordance with ASTM C476 Fine and/or Coarse grout.
 - 3. Application:
 - a. Coarse Grout: For grouting spaces with minimum 100 mm dimension in every direction.
 - b. Fine Grout: For grouting other spaces.
- D. Grout Mixing:
 - 1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
 - 2. Add admixtures in accordance with manufacturer's instructions and mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Request inspection of spaces to be grouted.

3.2 PREPARATION

- A. Apply bonding agent to existing concrete surfaces in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. Install mortar and grout in accordance with TMS MSJC Specification.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
- C. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.
- D. Test flexural bond strength of mortar and masonry units to ASTM C1357; test in conjunction with masonry unit sections specified.
- E. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

3.5 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 04810

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes concrete masonry units.
- B. Related Sections:
1. Section 04065 - Masonry Mortar and Grout: Mortar and grout.
 2. Section 05500 - Metal Fabrications: Product requirements for loose steel lintels, fabricated steel items, etc., for placement by this section.
 3. Section 07260 - Vapor Retarders: Vapor retarder membrane placed on interior face of wall insulation.
 4. Section 07270 - Air Barriers: Air barrier placed on interior face of wall insulation.
 5. Section 07620 - Sheet Metal Flashing and Trim: Product requirements for reglets for flashings for placement by this section.
 6. Section 07900 - Joint Sealers: Rod and sealant at control or expansion joints.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
1. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 2. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
 3. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 4. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 6. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 7. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
 8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 9. ASTM C34 - Standard Specification for Structural Clay Load-Bearing Wall Tile.
 10. ASTM C55 - Standard Specification for Concrete Brick.

11. ASTM C56 - Standard Specification for Structural Clay Non-Load-Bearing Tile.
12. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
13. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
14. ASTM C73 - Standard Specification for Calcium Silicate Face Brick (Sand-Lime Brick).
15. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
16. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
17. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
18. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
19. ASTM C212 - Standard Specification for Structural Clay Facing Tile.
20. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
21. ASTM C315 - Standard Specification for Clay Flue Linings.
22. ASTM C530 - Standard Specification for Structural Clay Non-Loadbearing Screen Tile.
23. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
24. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
25. ASTM C1261 - Standard Specification for Firebox Brick for Residential Fireplaces.
26. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

B. The Masonry Society:

1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Product Data: Submit data for concrete masonry units and fabricated wire reinforcement, wall ties, anchors and all other accessories.
- C. Samples: Submit four samples of concrete masonry units to illustrate color, texture and extremes of color range.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.
- B. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Accept concrete masonry units on site. Inspect for damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Hot and Cold Weather Requirements: TMS MSJC Specification.

1.9 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate masonry work with stone cut veneer, installation of window and door anchors.

1.10 EXTRA MATERIALS

Not Applicable.

PART 2 PRODUCTS

2.1 UNIT MASONRY ASSEMBLIES

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Hollow Load-Bearing Concrete Masonry Units (CMU): ASTM C90, Type I - Moisture Controlled and/or Type II - Non-moisture Controlled; normal, medium and/or light weight.
- B. Solid Load-Bearing Concrete Masonry Units (CMU): ASTM C90, Type I - Moisture Controlled and/or Type II - Non-moisture Controlled; normal, medium and/or light weight.

- C. Hollow and/or Solid Non-Load Bearing Concrete Masonry Units (CMU): ASTM C90, Type I - Moisture Controlled and/or Type II - Non-moisture Controlled; normal, medium and/or light weight.
- D. Size and Shape: Of Nominal modular size as shown on drawings and/or as directed by the Supervisor. Furnish special units for 90° corners, bond beams, lintels, coved base and bullnosed corners.

2.3 ACCESSORIES

- A. Single Wythe Joint Reinforcement: Truss and/or Ladder type; stainless steel type 316, conforming to ASTM A580/A580M, 4.8 mm side rods.
- B. Multiple Wythe Joint Reinforcement: Truss and/or Ladder type; with moisture drip; adjustable type, stainless steel type 316, conforming to ASTM A580/A580M, 4.8 mm side rods.
- C. Reinforcing Steel: As specified in section 03200.
- D. Head Restraints: Austenitic stainless steel Ancon Head Restraints Type IHR-V or approved equal.
- E. Strap Anchors: hot dip galvanized to ASTM A153/A153M "B2" finish.
- F. Wall Ties: Corrugated formed sheet metal, hot dip galvanized to ASTM A153/A153M "B2" finish.
- G. Wall Ties: Formed steel wire, adjustable and/or eye and pintle type, hot dip galvanized to ASTM A153/A153M "B2" finish.
- H. Dovetail Anchors: Bent steel strap, galvanized to ASTM A153/A153M "B2" finish.
- I. Anchor Bolts: Headed, J-shaped or L-shaped.
- J. Mortar and Grout: As specified in Section 04065.
- K. Stainless Steel: ASTM A666, Type 316, soft temper, smooth finish.
- L. Lap Sealant: As specified in Section 07900.
- M. Preformed Control Joints: Rubber, Neoprene and/or Polyvinyl chloride material. Furnish with corner and tee accessories, and fused joints.
- N. Joint Filler: Closed cell polyvinyl chloride, polyethylene, polyurethane and/or rubber; oversized 50 percent to joint width; self expanding.
- O. Building Paper: ASTM D226, No. 15 and/or 30 asphalt saturated felt.
- P. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

- Q. Weeps: Preformed plastic tubes cotton wick filled and/or hollow, vents with sloping louvers, and/or cotton rope.
- R. Cavity Vents: Molded polyvinyl chloride grilles and/or Aluminum; insect resistant.
- S. Chimney Cap: Precast concrete, sized to cover chimney construction plus additional overhang for drip on four sides, slope from flue opening to edges for natural drainage.
- T. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- U. Precast Concrete Lintels: size as indicated on Drawings, 28 MPa strength at 28 days.
- V. Steel Lintels: size as indicated on Drawings, hot-dip galvanized.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: coordination and project conditions.
- B. Prepare location where masonry is to be erected including removal of existing obstructions or walls. Clear surfaces and prepare the same for masonry erection.
- C. Verify field conditions are acceptable and are ready to receive work.
- D. Verify items provided by other sections of work are properly sized and located.
- E. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

- A. Establish lines, levels and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.
- C. Coursing of Concrete Masonry Units:
 - 1. Bond: Running and/or Stacked.
 - 2. Coursing: One unit and one mortar joint to equal 200 mm.
 - 3. Mortar Joints: Concave, Raked, Flush and/or Beveled.
- D. Placing and Bonding:
 - 1. Lay solid masonry units in full bed of mortar, with full head joints.

2. Lay hollow masonry units with face shell bedding on head and bed joints.
 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 4. Remove excess mortar as work progresses.
 5. Interlock intersections and external corners.
 6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
 7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 8. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, cavity insulation vapor barrier adhesive is applied, and/or bitumen dampproofing is applied.
 9. Isolate masonry from vertical structural framing members with movement joint as indicated on Drawings and/or as directed by the Supervisor.
 10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
- E. Weeps and Vents: Furnish weeps and vents in outer wythe at 600 and/or 800 mm oc horizontally above through-wall flashing, above shelf angles and lintels, and/or at bottom of walls.
- F. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier adhesive.
- G. Joint Reinforcement and Anchorage - Single Wythe Masonry:
1. Install horizontal joint reinforcement 400 mm oc.
 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
 3. Place joint reinforcement continuous in first and second joint below top of walls.
 4. Lap joint reinforcement ends minimum 150 mm.
 5. Reinforce stack bonded unit joint corners and intersections with strap anchors 400 mm oc.
- H. Joint Reinforcement and Anchorage - Masonry Veneer:
1. Install horizontal joint reinforcement 400 mm oc.
 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
 3. Place joint reinforcement continuous in 1st and 2nd joint below top of walls.
 4. Lap joint reinforcement ends minimum 150 mm.
 5. Embed wall ties in masonry backing to bond veneer for every 0.25 sq m. Place at maximum 75 mm oc each way around perimeter of openings, within 300 mm of openings.
 6. Coordinate following with typical stud spacing of 16 or 24 inch oc.
 7. Secure wall ties and rod and/or strap anchors to stud framed backing and embed into masonry veneer at maximum 400 mm oc vertically and 900 mm oc horizontally. Place at maximum 75 mm oc each way around perimeter of openings, within 300 mm of openings.
 8. Reinforce stack bonded unit joint corners and intersections with strap anchors 400 mm oc.

- I. Joint Reinforcement and Anchorages - Cavity Wall Masonry:
 - 1. Install horizontal joint reinforcement 400 mm oc.
 - 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
 - 3. Place joint reinforcement continuous in first and second joint below top of walls.
 - 4. Lap joint reinforcement ends minimum 150 mm.
 - 5. Embed anchors in concrete. Attach to structural steel members.
 - 6. Reinforce stack bonded unit joint corners and intersections with strap anchors 400 mm oc.
- J. Reinforcement and Anchorages - Multiple Wythe Unit Masonry:
 - 1. Install horizontal joint reinforcement 400 mm oc.
 - 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
 - 3. Place joint reinforcement continuous in first and second joint below top of walls.
 - 4. Lap joint reinforcement ends minimum 150 mm.
 - 5. Support and secure reinforcing bars from displacement. Maintain position within 13 mm of dimensioned position.
 - 6. Embed anchors embedded in concrete or attached to structural steel members. Embed anchorages in every second block and/or sixth brick joint.
 - 7. Reinforce stack bonded unit joint corners and intersections with strap anchors 400 mm oc.
- K. Masonry Flashings:
 - 1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, and/or at bottom of walls, and turn down on outside face to form drip.
 - 2. Turn flashing up minimum 200 mm and bed into mortar joint of masonry, seal to concrete, and/or seal to sheathing over wood, steel stud and/or framed backing.
 - 3. Lap end joints minimum 150 mm and seal watertight.
 - 4. Turn flashing, fold, and seal at corners, bends, and interruptions.
- L. Lintels:
 - 1. Install precast or cast-in-situ concrete lintels over openings.
 - 2. Reinforcing bars for lintels shall be as indicated on drawings.
 - 3. Do not splice reinforcing bars.
 - 4. Support and secure reinforcing bars from displacement.
 - 5. Place and consolidate grout fill without displacing reinforcing.
 - 6. Allow masonry lintels to attain specified strength before removing temporary supports.
 - 7. Bearing on each side of opening shall be as indicated on drawings, but in no case shall be less than 200 mm.
- M. Grouted Components:
 - 1. Reinforce bond beam as indicated on drawings.
 - 2. Lap splices bar diameters required by code.
 - 3. Support and secure reinforcing bars from displacement.
 - 4. Place and consolidate grout fill without displacing reinforcing.

5. At bearing locations, fill masonry cores with grout for minimum 300 mm both sides of opening.
- N. Reinforced Masonry:
1. Lay masonry units with core and/or cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
 2. Place reinforcement bars as indicated on Drawings.
 3. Splice reinforcement in accordance with Section 03200.
 4. Support and secure reinforcement from displacement.
 5. Place and consolidate grout fill without displacing reinforcing.
 6. Place grout in accordance with TMS MSJC Specification.
- O. Control and Expansion Joints:
1. Do not continue horizontal joint reinforcement through control and expansion joints.
 2. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
 3. Size control joint in accordance with Section 07900 for sealant performance.
 4. Form expansion joint by omitting mortar and cutting unit to form open space.
- P. Built-In Work:
1. As work progresses, install built-in metal door and/or glazed frames, fabricated metal frames, window frames, wood nailing strips, fireplace accessories, anchor bolts, plates, and all other items to be built in the work and furnished by other sections.
 2. Install built-in items plumb and level.
 3. Bed anchors of metal door and/or glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 300 mm from framed openings.
 4. Do not build in materials subject to deterioration.
- Q. Cutting and Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and/or grounds. Coordinate with other sections of work to provide correct size, shape, and location.
 2. Obtain Supervisor's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.
- R. Parging:
1. Dampen masonry walls prior to parging.
 2. Scarify each parging coat to ensure full bond to subsequent coat.
 3. Parge masonry walls in two uniform coats of mortar to total thickness of 19 mm.
 4. Steel trowel surface smooth and flat with maximum surface variation of 1mm/m.
 5. Strike top edge of parging at 45 degrees.
- S. Install Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.

3.4 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Alignment of Columns: 6 mm.
- C. Maximum Variation from Unit to Adjacent Unit: 1.6 mm.
- D. Maximum Variation from Plane of Wall: 6 mm/3 m and 13 mm/6 m or more.
- E. Maximum Variation from Plumb: 6 mm per story non-cumulative; 13 mm in two stories or more.
- F. Maximum Variation from Level Coursing: 3 mm/m and 6 mm/3 m; 13 mm/9 m.
- G. Maximum Variation of Joint Thickness: 3 mm/m.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 6 mm.
- I. Maximum Variation for Steel Reinforcement:
 - 1. Plus or minus 13 mm when distance from centerline of steel to opposite face of masonry is 200 mm or less.
 - 2. Plus or minus 25 mm when distance is between 200 and 600 mm.
 - 3. Plus or minus 32 mm when distance is greater than 600 mm.
 - 4. Plus or minus 50 mm from location along face of wall.

3.5 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

3.6 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.7 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes shop fabricated metal items.
1. Structural Steel Roofing Structures
 2. Stainless Steel Furnishings with Sinks and accessories.
 3. Lintels.
 4. Ledge and shelf angles.
 5. Door frames.
 6. Bollards.
 7. Ladders.
 8. Structural supports for miscellaneous attachments.
 9. Stair nosings.
 10. Wall protection plates and corner guards.
 11. Anchor bolts.
 12. Foot scrapers.
 13. Waste Bins.
- B. Related Sections:
1. Section 03300 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
 2. Section 04810 - Unit Masonry Assemblies: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in masonry.
 3. Section 05520 – Handrails and Railings.
 4. Section 09900 - Paints and Coatings: Field applied paint finish.
 5. Section 16503 – Posts and Standards.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. Aluminum Association:
1. AA DAF-45 - Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 6. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
 7. ASTM A297/A297M - Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application.
 8. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength.
 10. ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
 11. ASTM A325M - Standard Specification for High-Strength Bolts for Structural Steel Joints (Metric).
 12. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
 13. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 14. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 15. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
 16. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings.
 17. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.
 18. ASTM B177 - Standard Guide for Chromium Electroplating on Steel for Engineering Use.
 19. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 20. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric).
 21. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric).

- 22. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- D. American Welding Society:
 - 1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - 2. AWS D1.1 - Structural Welding Code - Steel.
 - 3. AWS D1.6 - Structural Welding Code - Stainless Steel.
- E. National Ornamental & Miscellaneous Metals Association:
 - 1. NOMMA Guideline 1 - Joint Finishes.
- F. The Society for Protective Coatings (SSPC):
 - 1. SSPC - Steel Structures Painting Manual.
 - 2. SSPC SP 1 - Solvent Cleaning.
 - 3. SSPC SP 2 - Hand Tool Cleaning.
 - 4. SSPC SP 10 - Near-White Blast Cleaning.
 - 5. SSPC Paint 15 - Steel Joist Shop Paint.
 - 6. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic & Type II - Organic).

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.
- C. Shop Drawings for structural roofing with complete details: Indicate dimensions, panel profile and layout, spans, joints, expansion joints, construction details, methods of anchorage, method and sequence of installation and interface with adjacent materials.
- D. Samples: Submit two samples of each metalwork type, size as directed by the Supervisor, illustrating factory finishes.
- E. Design and Performance Data: Submit panel profile characteristics and dimensions, and structural properties. Submit design calculations.
- F. Manufacturer's Installation Instructions: Submit special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of reference specified herein and to applicable codes and requirements of local authorities having jurisdiction, including the following:
 - 1. The National Association of Architectural Metal Manufacturers (NAAMM)
 - a. Metal Finishes Manual
 - b. Metal Bar Grating Manual
 - c. Metal Products Outline Manual

- B. Qualify welding processes and welding operators in accordance with AWS D1.1 “Structural Welding Code – Steel,” D1.3 “Structural Welding Code – Sheet Steel”, and D1.2 “Structural Welding Code – Aluminum”.
- C. Structural Performance: Design, engineer, fabricate and install metal fabrications to withstand structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Comply with the “Performance Criteria” specified hereinafter.
- D. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these specifications, the provisions of the more stringent shall govern.
- E. Design cold-formed framing to comply with ASCE-7-95 and Uniform Building Code.
 - 1. Design Load for Exterior Wall assembly: Not less than 146 kg/m².
 - 2. Increase size of individual members, including anchorage, or reinforce to resist loads without undue deflection.
- F. Maximum Horizontal Deflection at Mid-Plan
 - 1. At Ceramic Tile: 10mm or L/600 of span based on moment of inertia of stud cross section only, whichever is less.
 - 2. Increase size of individual members, including anchorage, or reinforce to resist loads without undue deflection.
- G. Sloped Sills: Size to resist wind loads plus anticipated live loads of 195 kg/m² per square foot, but not less than 1.5mm thick.
- H. Interior Locations Indicated as Structural Steel Stud: Size to resist anticipated loads, but not less than 0.9mm thick unless otherwise indicated.
- I. Differential Movement: Design and construct wall system to accommodate anticipated movement indicated herein, without damage or deterioration to studs or wallboards, without buckling, opening of joints, and cracking.
- J. Certifications: Work of this Section shall be performed under the direct supervision of a registered Professional Supervisor.
- K. Perform Work in accordance with the drawings and to the approval of the Supervisor.
- L. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Design under direct supervision of Professional Supervisor experienced in design of this Work and approved by the Supervisor.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

- C. Protect metal fabrications from damage by exposure to weather.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on shop drawings, and/or as instructed by the manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS – STEEL (unless higher standards are specified elsewhere)

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500, Grade B, and/or ASTM A501.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B, Schedule 40.
- E. Fasteners: as instructed by the manufacturer.
- F. Bolts, Nuts, and Washers: ASTM A325M, A307 and/or galvanized to ASTM A153/A153M for galvanized components.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic and/or Type II Organic zinc rich.

2.2 MATERIALS - STAINLESS STEEL (unless higher standards are specified elsewhere)

- A. Bars and Shapes: ASTM A276, and/or ASTM A479/A479M; Type 316.
- B. Tubing: ASTM A269, and/or ASTM A554; Type 316.
- C. Pipe: ASTM A312/A312M, seamless and/or welded; Type 316.
- D. Plate, Sheet and Strip: ASTM A167; Type 316.
- E. Bolts, Nuts, and Washers: ASTM A354.
- F. Welding Materials: AWS D1.6; type required for materials being welded.

2.3 MATERIALS – ALUMINUM (unless higher standards are specified elsewhere)

- A. Extruded Aluminum: ASTM B221M, Alloy 6063, Temper T5.
- B. Sheet Aluminum: ASTM B209M.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210M, Alloy 6063, Temper T6.

- D. Aluminum-Alloy Bars: ASTM B211M, Alloy 6063, Temper T6.
- E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.
- F. Aluminum-Alloy Die Castings: ASTM B85.
- G. Bolts, Nuts, and Washers: Stainless steel type 316.
- H. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ISOLATING NON-CONDUCTIVE MATERIALS BETWEEN DISSIMILAR METALS

- A. Contacts between dissimilar metals should be avoided in order to prevent bi-metallic or galvanic corrosion.
- B. Dissimilar metals shall be isolated from each other with non-conductive materials. Generally, such isolating elements will take the form of washers and bushes.
- C. Isolated Non-Conductive Materials: Neoprene, synthetic resin bonded fiber (SRBF) such as tufnol, polytetrafluoroethylene (PTFE), or hard nylon, depending on the fixing:
 - 1. Load Bearing Fixings: SRBF or PTFE (strong material).
 - 2. Restraint Fixings: Neoprene or nylon is acceptable.
- D. Electrical insulation tape and bitumen paint are considered in low risk short life application, and shall not be used as non-conductive materials unless directed by the Supervisor.

2.5 STRUCTURAL STEEL ROOFING STRUCTURES

- A. Furnish and install steel framing, posts, bracing, brackets, columns, beams, girders, plates, angles, channels, closures, brackets and miscellaneous steel indicated on the drawings or described in this specification including all fastening assemblies, base plates, anchor bolts, etc.
- B. Steel works shall include required support steel for the work of this section, and for the work of other sections.
- C. Steel members shall be of such shapes and sizes indicated on the drawings and details or as required to suit the condition and shall be provided with necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc... as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and other connecting and adjoining work.
- D. Equip units with integrally welded anchors for casting into concrete or building in to masonry. Furnish inserts if units must be installed after concrete is placed. Space anchors 300mm on center and provide minimum anchor units of 31.6mm by 6.4mm by 200mm steel straps.
- E. Steel used in roofing structures shall be high tensile of 3mm thickness in Pergola and 2.5mm in decorative sections.

- F. Included under this heading of miscellaneous steel also are:
1. Steel Rectangular hollow section beams and columns
 2. Steel angles for framed opening in floors
 3. Steel angles and plates for pipe and duct protection
 4. Elevator tie down and machine beams
 5. Steel supports for interior and exterior stonework
 6. Steel supports for rainwater down pipes
 7. Steel pipes for fencing and gates
 8. Steel posts for exterior signs.

2.6 STAINLESS STEEL FABRICATIONS

- A. Design, manufacture and supply according to drawings and the below specifications
Stainless Steel tables, tables with shelves and drawers, tables with integrated sinks (single and double bowl), drawers, sliding doors, etc. Units shall be modular as per dimensions instructed and reinforced. The Stainless Steel finish shall be satin. The Stainless Steel equipment shall be made fully of the same grade of stainless steel (304) including legs, reinforcement, doors, sinks, etc.
- B. Polished stainless steel work tables with bowl sink, legs, drawers, shelves, sliding doors, grade 304, including all necessary fixing accessories; as specified and as shown on drawings AR30, AR31 and AR32
- C. All units shall be movable and equipped with high-quality rigidly installed rubber hinges on all legs. All units resting on the floor shall be perfectly level and rigid with zero tolerance for shaking (no soldering or other method of attachment to floor is allowed).
- D. Sinks as per drawings (locations, quantities, dimensions, etc.) shall be integrally manufactured with the tables and made of the same Stainless Steel grade and material.
- E. All units resting on walls shall be supplied with approximately 150mm high splash back made of the same grade Stainless Steel.
- F. Shelves, drawer units and doors shall be supplied similarly as per the drawings.
- G. Dimensions shall be as per drawings. Thickness of all plates and members shall be 1.2 mm.
- H. Manufacturer to be approved by Supervisor.
- I. Samples to be supplied and approved prior to ordering.

2.7 LINTELS

Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 200 mm minimum bearing on both sides of opening.
Exterior Locations: Galvanized, and/or prime paint, one coat.
Interior Locations: Prime paint, one coat.

2.8 LEDGE AND SHELF ANGLES

- A. Ledge and Shelf Angles, Channels and/or Plates Not Attached to Structural Framing: For support of metal decking, joists, and/or masonry; galvanized and/or prime paint, one coat.

2.9 DOOR FRAMES

Door Frames: Steel channel or angle sections, size as indicated on Drawings, with jamb anchors suitable for building into masonry and/or attachment to concrete, or steel framing, minimum 4 anchors per jamb; galvanized and/or prime paint, one coat.

2.10 BOLLARDS

Bollards: Steel pipe, concrete filled, crowned cap, 150 mm diameter, height as indicated on Drawings; galvanized and/or prime paint, one coat.

Concrete Fill: 29 MPa as specified in Section 03300.

Anchors: Concealed type as indicated on Drawings.

2.11 LADDERS

Steel, Aluminum and/or Stainless Steel Ladder: ANSI A14.3, steel, aluminum and/or stainless steel welded construction: Unless otherwise indicated on drawings,

Side Rails: 9 x 50 mm side rails spaced at 500 mm.

Rungs: 25 mm diameter solid and/or tubular rod spaced 300 mm on center.

Mounting: Space rungs 175 mm from wall surface; with steel mounting brackets and attachments.

Finish: Galvanized, enamel, anodized, satin chrome, or polished chrome finish, as selected.

Ladder Safety Cage: Unless otherwise indicated on drawings, Steel and/or Aluminum bar sections, minimum 6 x 50 mm.

Bottom hoop 455 mm radius maximum 1880 mm above finished floor.

Other hoops 355 mm radius spaced maximum 1220 mm on center.

Vertical bars spaced 250 mm on center.

Finish: Match ladder finish.

Ladder Security Enclosure: Unless otherwise indicated on drawings, Sheet steel minimum 1.5 mm thick, formed to enclose ladder side rails and rungs when closed and to swing free of ladder rungs and side rails with minimum 38 mm clear to side rails in open position.

Provide continuous steel hinge full height of enclosure.

Provide steel hasp for padlocking in closed and open position.

Finish: Match ladder finish.

2.12 STRUCTURAL SUPPORTS

- A. Telescopic Steel Columns: Steel; size, shape and height as shown on the drawings; prime paint, one coat.
- B. Joist Hangers: Joist strap anchors, fabricated as instructed by the Supervisor; galvanized and/or prime paint, one coat.
- C. Toilet Partition Suspension Members: Steel and/or Aluminum channel and/or angle sections; prime paint, one coat and/or mill finish.
- D. Other Structural Supports: Steel sections, shape and size as indicated on Drawings, required to support applied loads with maximum deflection of 1/240 of the span; prime paint, one coat and/or mill finish.

2.13 STAIR NOSINGS

Stair Nosings: Cast iron, aluminum, bronze and/or nickel with abrasive surface, size as indicated on drawings, with integral or separate anchors for casting into concrete.

2.14 WALL PROTECTION PLATES AND CORNER GUARDS

- A. Wall Protection Plates: Stainless steel type 316 plate, 3 mm thick, counter sunk fasteners, beveled exposed edges, size as indicated on Drawings.
- B. Corner Guards: Stainless steel type 316 angle, 75 x 75 x 3 mm thick, counter sunk fasteners, beveled exposed edges as indicated on Drawings.

2.15 ANCHOR BOLTS

- A. Anchor Bolts: ASTM A307; 18 mm steel bolt, standard J-hook, with nut and washer; unfinished.

2.16 FOOT SCRAPERS

- A. Foot Scrapers: As detailed; aluminum, mill finish and/or steel galvanized, or prime paint, one coat.

2.17 WASTE BINS

- A. Garbage Bins (waste receptacles) shall be manufactured and installed as indicated on drawings. Bins shall be made of galvanized steel metal and powder coated to the satisfaction of the supervisor.
- B. Garbage Bins shall be securely fixed to the ground to prevent theft and accidents.
- C. Garbage Bins shall be so manufactured and installed so as to facilitate waste removal.
- D. Other Structural Supports: Steel sections, shape and size as indicated on Drawings or to the approval of the supervisor shall be also made of galvanized steel powder coated.

E. The bins shall be suitably installed to provide for a sturdy and durable installation that can safely resist natural and human loads.

F. The bins shall contain no denting or sharp edges and shall be perfectly safe.

2.18 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler and/or continuous welds.

D. Exposed Welded Joints: NOMMA Guideline 1 Joint Finish.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.19 FACTORY APPLIED FINISHES - STEEL

A. Prepare surfaces to be primed in accordance with SSPC SP 2.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Do not prime surfaces in direct contact with concrete or where field welding is required.

D. Prime paint items with one or two coats except where galvanizing is specified.

E. Galvanized Structural Steel Members: Galvanize after fabrication to ASTM A123. Furnish minimum 380 g/sq m galvanized coating.

F. Galvanized Non-structural Items: Galvanized after fabrication to ASTM A123. Furnish minimum 380 and/or 360 g/sq m galvanized coating.

G. Chrome Plating: ASTM B177, nickel-chromium alloy, satin and/or polished finish.

2.20 FACTORY APPLIED FINISHES - STAINLESS STEEL

A. Satin Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face. Color: As selected.

B. Mirror Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed. Color: As selected.

2.21 FACTORY APPLIED FINISHES - ALUMINUM

- A. Finish coatings to conform to AAMA 2603, 2604, 2605 and/or AAMA 611. Comply with AA DAF-45.
- B. Exterior and Interior Aluminum Surfaces: Advanced Durability Polyester Powder Coating System. Color: As selected. Minimum cover Thickness 60 microns. Gloss Percentage: As selected.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.22 FABRICATION TOLERANCES

- A. Squareness: 3 mm maximum difference in diagonal measurements.
- B. Maximum Offset between Faces: 1.5 mm.
- C. Maximum Misalignment of Adjacent Members: 1.5 mm.
- D. Maximum Bow: 3 mm in 1.2 m.
- E. Maximum Deviation from Plane: 1.5 mm in 1.2 m.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply steel items required to be cast into concrete, or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

- A. Install work of this section square, plumb, straight, true to line or radius, accurately fitted and located, with flush tight hairline joints (except as indicated otherwise or to allow for thermal movement). Provide attachment devices as required for secure and rigid installation.
- B. Exposed joints shall be close fitting, and bolts and screws, where exposed, shall be cut off flush with nuts or other adjacent metal. Cutting, drilling, punching and tapping required for the installation and attachment of other work to miscellaneous metal work, except where specified in connection with work under other sections, shall be performed as required.

- C. Metal work built-in with concrete or masonry shall be formed for anchorage, or be provided with suitable anchors, expansion shields or other anchoring devices indicated on drawings or required. Such metal work shall be furnished in ample time for setting and securing in place. Wherever possible fixings shall be built into concrete.
- D. Where indicated, install miscellaneous metal items in sleeves (furnished under this section) embedded in concrete with setting grout specified herein.
- E. Unless otherwise indicated, joints shall be as strong and rigid as adjoining sections. Welding shall be continuous along entire line of contact, except where spot welding is indicated or permitted. Where exposed, welds shall be ground smooth. Where bolted or riveted connections are indicated, such connections may be welded at the Contractor's option.
- F. Where welding is required, it shall conform to requirements for shielded metal arc welding of the Standard Code for Arc and Gas Welding of the American Welding Society. Exposed welds shall be flush and ground smooth.
- G. Threaded connections shall be made up tight so that threads are entirely concealed. Abutting bars shall be so shouldered and headed, doweled and pinned. Small bars shall pass through larger bars and pinned. Rivet, bolts and screw heads shall be flat and countersunk in exposed work and elsewhere as required. Removable members shall be carefully machined and fitted and secured, by means of screws or bolts of proper size and approved spacing.
- H. Bolts, brackets, sleeves and other items embedded in concrete shall be galvanized.
- I. Except where built in fixings cannot be used miscellaneous metal work may be fastened to concrete with expansion bolts and to hollow with toggle bolts. Fastening to wood plugs in concrete or masonry will not be permitted. Holes for plugs or bolts shall be drilled to the exact diameter of the plug or bolt, using a percussion drill for concrete and a rotary drill for masonry. Screws shall be threaded full length to the head of the screw.
- J. Provide for adjustments of miscellaneous metal items, with particular attention given to miscellaneous steel supporting the work of other sections, as required during the construction process.
- K. Install isolating non-conductive materials between dissimilar metals as per approved methodology.
- L. Setting Loose Plates:
 - 1. Clean concrete and masonry bearing surfaces of any bond-reducing materials, roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
 - 2. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 3. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

- M. Installation of Bollards: Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with non-shrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- N. Butt welds or splice butt joints in track. Splices in axial loaded studs shall not be permitted. Welds shall be fillet, plug, butt, or seam.
1. Secure floor and ceiling runners to structure with power driven anchors spaced not over 400mm on center and 150mm maximum from ends. Closer spacing at discretion of stud manufacturer based on design loads.
 2. Provide elastomeric sealant or sill sealer material between concrete structure and ceiling and floor runner channels at exterior.
- O. Slide Clip Detail: Provide flexible connection between studs and building structure to accommodate slab edge deflection and long term building creep without transferring axial load to studs.
- P. Tolerance: Wall construction to a maximum variation from plumb, level, or true-to-line of 3mm in 3m.
- Q. Exterior Gypsum Sheathing: Install sheathing vertically with end joints occurring over studs. Screw attach gypsum sheathing to exterior of each stud with fasteners and spacing as recommended by sheathing manufacturer.
1. Install alkaline resistant side of sheathing toward exterior as recommended by manufacturer.
 2. Apply full bead of silicone sealant around each piece of sheathing and at perimeter of interface with other materials and trowel flat.
 3. Select from either of the following method to seal joints:
 - a. Apply full bead of silicone sealant around each piece of sheathing and at perimeter of interface with other materials and trowel flat.
 - b. Apply fiberglass joint tape over sheathing joints, corners, and around perimeter of interface with other materials.
 4. Apply silicone sealant to tope of each fastener and trowel flat, or apply 50mm square membrane tape.
 5. Apply building paper horizontally to face of sheathing in cavity wall with upper sheets lapped over lower sheets. Lap vertical joints not less than 150mm and horizontal joints not less than 125mm. fasten with corrosion-resistant staples.
- R. Cement Board Sheathing: Apply with ends over support, staggering end joints in successive courses. Fit ends and edges closely but not forced. Drive fasteners in field of panels first, working towards ends and edges. Space fasteners not more than [8"] on center on framing with perimeter fasteners at least 10mm from ends and edges.
1. Fasteners to metal framing: 32mm or 41mm Type S-12, wafer-head screws with corrosion-resistant finish.
 2. Joint Tape: Apply over joints and corners. Do not overlap.
 3. Flashings: Prior to installation of sheathing, attach membrane flashings to back to exterior sheathing.
 4. Expansion Joint: Install as indicated, securely fastening ends to studs.
- S. Gypsum Soffit Board: Apply gypsum soffit board with neatly fit and staggered end joints. Back block end joints. Neatly cut to fit around openings or obstructions. Screw

and attach soffit boards using size and spacing of fasteners as recommended by gypsum board manufacturer for Project Conditions.

- T. Obtain approval of the Supervisor prior to site cutting or making adjustments not scheduled.
- U. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.
- V. Installation of Slab Edge Panels:
 - 1. Protect panel surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
 - 2. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.
 - 3. Locate panel joints over supports.
 - 4. Install control joints where required.
 - 5. Use concealed fasteners wherever possible.
 - 6. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb: 6 mm per story or for every 3.65 m in height whichever is greater, non-cumulative.
- C. Maximum Offset from Alignment: 6 mm.
- D. Maximum Out-of-Position: 6 mm.

3.5 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Remove site cuttings from finish surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.6 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes pipe or tube railings/fence, balusters, and fittings with or without glazing.
- B. Related Sections:
1. Section 04810 - Unit Masonry Assemblies: Execution requirements for placement of anchors specified in this section in masonry.
 2. Section 08800 - Glazing
 3. Section 09900 - Paints and Coatings: Paint finish.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 4. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 5. ASTM B177 - Standard Guide for Chromium Electroplating on Steel for Engineering Use.

6. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric).
7. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
8. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
9. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
10. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
11. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

C. National Ornamental & Miscellaneous Metals Association:

1. NOMMA Guideline 1 - Joint Finishes.

D. The Society for Protective Coatings (SSPC):

1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Paint.
3. SSPC Paint 20 - Zinc-Rich Primers Type I - Inorganic or Type II - Organic.

1.4 DESIGN REQUIREMENTS

- A. Fabricate fence/railing assembly, wall rails, and attachments to ASTM E985.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two samples of railing/handrail, length as directed by the Supervisor. Submit two samples, of elbow, Tee, wall bracket, escutcheon, end stop and all other fittings and accessories.

1.6 QUALITY ASSURANCE

- A. Finish joints in accordance with NOMMA Guideline 1.
- B. Perform Work in accordance with the drawings and to the approval of the Supervisor.
- C. Maintain one copy of each document on site.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication at sole responsibility of Contractor.

PART 2 PRODUCTS

2.1 HANDRAILS AND RAILINGS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 PAINTED OR GALVANIZED STEEL RAILING SYSTEM COMPONENTS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500, Grade B, and/or ASTM A501.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B, Schedule 40.
- E. Fasteners: as instructed by the manufacturer.
- F. Bolts, Nuts, and Washers: ASTM A325M, A307 and/or galvanized to ASTM A153/A153M for galvanized components.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Rails and Posts: Type, size and shape as indicated on drawings; welded and/or threaded joints.
- I. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast and/or machined steel.
- J. Mounting: Adjustable brackets and flanges, with steel inserts for casting in concrete and/or with steel brackets for embedding in masonry. Prepare backing plate for mounting in wall construction.
- K. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- L. Splice Connectors: Steel, concealed spigots, welding collars and/or threaded collars.
- M. Handrail Cover: As indicated on drawings.
- N. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
- O. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic and/or Type II Organic zinc rich.

2.3 ALUMINUM RAILING SYSTEM COMPONENTS

- A. Rails and Posts: extruded tubing, size and shape as indicated on drawings, conforming to B211M, B221M, B241/B241M and/or B483/B483M.
- B. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast and/or machined aluminum.
- C. Mounting: Adjustable brackets and flanges, with aluminum and/or steel inserts for casting in concrete and/or with aluminum and/or steel brackets for embedding into masonry. Prepare backing plate for mounting in wall construction.

- D. Splice Connectors: Concealed spigot, Collar with locking set screws and/or Welding collars; cast and/or machined aluminum.
- E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- F. Finish coatings to conform to AAMA 611, AAMA 2603, AAMA 2604 and/or AAMA 2605.
- G. Exterior Aluminum Surfaces: AAMA A41, A42, A43 and/or A44 anodized, prepared with mechanical and chemical pre-treatments, anodized to clear color.
- H. Interior Aluminum Surfaces: AAMA A41, A42, A43 and/or A44 anodized, prepared with mechanical and chemical pre-treatments, anodized to clear color.
- I. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.4 STAINLESS STEEL RAILING SYSTEM COMPONENTS

- A. Bars and Shapes: ASTM A276, and/or ASTM A479/A479M; Type 316.
- B. Tubing: ASTM A269, and/or ASTM A554; Type 316.
- C. Pipe: ASTM A312/A312M, seamless and/or welded; Type 316.
- D. Plate, Sheet and Strip: ASTM A167; Type 316.
- E. Bolts, Nuts, and Washers: ASTM A354.
- F. Welding Materials: AWS D1.6; type required for materials being welded.
- G. Rails and Posts: Type, size and shape as indicated on drawings; welded and/or threaded joints.
- H. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast and/or machined steel.
- I. Mounting: Adjustable brackets and flanges, with steel inserts for casting in concrete and/or with steel brackets for embedding in masonry. Prepare backing plate for mounting in wall construction.
- J. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- K. Splice Connectors: Steel, concealed spigots, welding collars and/or threaded collars.
- L. Handrail Cover: As indicated on drawings.

2.5 FABRICATION

- A. Fit and shop assemble components in largest practical sizes for delivery to site.

- B. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler and/or continuous welds. Drill condensate drainage holes at bottom of members at locations not encouraging water intrusion.
- F. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler and/or continuous welds.
- G. Exposed Welded Joints: NOMMA Guideline 1 Joint Finish.
- H. Accurately form components to suit stairs and landings, to each other and to building structure.
- I. Accommodate for expansion and contraction of members and building movement without damage to connections or members.
- J. Furnish continuous plastic handrail cover. Heat weld joints and trim smooth.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal and/or aluminum where site welding is required.
- B. Supply items required to be cast into concrete, embedded in masonry and/or placed in partitions with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Anchor railings to structure with anchors, plates and/or angles.

- C. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
- D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Assemble with spigots and sleeves to accommodate tight joints and secure installation.
- F. Install Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.

3.4 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb: 1 mm per 1,000 m.
- C. Maximum Offset from Alignment: 1 mm.
- D. Maximum Out-of-Position: 1 mm.

3.5 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes carpentry items; benches, wood door frames, glazed frames; wood casings and moldings; wood benches; decorative wall cladding; steel sections cladding; and hardware and attachment accessories. All outdoor wood shall be hardwood lumber – Sweden with varnish finish paint; all doors shall be MDF-formaika wood veneer.
- B. Related Sections:
1. Section 05500 – Metal Fabrication
 2. Section 06410 - Custom Cabinets
 3. Section 08212 - Flush Wood Doors.
 4. Section 08800 - Glazing.
 5. Section 09900 - Paints and Coatings: Finishing of finish carpentry items.

1.3 REFERENCES (*Equivalent Equal Acceptable*)

- A. American National Standards Institute:
1. ANSI A135.4 - Basic Hardboard.
 2. ANSI A156.9 - Cabinet Hardware.
 3. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. APA-The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- C. ASTM International:
1. ASTM C1036 - Standard Specification for Flat Glass.
 2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. Architectural Woodwork Institute:
1. AWI - Quality Standards Illustrated.
- E. American Wood-Preservers' Association:

1. AWPAC1 - All Timber Products - Preservative Treatment by Pressure Process.
- F. Federal Specification Unit:
 1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.
- G. Hardwood Plywood and Veneer Association:
 1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
- H. National Institute of Standards and Technology:
 1. NIST PS 20 - American Softwood Lumber Standard.
- I. National Electrical Manufacturers Association:
 1. NEMA LD 3 - High Pressure Decorative Laminates.
- J. Window and Door Manufacturers Association:
 1. WDMA I.S.4 - Water-Repellent Treatment for Millwork.
- K. Woodwork Institute of California:
 1. WIC - Manual of Millwork.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Provide shop drawings for all wood works including cladding, paneling, benches, etc. including assembly and attachment methods. Indicate materials, component profiles, fastening methods, jointing details, and accessories to minimum scale of (1:8).
- C. Product Data:
 1. Submit data on fire retardant treatment materials and application instructions.
 2. Submit data on attachment hardware and/or finish hardware.
- D. Samples:
 1. Submit two samples of hardwood, 200 x 250 mm in size illustrating wood grain and specified finish.
 2. Submit two samples of finish plywood, 200 x 250 mm in size illustrating wood grain and specified finish.
 3. Submit two samples of wood trim 250 mm long.
 4. Submit two samples of laminates, pre-finished paneling, synthetic surfacing, hardware items, and/or shop finishes.
- E. Certification: Submit copy of fabricator's authorization to use AWI Grade Stamps, AWI Quality Certification Program license and Project specific letters and/or WIC certified compliance certificate.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Economy, Custom and/or

Premium Grade, and/or WIC (Woodwork Institute of California) Manual of Millwork, Economy, Custom and/or Premium Grade.

- B. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect work from moisture damage.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements at sole Contractor responsibility prior to fabrication.

1.9 SEQUENCING

- A. Sequence work to ensure utility connections are achieved in orderly and expeditious manner.

1.10 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.1 CARPENTRY

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Softwood and/or Hardwood Lumber: NIST PS 20, and/or AWI Grade III, II and/or I, WIC Economy, Custom and/or Premium Grade; maximum moisture content of (6-8) percent.
- B. Softwood and/or Hardwood Plywood: APA/EWA PS 1 Grade (C-D) softwood plywood, HPVA HP-1 hardwood plywood, AWI Grade B, A, and/or AA veneer; and/or WIC Economy, Custom and/or Premium veneer; with particleboard, medium density fiberboard, veneer and/or lumber core; type of glue recommended for application.

- C. High Pressure Decorative Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces, BK20 for undecorated backing sheets, PF42 for post forming, FR50 for fire-retardant surfaces; color, pattern, and surface texture as selected and indicated.
- D. Pre-finished Paneling: As indicated on drawings.
- E. Wood Particleboard: ANSI A208.1 Type 1 and/or 2; composed of wood chips or sawdust, medium density, made with water resistant adhesive; sanded faces.
- F. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, standard and/or tempered grade, 6 mm thick, smooth one and/or two sides.
- G. Pegboard: Pressed wood fiber with resin binder, standard and/or tempered grade; 3 mm thick 4 mm diameter holes at 25 mm on center and/or 6 mm thick with 7 mm diameter holes at 25 mm on center.
- H. Sheet Metal Components: Stainless steel, Type 316 with #4 satin and/or #8 polished finish.
- I. Synthetic Surfacing: Synthetic marble of polyester and/or proprietary resins, with color and design as indicated on drawings, stain resistant to domestic chemicals and cleaners.

2.3 ACCESSORIES

- A. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive and/or Type recommended by laminate manufacturer to suit application.
- B. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel type 316 finish in exposed locations.
- C. Concealed Joint Fasteners: Threaded steel.
- D. Lumber for Shimming and Blocking: Softwood lumber as indicated.
- E. Veneer Edge Band: Standard wood veneer edge band matching face veneer.
- F. Plastic Edge Trim: Extruded convex and/or flat shaped; smooth and/or ridged finish; self locking serrated tongue; of width to match component thickness; color as selected.
- G. Aluminum Edge Trim: Extruded convex and/or flat shape; smooth and/or ridged surface finish; self locking serrated tongue; of width to match component thickness; natural mill, clear anodized and/or bronze anodized finish.
- H. Glass: Type as specified in Section 08800.
- I. Float and/or Patterned Glass: ASTM C1036 and/or C1048, type, color, pattern, quality and thickness as indicated on drawings.

- J. Safety Glass: ASTM C1036 and/or C1048, type, color, pattern, quality and thickness as indicated on drawings.
- K. Primer: Alkyd primer sealer.
- L. Wood Filler: Solvent and/or Oil base, tinted to match surface finish color.
- M. Wood Treatment:
 - 1. Fire Retardant (FR-S Type): Chemically treated and pressure impregnated; capable of providing maximum flame spread/smoke development rating in accordance with ASTM E84.
 - 2. Wood Preservative by Pressure Treatment (PT Type): AWWA Treatment C1 using water borne preservative with 0.25 lb/cu ft retention.
 - 3. Water Repellant Preservative Treatment by Dipping Method: WDMA I.S.4, with 0.25 cubic lb/in/ft of chromated copper arsenate.
 - 4. Wood Preservative (Surface Application): color and type as indicated.
 - 5. Shop pressure treat, dip and/or brush apply treatment to wood materials requiring fire rating and/or preservatives to concealed wood blocking.
 - 6. Provide identification on fire retardant treated material.
 - 7. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
 - 8. Redry and/or Kiln dry wood after pressure treatment to maximum moisture content percentage as instructed by the manufacturer.
- N. Hinges: As indicated on drawings.
- O. Pulls: As indicated on drawings.
- P. Latches: As indicated on drawings.
- Q. Shelf Standards: As indicated on drawings.
- R. Shelf Brackets: As indicated on drawings.
- S. Drawer Slides: As indicated on drawings.

2.4 BENCHES

- A. Benches shall be made of structural steel supports and hardwood lumber beams bolted using carriage bolts.
- B. Structural supports shall be galvanized and powder coated fixed to the ground using reinforced concrete foundations.
- C. Wood beams shall be surface treated and painted to provide a smooth dent-free surface.

2.5 FABRICATION

- A. Fabricate to AWI Economy, Custom and/or Premium standards and/or WIC Economy, Custom and/or Premium standards.

- B. Shop-assemble work for delivery to site, permitting passage through building openings.
- C. Fit exposed sheet material edges with matching hardwood, matching veneer, plastic and/or aluminum edging. Use one piece for full length only.
- D. Cap exposed high pressure decorative laminate finish edges with material of same finish and pattern.
- E. Shop prepare and identify components for book match grain matching during site erection.
- F. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.
- G. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 600 mm from sink cut-outs.
- H. Apply laminate backing sheet to reverse face of high pressure decorative laminate finished surfaces.

2.6 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.
- D. Finish work in accordance with AWI - Section 1500 Finish System Transparent and/or Opaque.
- E. Finish work in accordance with WIC - Section 25 System (#1) (#2) (#3) (#4) (#5) (#6) (#7) (#8).
- F. Stain, seal, and varnish exposed to view surfaces.
- G. Seal internal surfaces and semi-concealed surfaces.
- H. Prime paint and/or Seal surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify adequacy of backing and support framing.

- C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 EXISTING WORK

- A. Modify and extend existing finish carpentry installations using materials and methods as specified.

3.3 INSTALLATION

- A. Install work in accordance with AWI, and/or WIC Economy, Custom and/or Premium quality standard.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1 mm. Do not use additional overlay trim to conceal larger gaps.
- D. Install components and/or trim with nails, screws and/or bolts with blind fasteners as instructed by the manufacturer, and/or wall adhesive by gun application.
- E. Install pre-finished paneling with full bed contact adhesive applied to substrate, and/or nails, screws and/or wall adhesive by bead method as instructed by the manufacturer.
- F. Install hardware.
- G. Site Applied Wood Treatment:
 - 1. Apply preservative treatment.
 - 2. Brush apply one coat of preservative treatment on wood in contact with cementitious materials, and roofing and related metal flashings. Treat site-sawn cuts.
 - 3. Allow preservative to dry prior to erecting members.
- H. Preparation for Site Finishing:
 - 1. Site Finishing: Refer to Section 09900.
 - 2. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.4 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Indicated Position: 1.5 mm.
- C. Maximum Offset from Alignment with Abutting Materials: 0.7 mm.

3.5 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 06250

WOOD WALL PANELING

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes external wood paneling to walls (hardwood lumber Sweden wood with varnish paint) and attachment accessories (wood strip nailer).
- B. Related Sections:
 - 1. Section 06200 – Finish Carpentry.
 - 2. Section 09900 - Paints and Coatings: Finishing of finish carpentry items.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. American National Standards Institute:
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. APA-The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- C. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. Architectural Woodwork Institute:
 - 1. AWI - Quality Standards Illustrated.
- E. American Wood-Preservers' Association:
 - 1. AWWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
- F. Federal Specification Unit:
 - 1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.
- G. Hardwood Plywood and Veneer Association:
 - 1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

- H. National Institute of Standards and Technology:
 - 1. NIST PS 20 - American Softwood Lumber Standard.
- I. National Electrical Manufacturers Association:
 - 1. NEMA LD 3 - High Pressure Decorative Laminates.
- J. Window and Door Manufacturers Association:
 - 1. WDMA I.S.4 - Water-Repellent Treatment for Millwork.
- K. Woodwork Institute of California:
 - 1. WIC - Manual of Millwork.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Submit shop drawings for decorative cladding as shown on drawings indicating chamfering details, sections, attachment methods, etc. Indicate materials, component profiles, fastening methods, jointing details, and accessories to minimum scale of (1:8).
- C. Product Data:
 - 1. Submit data on fire retardant treatment materials and application instructions.
 - 2. Submit data on attachment hardware and/or finish hardware.
- D. Samples:
 - 1. Submit two samples of finish cladding, 300 x 500 mm in size illustrating wood grain and specified finish.
 - 2. Submit two samples of wood trim 250 mm long.
 - 3. Submit two samples of laminates, pre-finished paneling, synthetic surfacing, hardware items, and/or shop finishes.
- E. Certification: Submit copy of fabricator's authorization to use AWI Grade Stamps, AWI Quality Certification Program license and Project specific letters and/or WIC certified compliance certificate.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Economy, Custom and/or Premium Grade, and/or WIC (Woodwork Institute of California) Manual of Millwork, Economy, Custom and/or Premium Grade.
- B. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect work from moisture damage.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements at sole Contractor responsibility prior to fabrication.

1.9 SEQUENCING

- A. Sequence work to ensure utility connections are achieved in orderly and expeditious manner.

1.10 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.1 EXTERNAL WALL CLADDING PANELS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Hardwood Lumber: NIST PS 20, and/or AWI Grade III, II and/or I, WIC Economy, Custom and/or Premium Grade; maximum moisture content of (6-8) percent.
- B. High Pressure Decorative Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces, BK20 for undecorated backing sheets, PF42 for post forming, FR50 for fire-retardant surfaces; color, pattern, and surface texture as selected and indicated.
- C. Pre-finished Paneling: As indicated on drawings.
- D. Pegboard: Pressed wood fiber with resin binder, standard and/or tempered grade; 3 mm thick 4 mm diameter holes at 25 mm on center and/or 6 mm thick with 7 mm diameter holes at 25 mm on center.

2.3 ACCESSORIES

- A. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive and/or Type recommended by laminate manufacturer to suit application.
- B. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel type 316 finish in exposed locations.

- C. Concealed Joint Fasteners: Threaded steel.
- D. Lumber for Shimming and Blocking: Softwood lumber as indicated.
- E. Veneer Edge Band: Standard wood veneer edge band matching face veneer.
- F. Plastic Edge Trim: Extruded convex and/or flat shaped; smooth and/or ridged finish; self locking serrated tongue; of width to match component thickness; color as selected.
- G. Aluminum Edge Trim: Extruded convex and/or flat shape; smooth and/or ridged surface finish; self locking serrated tongue; of width to match component thickness; natural mill, clear anodized and/or bronze anodized finish.
- H. Primer: Alkyd primer sealer.
- I. Wood Filler: Solvent and/or Oil base, tinted to match surface finish color.
- J. Wood Treatment:
 - 1. Fire Retardant (FR-S Type): Chemically treated and pressure impregnated; capable of providing maximum flame spread/smoke development rating in accordance with ASTM E84.
 - 2. Wood Preservative by Pressure Treatment (PT Type): AWWA Treatment C1 using water borne preservative with 0.25 lb/cu ft retention.
 - 3. Water Repellant Preservative Treatment by Dipping Method: WDMA I.S.4, with 0.25 cubic lb/in/ft of chromated copper arsenate.
 - 4. Wood Preservative (Surface Application): color and type as indicated.
 - 5. Shop pressure treat, dip and/or brush apply treatment to wood materials requiring fire rating and/or preservatives to concealed wood blocking.
 - 6. Provide identification on fire retardant treated material.
 - 7. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
 - 8. Redry and/or Kiln dry wood after pressure treatment to maximum moisture content percentage as instructed by the manufacturer.
- K. Hinges: As indicated on drawings.
- L. Pulls: As indicated on drawings.
- M. Latches: As indicated on drawings.
- N. Shelf Standards: As indicated on drawings.
- O. Shelf Brackets: As indicated on drawings.
- P. Drawer Slides: As indicated on drawings.

2.4 FABRICATION

- A. Fabricate to meet the specified standards and requirements as a minimum.
- B. Site assemble work for installation.

- C. Fit exposed sheet material edges with matching hardwood, matching veneer, plastic and/or aluminum edging. Use one piece for full length only.
- D. Cap exposed high pressure decorative laminate finish edges with material of same finish and pattern.
- E. Shop prepare and identify components for book match grain matching during site erection.
- F. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.
- G. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 600 mm from sink cut-outs.
- H. Apply laminate backing sheet to reverse face of high pressure decorative laminate finished surfaces.

2.5 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.
- D. Finish work in accordance with AWI - Section 1500 Finish System Transparent and/or Opaque.
- E. Finish work in accordance with WIC - Section 25 System (#1) (#2) (#3) (#4) (#5) (#6) (#7) (#8).
- F. Stain, seal, and varnish exposed to view surfaces.
- G. Seal internal surfaces and semi-concealed surfaces.
- H. Prime paint and/or Seal surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Validate dimensions, quantities and sizes at sole responsibility of Contractor.
- C. Design backing and supporting frame to match requirements.

- D. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

- A. Install work in accordance with AWI, and/or WIC Economy, Custom and/or Premium quality standard.
- B. Install the backing and support framing.
- C. Set and secure materials and components in place, plumb and level and as shown in drawings or instructed by Supervisor.
- D. Install components and/or trim with nails, screws and/or bolts with blind fasteners as instructed by the manufacturer, and/or wall adhesive by gun application.
- E. Install pre-finished paneling with full bed contact adhesive applied to substrate, and/or nails, screws and/or wall adhesive by bead method as instructed by the manufacturer.
- F. Site Applied Wood Treatment:
 - 1. Apply preservative treatment.
 - 2. Brush apply one coat of preservative treatment on wood in contact with cementitious materials, and roofing and related metal flashings. Treat site-sawn cuts.
 - 3. Allow preservative to dry prior to erecting members.
- G. Preparation for Site Finishing:
 - 1. Site Finishing: Refer to Section 09900.
 - 2. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.3 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Indicated Position: 0.5 mm.
- C. Maximum Offset from Alignment with Abutting Materials: 0.5 mm.

3.4 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 06410

CUSTOM CABINETS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes custom-fabricated cabinet units; cabinet hardware; preparation for installing utilities in cabinets; and shop and/or site finishing. Cabinets shall be Lamaika Hydrofuge (water resistant) as per thicknesses and dimensions shown on drawings.
- B. Related Sections:
1. Section 06200 - Finish Carpentry: Related trim not specified in this section.
 2. Section 08800 - Glazing: Glass for casework.
 3. Section 09900 - Paints and Coatings: Site finishing of cabinet.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. American National Standards Institute:
1. ANSI A156.9 - Cabinet Hardware.
 2. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. Architectural Woodwork Institute:
1. AWI - Quality Standards Illustrated.
- C. Federal Specification Unit:
1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.
- D. National Electrical Manufacturers Association:
1. NEMA LD 3 - High Pressure Decorative Laminates.
- E. Woodwork Institute of California:
1. WIC - Manual of Millwork.
- F. ASTM International:
1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.

- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessories, hardware location, finishes etc.
- C. Product Data: Submit data for hardware accessories.
- D. Samples:
 - 1. Submit two samples, each size 200 x 250 mm illustrating cabinet finish.
 - 2. Submit two samples each size 200 x 250 mm illustrating counter top finish.
 - 3. Submit two samples of drawer pulls, hinges, etc. illustrating hardware finish.
- E. Certification: Submit copy of fabricator's authorization to use AWI Grade Stamps, AWI Quality Certification Program license and Project specific letters and/or WIC certified compliance certificate.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Economy, Custom and/or Premium Grade, and/or WIC (Woodwork Institute of California) Manual of Millwork, Economy, Custom and/or Premium Grade.
- B. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect units from moisture damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. During and after installation of Work of this section, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 CUSTOM CABINETS

- A. Manufacturer: Any recognized cabinet manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Lamaika Wood, 18mm thickness. Backing wood panels shall be Masonite of 8mm thickness. All door and shelves shall be banded with 1.3 mm PVC edge banding. Kitchen cabinets shall be water resistant Lamaika Hydrofuge. All color shall be Swedish wood.
- B. Softwood and Hardwood Lumber: AWI Grade III, II and/or I; and/or WIC Economy, Custom and/or Premium Grade; maximum moisture content of 6-8 percent;
- C. Softwood and Hardwood Plywood: AWI Grade B, A and/or AA veneer; and/or WIC Economy, Custom and/or Premium veneer; with particleboard, medium density fiberboard, veneer and/or lumber core; type of glue recommended for application;
- D. Wood Particleboard: ANSI A208.1 Type 1 and/or 2; composed of wood chips or sawdust, medium density, made with water resistant adhesive; sanded faces.
- E. High Pressure Decorative Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces, BK20 for undecorated backing sheets, PF42 for post forming, and/or FR50 for fire-retardant surfaces; Color, pattern, and surface texture as selected and/or indicated on drawings.
- F. Sheet Metal Components: Stainless steel type 316 with #4 satin or #8 polished finish;
- G. Synthetic Surfacing: Synthetic marble of polyester and/or proprietary resins, stain resistant to domestic chemicals and cleaners and as per approved codes and standards.
- H. Counter Tops, Back Splash and Side Splash: As per schedule stated hereinafter or as shown on drawings.
- I. Service Fittings for Kitchen Cupboards: As per schedule stated hereinafter or as shown on drawings.
- J. Electrical Built-in Appliances in Kitchen Cupboards: As per schedule stated hereinafter or as shown on drawings.

2.3 ACCESSORIES

- A. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive. Type recommended by laminate manufacturer to suit application.
- B. Veneer Edge Band: Standard wood veneer edge band matching face veneer.
- C. Plastic (PVC) Edge Trim/Banding for Cabinet Doors and Shelves: 1.3 mm Extruded convex and/or flat shaped; smooth and/or ridged finish; self locking serrated tongue; color as selected and/or as indicated on drawings.
- D. Aluminum Edge Trim: Extruded convex and/or flat shape; smooth and/or ridged surface finish; self locking serrated tongue; of width to match component thickness; natural mill, clear anodized and/or bronze anodized finish.
- E. Glass: As specified in Section 08800.

- F. Fasteners: Size and type to suit application.
- G. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized finish in concealed locations and stainless steel type 316 finish in exposed locations.
- H. Bolts: Steel and comply with BS916
- I. Washers: to BS3410, part 2.
- J. Screws:
 - 1. All steel screws shall be finished to resist corrosion by sherardizing, cadmium plating, nickel plating or other approved finish.
 - 2. Screws shall be protected steel, stainless steel type 316, brass silicone bronze, nickel/copper alloy or aluminum as specified on drawings or as appropriate to the work. Screws for fixing hardware shall match the items being fixed.
 - 3. Screw heads shall be for the generality of the work, countersunk slotted. Screw heads in the finished work shall, unless otherwise described, be brass, bronzed finish with matching fully countersunk brass cups. Phillips crosshead screws or pozidrive screws shall be used where so described on drawings.
- K. Concealed Joint Fasteners: Threaded steel.
- L. Grommets: Plastic, Metal and/or Rubber material for cut-outs.
- M. Hardware:
 - 1. Hinges: Plain bearing two knuckle stainless steel type 316 hinges (3 No. per door leaf).
 - 2. Knob for door panels as selected (1 No. per door leaf).
 - 3. Perforations: 25mm diameter to act instead of knobs where indicated.
 - 4. Lock: Cabinet lock for each door panel or couple of panels as appropriate with security cylinder and with two keys for each lock.
 - 5. Knob for drawer as selected (1 No. per drawer).
 - 6. Drawer runners: Steel telescopic runners (full width of drawer on both sides).
 - 7. Chrome pins for adjustable shelves.
 - 8. Chrome hanging rods.
- N. Shelf Standards and Rests: Formed steel channels and rests, cut for fitted rests spaced as indicated; chrome and/or satin finish.
- O. Shelf Brackets: Formed steel brackets, formed for attachment with lugs; chrome and/or satin finish.
- P. Drawer and Door Pulls: Extruded aluminum pull, full width of drawer, polished and/or satin finish, "U" shaped pull, steel with chrome and/or satin finish, aluminum with polished and/or satin finish, bronze with satin finish, and/or plastic of color as selected.
- Q. Sliding Door Pulls: Circular, Oval and/or Elongated shape, steel with chrome and/or satin finish, aluminum with polished and/or satin finish, bronze with satin finish, and/or plastic of color as selected.
- R. Catches: Type as indicated on drawings.

- S. Drawer Slides: Galvanized steel construction, ball bearings separating tracks, full extension type.
- T. Sliding Door Track Assemblies: Galvanized steel construction, ball bearing carriers fitted within tracks, multiple pendant suspension attachments for door.

2.4 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fit shelves, doors, and exposed edges with matching veneer, plastic and/or aluminum edging. Use one piece for full length only.
- C. Cap exposed high pressure decorative laminate finish edges with material of same finish and pattern.
- D. Door and Drawer Fronts: 19 mm thick; flush, overlay and/or reveal overlay style.
- E. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.
- F. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 600 mm from sink cut-outs.
- G. Apply wood laminate by grain matching adjacent sheets to book, slip, random and/or end matching.
- H. Apply laminate backing sheet to reverse side of plastic and/or wood laminate finished surfaces.
- I. Fabricate metal counter top surfaces pressure glued to plywood or particle board core backing with butt or welded joints, or without visible joints.
- J. Mechanically fasten back splash to counter tops with steel brackets at 400 mm on center.
- K. Fabricate cabinets and counter tops with cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint and/or Seal cut edges.
- L. Shop glaze glass materials using Interior Dry, Combination and/or Wet method specified in Section 08800.

2.5 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

- D. Finish work in accordance with AWI - Section 1500 Finish System Transparent and/or Opaque.
- E. Finish work in accordance with WIC - Section 25 System (#1) (#2) (#3) (#4) (#5) (#6) (#7) (#8).
- F. Stain, seal and varnish exposed to view surfaces. Brush and/or Spray apply only.
- G. Seal and/or stain and varnish internal exposed to view and semi-concealed surfaces.
- H. Seal internal surfaces of cabinets.
- I. Prime paint and/or Seal surfaces in contact with cementitious materials.
- J. Finish in accordance with Section 09900.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify adequacy of backing and support framing at sole responsibility of Contractor.
- C. Verify sizes and dimensions at sole responsibility of Contractor.
- D. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

- A. Set and secure casework in place; rigid, plumb and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units, counter tops etc.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1 mm. Do not use additional overlay trim for this purpose.
- E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- G. Site glaze glass materials using Interior Dry, Combination or Wet method specified in Section 08800.

3.3 ADJUSTING

- A. Section 01700 - Execution Requirements: Testing, adjusting and balancing.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

SECTION 07115

BITUMINOUS DAMP PROOFING

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes This Section specifies cold-applied, emulsified-asphalt damp proofing applied to the exterior of below-grade surfaces on concrete and masonry foundation and retaining walls.
- B. Related Sections:
 - 1. Section 02320 - Backfill.
 - 2. Section 07140 - Waterproofing

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM D 41 - Cut-Back Asphalt Primer
 - 2. ASTM D 1227 - Emulsified-Asphalt Primer, Type III, Class 1.
 - 3. ASTM D 1668 - Asphalt-Coated Glass Fabric, Type I.
 - 4. ASTM D 4586 - Trowel Coats, Type I, Class 1, fibered.
 - 5. ASTM D 4479 - Brush and Spray Coats, Type I, fibered.
- B. National Roofing Contractors Association:
 - 1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- C. Product Data: Submit data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
- D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.
- B. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Maintain ambient temperatures above 5 °C for 24 hours before and during application and until liquid or mastic accessories have cured.

PART 2 PRODUCTS

2.1 BITUMINOUS DAMP PROOFING

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product with origin of materials from Europe, USA or Japan.
- B. Products shall be accompanied with a 10-year warranty.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Examine substrates for compliance with manufacturer's requirements for surface smoothness and other conditions affecting performance of work. Verify substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of damp proofing materials. Begin damp proofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive damp proofing. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with damp

proofing. Prevent damp proofing materials from entering and clogging weep holes and drains.

- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer. Concrete shall be allowed to cure for a minimum of 5 days after form removal prior to damp proofing application.
- C. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer and/or in accordance with Section 07900.

3.3 INSTALLATION

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of damp proofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
 - 2. Allow each coat of damp proofing to cure 24 hours before applying subsequent coats.
 - 3. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 20 cm over outside face of footing.
 - 4. Extend 30 cm onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 5. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced", by embedding a 20 cm- wide strip of asphalt-coated glass fabric in a heavy coat of damp proofing. Damp proofing coat required for embedding fabric is in addition to other coats required.
- B. On Concrete Foundations: Apply two brush or spray coats at not less than 0.5 Liters / sq.m. for first coat and 0.4 Liters / sq.m. for second coat.
- C. On Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 0.5 Liters / sq.m. for first coat and 0.4 Liters / sq.m. for second coat.
- D. On Backs of Concrete and Masonry Retaining Walls: Apply one brush or spray coat at not less than 0.5 Liters / sq.m.
- E. Install protection course over completed-and-cured damp proofing. Comply with damp proofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated. Protection Course, Polystyrene Type: Fan-folded, rigid, extruded-polystyrene board insulation; nominal thickness not less than 5mm.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.
- B. Remove damp proofing materials from surfaces not intended to receive damp proofing

3.6 SCHEDULE

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 07140

WATERPROOFING

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes fluid applied rubberized asphalt and/or elastomeric membrane waterproofing and/or flexible cementitious coating and/or polyurethane waterproofing; and surface dusting and/or protective covering.
- B. Related Sections:
1. Section 02320 - Backfill.
 2. Section 07212 - Board Insulation.
 3. Section 07620 - Sheet Metal Flashing and Trim.
 4. Division 15 - Mechanical: Plumbing Fixtures (Roof drain and plumbing vent flashing flanges) and Plumbing Specialties (Drain installations).

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
1. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
 2. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 3. ASTM D429 - Standard Test Method for Rubber Property - Adhesion to Rigid Substrates.
 4. ASTM D471 - Standard Test Method for Rubber Property - Effect of Liquids.
 5. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 6. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 7. ASTM D822 - Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
 8. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 9. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.

10. ASTM D3468 - Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing.
11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
12. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
13. ASTM C 348 - Standard Test Method for Flexural Strength of Hydraulic Cement Mortars.
14. ASTM C 321 - Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
15. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials.

- B. National Roofing Contractors Association:
1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

1.4 SYSTEM DESCRIPTION

- A. Waterproofing System:
1. Fluid applied material to prevent moisture migration to interior.
 2. Cementitious coating to prevent moisture and water leakage from the garden pool.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- C. Product Data: Submit data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
- D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.
- B. Maintain one copy of each document on site.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Maintain ambient temperatures above 5 °C for 24 hours before and during application and until liquid or mastic accessories have cured.

PART 2 PRODUCTS

2.1 WATERPROOFING

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product with origin of materials from Europe, USA or Japan.
- B. Products shall be accompanied with a 10-year warranty.

2.2 COMPONENTS

- A. Waterproofing Membrane- General: Fluid; cold applied; quick setting.
- B. Cured Membrane Characteristics:

| 1. <u>Properties</u> | <u>Test</u> |
|--------------------------------|------------------------|
| a. Tensile Strength | ASTM D412 |
| b. Elongation | ASTM D412 |
| c. Hardness - Shore A | ASTM D2240 |
| d. Tear Strength | ASTM D624 and/or D1004 |
| e. Water Absorption | ASTM D471 |
| f. Moisture Vapor (perms) | ASTM E96 |
| g. Exposure at Low Temperature | ASTM D822 |
| h. Brittleness | ASTM D746 |
| i. Adhesion | ASTM D429 |
- C. Cementitious coating:
 - 1. UV resistance, underground ground-chemical resistance, high melting points, flexible and elastic with high adhesive strength.
 - 2. Material shall not contain additives such as chlorides, sulphates, iron oxides or similar deleterious substances.
 - 3. The membrane shall be reinforced with a layer of non-woven polyester fabric of minimum 30 g/sqm.
 - 4. The Cementitious Membrane / Coating shall be protected with a subsequent protective cementitious layer of concrete screed / plaster in thickness as recommended by manufacturer.
 - 5. The total coating thickness shall be as specified by the manufacturer's technical literature but not less than 1.5 mm and shall be applied in 3 coats.
- D. Liquid-applied, Water-Based, Elastomeric Polyurethane Membrane:
 - 1. UV resistance, underground ground-chemical resistance, high melting points, flexible and elastic with high adhesive strength.

2. The membrane shall be reinforced with a layer of non-woven polyester fabric of minimum 40 g/sqm.
 3. The upper surface shall be finished with 8-12 sieve quartz sand which shall be sprinkled on to the final wet layer of the liquid applied membrane, to provide 'keying' to the subsequent protective cementitious layer of concrete screed / plaster as specified.
 4. The total membrane thickness shall be as specified by the manufacturer's technical literature but not less than 500 - 600 microns and shall be applied in 2 - 3 coats.
- E. Pre-fabricated Modified Polyester Re-enforced Bituminous Membrane:
1. UV resistance, underground ground-chemical resistance, high melting points, flexible and elastic with high adhesive strength.
 2. The membrane shall be reinforced with a layer of non-woven polyester fabric of minimum 180 g/sqm or composite reinforcement of minimum of 175 g/sqm and reinforced with glass fibre grill of 8 g/sqm.
 3. The upper surface is finished with calibrated granules of 1 mm, pressed mechanically into the bitumen.
 4. The under surface is finished with a polyethylene foil of 12 micron thickness.
 5. The total membrane thickness is 4mm and minimum weight 4.2 to 4.5 kg/m² including coating with compatible primer of bituminous base and torch application with overlap of 70 - 100 mm wherever required.
 6. The reinforcement provided shall be able to withstand the traffic flow density and shall include necessary protection layer approved by Supervisor.

2.3 ACCESSORIES

- A. Surface Conditioner and/or Primer: type compatible with membrane compound; as recommended by membrane manufacturer.
- B. Elastic Flashings: 1.2 mm thick, as recommended by membrane manufacturer.
- C. Joint Cover Sheet: Elastic sheet material designated for and compatible with membrane. Thickness as recommended by membrane manufacturer.
- D. Cant Strips: Premolded composition material, as recommended by membrane manufacturer.
- E. Drainage Panel: As recommended by membrane manufacturer.
- F. Joint and Crack Sealant: As recommended by membrane manufacturer.
- G. Back-up Material: As recommended by membrane manufacturer.
- H. Reglet Strip Devices: As recommended by membrane manufacturer.
- I. Counterflashings: As recommended by membrane manufacturer.
- J. Tack-free Surfacing: Type 1 Portland cement and/or Stone dust.
- K. Separation Sheet: As recommended by membrane manufacturer.

- L. Protection Board: Rigid insulation specified in Section 07212.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- D. Verify items penetrating surfaces to receive waterproofing are securely installed.
- E. Verify substrate surface slopes to drain for horizontal waterproofing applications.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer.
- D. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer and/or in accordance with Section 07900.

3.3 INSTALLATION

- A. Apply surface conditioner at rate recommended by manufacturer. Protect conditioner from rain or frost until dry.
- B. Apply 300 mm wide strip of joint cover sheet over cracks, non-working joints, and expansion joints over 1.6 mm but not exceeding 13 mm in width.
- C. At expansion joints from 13 to 25 mm in width, loop cover sheet down into joint between 31 and 44 mm. Extend sheet 150 mm on both sides of expansion joint.
- D. Center cover sheet over crack or joints. Roll sheet into 3.2 mm coating of waterproofing material. Apply second coat over sheet extending minimum of 150 mm beyond sheet edges. Apply this procedure especially to expansion joints between horizontal and vertical surfaces.
- E. Apply waterproofing material.
- F. Apply and spread waterproofing material to a minimum cured thickness and averaging thickness as recommended by the manufacturer.

- G. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 150 mm above horizontal surface.
- H. Install cant strips at inside corners.
- I. Apply extra thickness of waterproofing material at corners, intersections, angles, and over joints.
- J. Seal items protruding to or penetrating through membrane and install counter-flashing membrane material.
- K. Extend waterproofing material and flexible flashing into drain clamp flange and apply adequate coating of liquid membrane to assure clamp ring seal. Coordinate with drain installation specified in Division 15 - Mechanical.
- L. Install membrane flashings and seal into waterproofing material.
- M. Conform to NRCA - Waterproofing Manual drawing details as noted:
- N. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward.
- O. Place protection board and/or panel directly against drainage panel and/or membrane; butt joints.
- P. Adhere protection board and/or drainage panel to substrate with mastic. Scribe and cut boards around projections, penetrations, and interruptions.
- Q. Install Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. On completion of membrane installation, dam installation area as directed by the Supervisor, in preparation for flood testing.
- C. Flood to minimum depth of 25 mm with clean water. After 48 hours, verify no leaks with the Supervisor.
- D. When leaking is found, remove water, patch leaking areas with new waterproofing materials as directed by the Supervisor; repeat flood test. Repair damage to building.
- E. When area is proven watertight, drain water and remove dam.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.
- B. Do not permit traffic over unprotected or uncovered membrane.

- C. After membrane has cooled and/or cured, but before it becomes dusty, apply separation sheet. Lap joints to ensure complete coverage.

3.6 SCHEDULE

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 07260

VAPOR RETARDERS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes sheet and sealant materials for controlling vapor diffusion.
- B. Related Sections:
 - 1. Section 07270 - Air Barriers.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- B. Sealant, Waterproofing and Restoration Institute:
 - 1. SWRI - Sealant Specification.

1.4 PERFORMANCE REQUIREMENTS

- A. Maximum Vapor Permeability (Perm): 1 ng/S/m/Pa measured in accordance with ASTM E96 Method E.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data indicating material characteristics, performance criteria, and limitations.
- C. Manufacturer's Installation Instructions: Submit preparation and installation requirements, techniques.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SWRI - Sealant and Caulking Guide Specification requirements for materials and installation.

1.7 SEQUENCING

- A. Sequence Work to permit installation of materials in conjunction with other retardant materials and seals, and air barrier assemblies specified in Section 07270.
- B. Do not install vapor retarder until items penetrating vapor retarder are in place.

PART 2 PRODUCTS

2.1 VAPOR RETARDERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Sheet Retarder: Polyethylene film for above grade application, 0.25 mm thick.
- B. Sealant: Type as recommended by the Supervisor
- C. Primer and Backer Rods: As recommended by sealant manufacturer.
- D. Cleaner: Non-corrosive type; as recommended by sealant manufacturer.
- E. Mastic Adhesive: Asphalt type, compatible with sheet retarder and substrate.
- F. Adhesive: Compatible with sheet retarder and substrate, permanently non-curing.

2.3 ACCESSORIES

- A. Thinner and Cleaner: As recommended by sheet material manufacturer.
- B. Tape: Bright aluminum, Polyethylene and/or Polyester self-adhering type, mesh reinforced, 50 mm wide, compatible with sheet material.
- C. Attachments: Stainless steel type 316 bars and anchors.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove loose or foreign matter capable of impairing adhesion.
- B. Clean and prime substrate surfaces to receive adhesive and sealants.

3.2 EXISTING WORK

- A. Clean and repair existing construction to provide positive and continuous seal for vapor retarders.

3.3 INSTALLATION

- A. Install Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.

END OF SECTION

SECTION 07270

AIR BARRIERS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes air leakage criteria for primary air seal building enclosure materials and assemblies; materials and installation methods supplementing other and primary air seal materials and assemblies; and air seal materials to connect and seal openings, joints, and junctions between other air seal materials and assemblies.
- B. Related Sections:
 - 1. Section 07260 - Vapor Retarders: Vapor retarders.
 - 2. Section 07900 - Joint Sealers: Sealant materials and installation techniques.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. American Society of Civil Engineers:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International:
 - 1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 3. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
 - 4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- C. Sealant, Waterproofing and Restoration Institute:
 - 1. SWRI - Sealant Specification.

1.4 DEFINITIONS

- A. Air Barrier: Continuous network of materials and joints providing air tightness, with adequate strength and stiffness to not deflect excessively under air pressure differences, to which it will be subjected in service. It can be comprised of single material or combination of materials to achieve performance requirements.

1.5 DESIGN REQUIREMENTS

- A. Perform design work in accordance with ASCE 7.

1.6 PERFORMANCE REQUIREMENTS

- A. Static Test: Resist air leakage caused by static air pressure across exterior wall assemblies and other interruptions to integrity of building enclosure systems; in accordance with ASTM E283 and/or ASTM E330.
- B. Dynamic Test: Resist air leakage caused by dynamic air pressure across exterior wall assemblies and other interruptions to integrity of wall and roof systems; in accordance with ASTM E283 and/or ASTM E330.
- C. Provide continuity of air seal materials and assemblies in conjunction with materials described in Sections 03300, 07212, 07900 & 08520.

1.7 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate special joint conditions.
- C. Design Data: Submit design calculations.
- D. Product Data: Submit data on material characteristics, performance criteria, and limitations.
- E. Manufacturer's Installation Instructions: Submit preparation, installation requirements and techniques, product storage and handling criteria.

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with SWRI - Sealant and Caulking Guide Specification requirements for materials and installation.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 AIR BARRIERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Sheet Seal: Type as recommended by the manufacturer.
- B. Liquid Seal: Type as recommended by the manufacturer.
- C. Sealant: Type as recommended by the manufacturer.
- D. Polysulfide Sealant: Type as recommended by the manufacturer.

- E. Polyurethane Sealant: Type as recommended by the manufacturer.
- F. Silicone Sealant: Type as recommended by the manufacturer.
- G. Primer: As recommended by the manufacturer.
- H. Substrate Cleaner: Non-corrosive, compatible with adjacent materials.
- I. Mastic Adhesive: Compatible with sheet seal and substrate.
- J. Adhesive: Type compatible with sheet seal and substrate, permanently non-curing.

2.3 ACCESSORIES

- A. Thinner and Cleaner for Sheet: As recommended by sheet material manufacturer.
- B. Tape: Bright aluminum, Polyethylene and/or Polyester self adhering type, mesh reinforced, 50 mm wide, compatible with sheet material.
- C. Attachments: Stainless steel type 316 bars and anchors.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean and prime substrate surfaces to receive adhesive and sealants.

3.2 INSTALLATION

- A. Install Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.
- B. Do not permit adjacent work to damage work of this section.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sealants and joint backing, foam sealers, gaskets and accessories.
- B. Related Sections:
 - 1. Section 07260 - Vapor Retarders: Sealants required for vapor retarders.
 - 2. Section 07270 - Air Barriers: Sealants required for air barriers.
 - 3. Section 08520 – Aluminum Windows and Doors.
 - 4. Section 08114 – Standard Steel Doors.
 - 5. Section 08800 - Glazing: Glazing sealants and accessories.
 - 6. Section 09300 - Tile: Sealant used as tile grout.

1.2 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM C834 - Standard Specification for Latex Sealants.
 - 2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
 - 3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
 - 5. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - 6. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
 - 7. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit two samples, 300 x 300 mm, illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

- A. General Joint Sealer Performance Requirements: Select materials for compatibility with joint surfaces and other indicated exposures.
 - 1. Select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

2. Where exposed to foot traffic, select materials of sufficient strength and hardness to withstand stiletto heel traffic without damage to sealer system.
- B. Color Selection: Provide colors specified and if not to match adjacent material or paint color; provide custom colors where required; colors to be selected by Supervisor
- C. Perform work in accordance with sealant manufacturer's requirements.
- D. Contractor shall require sealant manufacturer to review the project joint conditions and details for this Section of the work. Contractor shall submit to the Supervisor written certification from the sealant manufacturer that joints are of the proper size and design, that the materials and backing will properly perform to provide permanent watertight, airtight or vaportight seals (as applicable), and that materials supplied meet specified performance requirements.
- E. Certification shall include copies of manufacturer's test regarding adhesion and staining of adjacent.
- F. Perform acoustical sealant application work in accordance with ASTM C919.
- G. Maintain one copy of each referenced document on site.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Products Requirements.
- B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with sections referencing this section and others as required.

PART 2 PRODUCTS

2.1 JOINT SEALERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. General: Provide a complete system of cleaners, primers, fillers, tapes, backer rods and tapes and sealants in accordance with the manufacturer's requirements and the standards specified herein.
 1. Color of Sealants: For concealed joints provide manufacturer's standard color which has the best overall performance quantities for the application shown. For exposed joints provide custom colors as selected by the Supervisor from the manufacturer's standard colors or other special custom colors.

- C. 1-Part Polyurethane Sealants: Polyurethane based 1-part elastomeric sealant, complying with Fed. Spec. TT-S-00230C, Type II Class A, with elongation and compression of not less than 25 %. ASTM C-920, Type S, Class 25, Grade NS.
1. Location: Interior joints subject to movement.
- D. 2-Part Polyurethane Sealant: Polyurethane based 2-part elastomeric sealant, complying with Fed. Spec. TT-S-00227, Type II, Class A, with elongation and compression of not less than 25 %. ASTM C-920, Type M, Class 25, Grade NS:
1. Location: Exterior joints within masonry and concrete.
- E. 2-Part Polyurethane Sealant for Horizontal Applications: Self leveling polyurethane based 2-part elastomeric sealant, complying with Fed. Spec. TT-S-00227E, Type I, Class A, with shore "A" hardness of not less than 30 and elongation and compression of not less than 25 %. ASTM C-920, Type M, Class 25, Grade P.
1. Location: Joints subject to pedestrian or vehicle traffic.
- F. Medium Modulus Silicone Rubber Sealant: Silicone rubber based 1-part neutral cure elastomeric sealant with plus 50 percent to minus 50 percent movement complying with ASTM C-920 and Fed. Spec. TT-S-001543, Class A, and recommended by manufacturer for joints.
1. Location: Exterior joints subject to movement, NOT in contact with EIFS.
- G. Medium Modulus Silicone Rubber Sealant to Reduce Bleeding and Mildew Growth: Silicone rubber based 1-part neutral cure elastomeric sealant with plus 50 percent to minus 50 percent movement specially design for exterior application to reduce bleeding and mildew growth complying with ASTM C-920.
1. Location: Exterior joints in metal panels and exterior ceramic tile.
- H. Ultra Low-Modulus Silicone Rubber Sealant: Silicone rubber based 1-part neutral cure elastomeric sealant with plus 100 percent to minus 50 percent movement complying with ASTM C-920 and Fed. Spec. TT-S-001543, Class A.
1. Location: Joints in contact with EIFS.
- I. High Modulus Silicone Rubber Sealant: 1-part nonacid-curing silicone.
1. Location: Joints related to structural glazing.
- J. Mildew-Resistant Silicone Rubber Sealant: Silicone rubber based, 1-part mildew resistance sealant with integral fungicide complying with Fed. Spec. TT-S-001543, Class A. Specifically recommended by manufacturer for interior joints in wet areas around plumbing fixtures and ceramic tile.
1. Location: Joints in ceramic tiles, and around equipment & plumbing fixtures.
- K. Acrylic Sealants: General purpose, paintable acrylic-emulsion sealant with plus 7.5 percent to minus 7.5 percent movement complying with ASTM C834.
1. Location: Interior joints NOT subject to movement.
- L. 2-Part Polysulfide Sealant: Polysulfide based, 2-part elastomeric sealant with +25% to -25 % movement complying with Fed. Spec. TT-S-00227, Type II. Class A, non-sag synthetic rubber formulated form "Thiokol LP" polymer and recommended by manufacturer for continuous submersion in chlorinated water.
1. Location: Joints submerged in treated water, swimming pools and whirlpools.

- M. Foam Gasket Seal: Precompressed, impregnated open-cell foam sealant incorporating permanently elastic open cell polyurethane foam, manufacturer's standard impregnating agent, and pressure sensitive backing.
- N. Foam Gasket Seal for Submerged Application: Precompressed, impregnated open-cell foam sealant incorporating permanently elastic open cell polyurethane foam, manufacturer's impregnating agent at higher levels than standard product, and pressure sensitive backing. Specially designed for use in submerge application.
- O. Splice Adhesive for Foam Gasket Seal: 1-part urethane wet sealant as recommended by gasket seal manufacturer.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant, type as recommended by manufacturer; ASTM D1056, sponge or expanded rubber, or D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and joint openings are ready to receive work.
- C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.
- D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Perform acoustical sealant application work in accordance with ASTM C919.

- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints as detailed.
- H. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 3 to 6 mm below adjoining surface.
- I. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 3 to 6 mm below adjoining surface.

3.4 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.
- B. Protect sealants until cured.

END OF SECTION

SECTION 08114

STEEL GATES

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes steel gates (with all wood beams, accessories, hardware, components, painting, etc.).
- B. Related Sections:
1. Section 05520 – Handrails and Railings.
 2. Section 08710 - Door Hardware.
 3. Section 09900 - Paints and Coatings: Field painting of doors.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
1. ASTM A 153/ A 153M -Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 2. ASTM A 250.5 -Accelerated Physical Endurance Test Procedure for
 3. Steel Doors, Frames and Frame Anchors
 4. ASTM A 591/ A 591M -Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight/Mass Applications
 5. ASTM A 653/ A 653M -Standard Specification for Steel Sheet, Zinc- Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 6. ASTM A 1008 -Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 7. ASTM A 1011/A 1011M -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
 8. ASTM E 329 -Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
 9. ASTM E 548 -Standard Guide for General Criteria Used for Evaluating Laboratory Competence

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.

- B. Shop Drawings: Indicate gate elevations, internal reinforcement, closure method, and cut-outs.
- C. Product Data: Submit gate configurations, location of cut-outs for hardware reinforcement.
- D. Manufacturer's Installation Instructions: Submit special installation instructions.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the drawings, to the manufacturer's instructions and to the approval of the Supervisor.
- A. Coordinate installation of anchorages for gate. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide Cold-Rolled Steel Sheet suitable for exposed applications per ASTM A 1008/A 1008M, Commercial Steel (CS).
- B. Provide Hot-Rolled Steel Sheet free of scale, pitting, or surface defects; pickled and oiled: per ASTM A 1011/A 1011M, Commercial Steel (CS).
- C. Provide Metallic-Coated Steel Sheet with minimum A40 (ZF120) zinc-ironalloy (galvannealed) coating designation per ASTM A 653/A 653M, Commercial Steel (CS).
- D. Provide Electrolytic Zinc-Coated mill phosphatized Steel Sheet: ASTM A591/A 591M, Commercial Steel (CS), Class B coating.
- E. Provide galvanized Supports and Anchors to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Provide Inserts, Bolts, and Fasteners to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

2.2 STEEL GATE

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. Provide 3 mm thick steel sheet for all members.

- C. Metal Surfaces exposed to view in the completed Work, will be fabricated from materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- D. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure frames to types of supports indicated.
- E. Metal leafs to have no visible seams, and be factory welded with integral stop and extended frame to allow for 12.5 mm reveal to finishes.
- F. Locking and latching mechanisms: Furnish number required to hold gates in flush, smooth plane when closed.
- G. Gates and frames shall be made such that any security hardware and electrical service associated with such equipment is inconspicuously integrated into the design profiles and concealed from view.
- H. Minor scratches and blemishes shall be repairable with the coating manufacturer's recommended product and system, matching the original finish for colour, texture and gloss as acceptable to the Supervisor.
- I. Minimum gate Reinforcement: Use 16 gauge spot welded plates for surface items and those not otherwise specified. Gauges specified are minimum. Dimensions and quantities to be verified by the Contractor at its sole responsibility.
 - 1. Hinges: Not less than 7 gauge, minimum 32mm by 250mm with at least 3 electric spot welds staggered at each end. Dimensions and quantities to be verified by the Contractor at its sole responsibility.
 - 2. Floor hinges and pivots: Not less than 7 gauge, size per manufacturer's template recommendation. Dimensions and quantities to be verified by the Contractor at its sole responsibility.
 - 3. Mortise lock: Not less than 12 gauge with centering clips for lock case alignment and 14 gauge reinforcement for escutcheons or roses.
 - 4. Cylindrical lock: Not less than 12 gauge for lock front and 2 welded-in support clips. Dimensions and quantities to be verified by the Contractor at its sole responsibility.
 - 5. Flush bolts: Not less than 12 gauge, size per manufacturer's template recommendation. Dimensions and quantities to be verified by the Contractor at its sole responsibility.
 - 6. Exit devices: Not less than 14 gauge, size per manufacturer's template recommendation.
 - 7. surface gate closer: Not less than 12 gauge channel type reinforcement not less than 100mm high by 450mm long with not less than 8 electric spot welds for application of closers at any time on all gates. Dimensions and quantities to be verified by the Contractor at its sole responsibility.
 - 8. Mortise gate closer: Not less than 14 gauge channel type reinforcement per manufacturer's template recommendation.
 - 9. Pulls and pull bars: Not less than 16 gauge plate type reinforcement for concealed fastening and 12 gauge channel type for through-bolt mounting.
- J. Finish metal fabrications after assembly.
- K. Paint finishes shall be stable, fade resistant, durable and of uniform texture and color.

2.3 FABRICATION

- A. Fabricate gate with hardware reinforcement welded in place.
- B. Configure gates with edge profile to receive recessed weatherstripping.

2.4 SHOP FINISHING

- A. Steel Sheet: Galvanized to ASTM A653/A653M Z120, Z180 and/or Z275.
- B. Primer: Air dried and/or baked.
- C. Shop Finish: Baked enamel and/or Thermosetting epoxy of color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify opening sizes and tolerances are acceptable and correct at sole responsibility of Contractor.

3.2 GATE AND HARDWARE INSTALLATION

- A. Coordinate installation of gates with installation of frames specified in Section 08115 and hardware specified in Section 08710.
- B. Gates shall be fitted with the specified hardware, hung and immediately before final completion, additional adjustments to be made so that gates operate in perfect order.
- C. Location of hardware on gates and frames shall be in accordance with applicable standard of the National Association of Architectural Metal Manufacturers (NAAMM) and the Door Hardware Institute (DHI).
- D. Install on-site allshop-finished wooden members as shown on drawings.
- E. Hardware shall be assorted and stored in space assigned and shall be kept under lock and key. The safety and preservation of delivered items will be the responsibility of the Contractor.
- F. Install finishing hardware in accordance with manufacturer's written instructions. Do not modify finishing hardware. Set, fit, adjust and clean hardware according to manufacturer's written instruction. After installation of hardware under this section, check opening units for correct fit and uniformity of space around perimeter of units, or between units. Ensure smoothly operating opening units free from binding.
- G. After installation, templates, instruction sheets, and installation details, shall be turned over to the Client's representative at the project closeout.

- H. Do not use shims without Supervisor's approval.
- I. Wrapping or other factory-applied protection furnished with finish hardware, installed under this section, shall be left on such hardware, or, if removed, replaced on completion of hardware installation, until final acceptance by the Supervisor, at which time protection shall be removed and work left in proper condition.
- J. Exposed surfaces shall be free of any tool marks, rust, or blemishes, and any damage to exposed surfaces shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Supervisor and Client.
- K. Fasteners furnished with the hardware shall be used to secure the hardware in place for each type of substrate. Through-bolts shall in no case be permitted for the fastening of any hardware unless otherwise approved. Hardware shall be properly adjusted and checked out to ensure the hinges, locks, latches, bolts, holders and closers are in proper operational condition. After hardware has been checked, key shall be tagged, identified and delivered to the Client. Any errors in cutting and fitting, keying or any damage to adjoining work shall be repaired at no extra cost to the Client or Supervisor. Drill and countersink units which are not factory prepared for anchorage.
- L. Cut and fit threshold and floor covers to profile of frames, with mitered corners and hairline joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.
- M. Keys used shall be construction keys which are to be tagged with fiber discs as approved, clearly labeled with identifying inscriptions and then neatly arranged in a temporary cabinet. Construction keys shall be returned to the Client.
- N. Adjusting and Cleaning: Adjust and check each operating item of hardware and each gate, to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer. Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made. Final adjustment of hardware is to be done after heating and ventilating has been balanced.
- O. Rejection: metal work which in the opinion of the Supervisor is defective, shall be removed and replaced with new at no additional cost. Rejection will additionally be considered for items including hardware cutouts of improper size or location or which prevent proper installation of gates, hardware or work of other trades.

3.3 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Diagonal Distortion: 1.5 mm measured with straight edge, corner to corner.

3.4 ADJUSTING

- A. Section 01700 - Execution Requirements: Requirements for adjusting.

B. Adjust gate for smooth and balanced movement.

3.5 SCHEDULE

A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 08520

ALUMINUM DOORS AND WINDOWS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes extruded aluminum windows and doors with fixed and operating sash, factory glazed panels, operating hardware and insect screens.
- B. Related Sections:
1. Section 05500 - Metal Fabrications.
 2. Section 07260 - Vapor Retarders.
 3. Section 07270 - Air Barriers.
 4. Section 07900 - Joint Sealers.
 5. Section 08800 - Glazing.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. Aluminum Association:
1. AA DAF-45 - Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association:
1. AAMA 101 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
 2. AAMA 501.4 - Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Inter Story Drifts.
 3. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 4. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 5. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 6. AAMA MCWM-1 - Metal Curtain Wall manual.
- C. American National Standards Institute:
1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- D. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

- E. ASTM International:
 - 1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - 3. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
 - 4. ASTM D1784 - Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
 - 5. ASTM D3656 - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
 - 6. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 7. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 8. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 9. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
 - 10. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
 - 11. ASTM F588 - Standard Test Methods for Resistance of Window Assemblies to Forced Entry Excluding Glazing.
- F. Glass Association of North America:
 - 1. GANA - Glazing Manual.
- G. National Fenestration Rating Council Incorporated:
 - 1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
- H. SSPC: The Society for Protective Coatings:
 - 1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic or Type II - Organic).
 - 2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related Work; and installation requirements.
- C. Product Data: Submit component dimensions, anchorage and fasteners, glass and typical details.

- D. Samples: Submit two samples 600 x 600 mm in size, illustrating window frame section mullion section, insect screen and frame, factory finished aluminum surfaces, glass units, glazing materials. Submit two samples of operating hardware.
- E. Manufacturer's Certificates: Certify Products meet or exceed specified requirements.
- F. Test Reports: Indicate substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Aluminum Doors/Windows: Fabricate window assemblies in accordance with AAMA 101 for types of windows required and equivalent for doors.
 - 2. Insulated Glass: Fabricate insulated glass units in accordance with GANA (formerly FGMA) Glazing Manual.
 - 3. Safety Glass: Conform to ANSI Z97.1 and applicable codes.
 - 4. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 ALUMINUM DOORS/WINDOWS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. All colors and dimensions shall be as per drawings or as instructed by Supervisor.
- B. Extruded Aluminum: ASTM B221M; 6063 alloy, T5 temper.
- C. Sheet Aluminum: ASTM B209M; 5005 alloy, H15 or H34 temper.
- D. Steel Sections: Profiled to suit mullion sections.
- E. Thermally broken Aluminum frame.
- F. Glass: Conforming to requirements of Section 08800 - Glazing.
- G. Hardware:
 - 1. Operator: Geared rotary handle fitted to projecting sash arms with limit stops.
 - 2. Projecting Sash Arms: Cadmium and/or Zinc plated steel, friction pivot joints with nylon bearings, removable pivot clips for cleaning.
 - 3. Pulls: Manufacturer's standard.
 - 4. Sash lock: Lever handle with cam lock.
 - 5. Bottom Rollers: Stainless steel type 316, adjustable.

- H. Sills: Extruded aluminum; sloped for positive wash; fit under sash leg 12 mm beyond wall face; one piece full width of opening jamb angles to terminate sill end.
- I. Operable Sash Weather Stripping: Wool pile, Nylon pile and/or Resilient plastic; permanently resilient, profiled to effect weather seal.
- J. Internal Aluminum doors shall be fixed using double-action wall-type hinges.
- K. Insect Screen with frame: consisting of sub frame, main frame, wire/mesh cloth and support assembly, hinges, rollers and all fittings, rubber cushions, insulations and anchors required. Insect screens shall be of the fixed type covering the whole of the opening area. The mesh type shall be of aluminum of an approved type and color.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type 316.
- B. Visual Glass Dividers: Formed aluminum, fitted against interior of glazed surface, secured with spring loaded steel pins into plastic sockets.
- C. Visual Glass Muntins: Formed aluminum, applied to interior and/or exterior glass surface.
- D. Bituminous Paint: Fibered asphaltic type.
- E. Limit Stops: Resilient rubber.

2.4 FABRICATION

- A. Wherever possible, the doors/windows should be prefabricated, transported to site and installed without scaffolding. This allows superior quality control during fabrication and quick installation.
- B. The panels will be transported to site and craned to the appropriate floor.
- C. All occupational health and safety issues should be adequately addressed for the installation.
- D. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- E. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- F. Prepare components to receive anchor devices. Fabricate anchors.
- G. Arrange fasteners and attachments to ensure concealment from view.
- H. Prepare components with internal reinforcement for operating hardware.

- I. Furnish internal reinforcement in mullions with galvanized steel members to maintain rigidity.
- J. Permit internal drainage weep holes and channels to migrate moisture to exterior. Furnish internal drainage of glazing spaces to exterior through weep holes.
- K. Assemble insect screen frame, miter and reinforce frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- L. Double and/or Single weatherstrip operable units.
- M. Factory glaze window units. Install glass panels in accordance with Section 08800.

2.5 SHOP FINISHING

- A. Finish Coatings: Conform to AAMA 2603, AAMA 2604 or 2605 and/or AAMA 611.
- B. Exterior and Interior Aluminum Surfaces: Advanced durability polyester powder coating system. Color and Percent Gloss: As selected. Cover thickness 60 microns.
- C. If anodized finishes are adopted, Color Anodized Aluminum Surfaces: AA-M12C22A44 non-specular as fabricated mechanical finish, medium matte chemical finish and Architectural Class I, 0.018mm anodized coating; Color as selected.
- D. Locks, Operators, and Exposed Hardware: Enameled to match window finish and/or color as directed by the Supervisor.
- E. Pull Handles: Prefinished wood with aluminum brackets, and/or Anodized aluminum. Color to match frames.
- F. Screens: Black, White, and/or Gray color as instructed by Supervisor.
- G. Apply coat of bituminous paint on concealed aluminum surfaces in contact with cementitious or dissimilar materials.
- H. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.
- I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
- J. Concealed Steel Items: Galvanized in accordance with ASTM A123/A123M to thickness Grade 85, 610 g/sq m.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this section.

- C. Verify sizes and tolerances at sole responsibility of Contractor.

3.2 INSTALLATION

- A. Attach door/window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- B. Align door/window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent Work.
- C. Install sill and sill end angles.
- D. Install thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- E. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.
- F. Install operating hardware.

3.3 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Level or Plumb: 1.5 mm/m non-cumulative or 3 mm/3m, whichever is less.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Inspection to monitor quality of installation and glazing.
- C. Test to AAMA 502, ASTM E1105, and AAMA 501.
- D. Perform field water test in compliance with ASTM E 1105, on completed portions of Aluminum Doors and Windows.
- E. Perform one test each at 10%, 50% and 80% of Doors and Windows completion, with repeat tests when failures occur.
- F. If testing results in leakage, eliminate causes of leaks and retest until no leaks occur.

3.5 ADJUSTING

- A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust hardware for smooth operation and secure weathertight closure.

3.6 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Remove protective material from factory finished aluminum surfaces.
- C. Wash surfaces by method recommended and acceptable to sealant and door/window manufacturer; rinse and wipe surfaces clean.
- D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and door/window manufacturer.

3.7 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes hardware for wood and metal doors.
- B. Related Sections:
1. Section 08114 – Steel Gates.
 2. Section 08520 – Aluminum Doors and Windows.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. American National Standards Institute:
1. ANSI A156.1 - Butts and Hinges.
 2. ANSI A156.2 - Bored and Preamsembled Locks and Latches.
 3. ANSI A156.3 - Exit Devices.
 4. ANSI A156.4 - Door Controls - Closures.
 5. ANSI A156.5 - Auxiliary Locks and Associated Products.
 6. ANSI A156.6 - Architectural Door Trim.
 7. ANSI A156.7 - Template Hinge Dimensions.
 8. ANSI A156.12 - Interconnected Locks and Latches.
 9. ANSI A156.13 - Mortise Locks and Latches.
 10. ANSI A156.14 - Sliding and Folding Door Hardware.
 11. ANSI A156.15 - Closer Holder Release Devices.
 12. ANSI A156.16 - Auxiliary Hardware.
 13. ANSI A156.18 - Materials and Finishes
 14. ANSI A156.24 - Delayed Egress Locks.
 15. ANSI A156 - Complete Set of 24 BHMA Standards A156 Series with Binder
- B. Builders Hardware Manufacturers Association:
1. BHMA Directory of Certified Products.
- C. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
 2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- D. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.

- 2. UL 305 - Panic Hardware.
- 3. UL - Building Materials Directory.
- E. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, and fixing details and requirements.
 - 1. Submit manufacturer's parts lists, and templates.
- C. Samples: Submit one sample of typical hinge, latchset, lockset and closer, illustrating style, color and finish. Approved samples might be incorporated into Work.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of installed cylinders.
- C. Keys: Deliver with identifying tags to Purchaser by security shipment direct from hardware supplier.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI A156 series, NFPA 80 and UL 305.
- B. Furnish hardware marked and listed in BHMA Directory of Certified Products.
- C. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 DOOR HARDWARE

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the products.

2.2 COMPONENTS

- A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
 - 1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.

2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
 3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware. Finish to match hardware item being fastened.
 4. Fire Ratings: Provide hardware with UL or Intertek Testing Services (Warnock Hersey Listed) listings for type of application involved.
- B. Hinges: To EN1935 class 13; 40 hours salt test; 3 mm thick stainless steel type 316 material; 5 knuckles; with stainless steel type 316 pin, removable at interior, non-rising pin housed in ball bearing.
1. Width: Sufficient to clear trim projection when door swings 180 degrees.
 2. Number: Furnish minimum three hinges for each door leaf up to 2200 mm high, and four hinges for each door leaf not exceeding 3000 mm high.
 3. Size and Weight: 114 mm high heavy weight for door leaf up to 44 mm thick and up to 1200 mm wide, and 125 mm high extra heavy weight ball or iolite bearing hinges for door leaf exceeding 44 mm thick or exceeding 1200 mm wide.
- C. Pivots: ANSI A156.1 and A156.4, center or offset full mortise pivots.
1. Size: As recommended by pivot manufacturer for size and weight of door.
- D. Locksets: Furnish locksets compatible with specified cylinders. Typical 70 mm backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt, verify type of cutouts provided in metal frames.
1. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1.
 2. Bored (Cylindrical) Locksets: ANSI A156.2, Series 4000, Grade 1.
 3. Preassembled (Unit) Locksets: ANSI A156.12, Series 2000, Grade 1.
 4. Interconnected Locksets: ANSI A156.12, Series 5000, Grade 1.
 5. Auxiliary Locksets: ANSI A156.5, Grade 1, mortise dead locks, bored dead locks, rim locks or narrow stile locks.
- E. Latch Sets: Match locksets.
1. Mortise Latch Sets: ANSI A156.13, Series 1000, Grade 1, 2 or 3.
 2. Bored (Cylindrical) Latch Sets: ANSI A156.2, Series 4000, Grade 1, 2 or 3.
- F. Exit Devices: ANSI A156.3, Grade 1, concealed vertical rod type or rim type, with push pad or cross bar. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt, verify type of cutouts provided in metal frames, with dust-proof floor strikes.
1. Types: Suitable for doors requiring exit devices.
 2. Coordinators: Furnish overhead concealed in frame type at pairs of doors.
- G. Lock: To BS 5872.
1. Sash Lock: 76mm lock case, 57mm backset centers to suit Euro profile cylinder, stainless steel type 316, for end plate and strike plate, brass latch and deadbolt, deadbolt with hardened steel rollers.
 2. Deadlock: Same as sash lock without latch.
 3. Latch lock: Same as sash lock without deadlatch.
 4. Bathroom Lock: Special cylinder with thumbturn lock system with normal deadbolt to suit 8 or 5mm indicator and turn spindle.

5. Nightlatch: Same as sash lock, cylinder to withdraw latch.
- H. Cylinders: To DIN V18254 and to ANSI A156.5, Grade 1, 5, 6, or 7, pin type removable cylinders, or interchangeable core type cylinders; Euro profile, length to suit door thickness; single, double or with turn where indicated; non copiable, protected with anti drill option from outside; nickel-plated finish or to suit finish of handle.
1. Locks and cylinders shall be keyed as per Supervisor's instruction.
 2. Keys: Nickel silver finish. Provide three keys per lock.
- I. Closers: ANSI A156.4 modern type with or without cover, stainless steel type 316 or to match door hardware on same face of door, surface mounted, overhead concealed, concealed in door, or concealed in floor center pivot or offset pivot closers; full rack and pinion type with steel spring and non-freezing hydraulic fluid.
1. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.
 2. Arms: Type to suit individual condition; parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.
 3. Location: Mount closers on inside of exterior doors, room side of interior doors typical; mount on pull side of other doors.
 4. Operating Pressure: Maximum operating pressure as follows.
 - a. Interior Doors: Maximum 22 N.
 - b. Exterior Doors: Maximum 38 N.
 - c. Fire Rated Doors: As required for fire rating, maximum 65 N.
- J. Sliding Door Hardware: ANSI A156.14; furnish complete hardware sets for operational installation.
- K. Door Stop: ANSI A156.1, Grade 1; stainless steel type 316, cylindrical or dome type with rubber and with no visible screws, to be fixed at minimum $\frac{2}{3}$ of door width from Hinge side. Furnish with accessories as required for applications indicated.
- L. Handles: Stainless steel type 316 satin finish, hollow type with bolt through fixing screws, return to door type.
- M. Pull handle: Stainless steel type 316; bolt through fixing type.

2.3 ACCESSORIES

- A. Lock Trim: Furnish levers and roses as selected from manufacturer's full range.
- B. Through Bolts: Do not permit through bolts and grommet nuts on door faces in occupied areas unless no alternative is possible. Do not permit through bolts on solid wood core doors.
- C. Flush Bolt:
1. All flush bolts for metal doors to be of type suitable for metal doors with rod length 305mm, size 25 x 172mm.
 2. All flush bolts for wood doors to be 19 x 200mm size, lever action type.

- D. Weatherstripping: Furnish continuous weatherstripping at top and sides of exterior doors.
- E. Gaskets: Furnish continuous fire rated gaskets at top and sides of fire rated doors.
- F. Key Cabinet:
 - 1. Cabinet Construction: Aluminum or sheet steel construction, baked enamel finish; color as selected; piano hinged door.
 - 2. Cabinet Size: Size to suit project keys plus 10 percent.
 - 3. Horizontal metal or plastic strips for key hook labeling with clear plastic strip cover over labels.

2.4 FINISHING

- A. Finishing of Other Hardware Items: Furnish manufacturer's standard finishes to match similar hardware types on same door.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings and as instructed by manufacturer.

3.2 INSTALLATION

- A. Mounting Heights of Hardware Item: Coordinate mounting heights with door and frame manufacturers, and comply with their recommendations, and applicable standards and codes where not otherwise stated.
- B. Install Work in accordance with the drawings, to the manufacturer's instructions and to the satisfaction of the Supervisor.

3.3 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services, and Section 01700 - Execution Requirements: Testing, adjusting and balancing.
- B. Primary hardware manufacturer's representatives shall inspect installation and certify that hardware has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

- A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust hardware for smooth operation.

3.5 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes glass for doors, windows and glazed panels.
- B. Related Sections:
 - 1. Section 07260 - Vapor Retarders.
 - 2. Section 07270 - Air Barriers.
 - 3. Section 07900 - Joint Sealers.
 - 4. Section 08212 - Flush Wood Doors.
 - 5. Section 08520 - Aluminum Windows and Doors.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. American National Standards Institute:
 - 1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- B. American Society of Civil Engineers:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International:
 - 1. ASTM C570 - Standard Specification for Oil- and Resin-Base Caulking Compound for Building Construction.
 - 2. ASTM C669 - Standard Specification for Glazing Compounds for Back Bedding and Face Glazing of Metal Sash.
 - 3. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 4. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 5. ASTM C1036 - Standard Specification for Flat Glass.
 - 6. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 7. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
 - 8. ASTM C1193 - Standard Guide for Use of Joint Sealants.
 - 9. ASTM D4802 - Standard Specification for Poly Methyl Methacrylate Acrylic Plastic Sheet.

10. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 11. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 12. ASTM E546 - Standard Test Method for Frost Point of Sealed Insulating Glass Units.
 13. ASTM E576 - Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.
 14. ASTM E773 - Standard Test Methods for Seal Durability of Sealed Insulating Glass Units.
 15. ASTM E774 - Standard Specification for Sealed Insulating Glass Units.
 16. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Exterior Windows and Doors.
 17. DIN 18516: Part4 - Heat Soaked Testing for Tempered Glass.
- D. Glass Association of North America:
1. GANA - FGMA Sealant Manual.
 2. GANA - Glazing Manual.
 3. GANA - Laminated Glass Design Guide.
- E. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
- F. Underwriters Laboratories Inc.:
1. UL - Building Materials Directory.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data:
1. Glass: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
 2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
- C. Samples:
1. Glass: Submit three samples 600 x 600 mm in size, illustrating each glass and plastic units, color and design.
 2. Glazing Materials: Submit 300 mm long bead of glazing sealant and gaskets, color as selected by the Supervisor.
- D. Certificates: Certify products meet or exceed specified requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Do not install glazing when ambient temperature is less than 10°C.

PART 2 PRODUCTS

2.1 GLAZING

- A. Glass, Glazing, Sealant, Gasket, Tapes Compounds and Glazing Accessories
Manufacturers: Any recognized manufacturers having an official technical agreement to conformity with standards for the products.
- B. Glass for Aluminum Doors and Windows, unless otherwise shown on drawings:
 - 1. Single Glazed Aluminum Windows as specified in drawings:
 - a. Pane: 6 mm thick clear toughened glass (tempered); and
 - b. Pane: 6 mm thick Satinovo toughened glass (tempered).
 - 2. Single Glazed Aluminum Doors as specified in drawings:
 - a. Pane: 10mm thick Satinovo toughened glass (tempered).
 - 3. Double Glazed Aluminum Doors, Windows and Panels:
 - a. Outer Pane: 6 mm thick clear toughened glass (tempered).
 - b. Void (air): 6 mm wide.
 - c. Inner Pane: 6 mm thick clear toughened glass.

2.2 COMPONENTS

- A. Safety Tempered and Laminated Glass Conform to ANSI Z97.1 and ASTM C1172.
- B. PVB Interlayer: Manufacturer's standard, minimum 0.76 mm thick.
- C. Insulated Glass Units: Double Pane Insulated Glass Units: ASTM E774 Class A and E773; with glass elastomer, glass to mastic, and special acoustic edge seal; place reflective film within unit; purge interpane space with dry hermetic air.
- D. All tempered glass to be heat soak tested.
- E. Obtain the total quantity of each glass material from the same material manufacturer. In the case of coated glasses, or other processed glass products, the Sub-Contractor shall ensure that all products are processed from 'raw' glass material obtained from one manufacturer.

2.3 ACCESSORIES

- A. Glazing Splines and Gaskets: ASTM C864 Option I, resilient neoprene, silicone, and/or polyvinyl chloride extruded shape to suit glazing channel retaining slot.
- B. Setting Blocks: ASTM C864 Option I, Neoprene, EPDM, or Silicone, 80 to 90 Shore A durometer hardness, length of 25 mm for each square meter of glazing or minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area.
- C. Spacer Shims: ASTM C864 Option I, neoprene or silicone, 50 to 60 Shore A durometer hardness, 75mm long, ½ glazing stop height, thickness to suit application.
- D. Glazing Clips: Manufacturer's standard type.

- E. Fire-Resistant Glazing Materials: Used to obtain required fire-resistant rating.
- F. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units destined for removal of smoke.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Provide testing and analysis of glass to Section 01400.
- B. Provide shop inspection and testing for safety insulated glass.
- C. Test samples in accordance with ANSI Z97.1, or ASTM E773, E546 or E576.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify openings for glazing are correctly sized and within acceptable tolerance.
- C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement; weeps are clear and ready to receive glazing.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 - 1. Glazing Sealants: Comply with ASTM C1193.
 - 2. Fire Rated Openings: Comply with NFPA 80
- B. Exterior Dry Method:
 - 1. Cut glazing spline to length; install on glazing pane. Seal corners by butting tape and sealing junctions with compatible butyl sealant.
 - 2. Place setting blocks at $\frac{1}{4}$ or $\frac{1}{3}$ points with edge block 150 mm from corners.
 - 3. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
 - 4. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
 - 5. Trim protruding tape edge.

3.4 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Remove glazing materials from finish surfaces; remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.
- B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Don't mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09220

PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes Portland cement plaster system.
- B. Related Sections:
1. Section 03300 - Concrete Works: Wall substrate surface.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
1. ASTM C91 - Standard Specification for Masonry Cement.
 2. ASTM C150 - Standard Specification for Portland Cement.
 3. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
 4. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 6. ASTM C847 - Standard Specification for Metal Lath.
 7. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.
 8. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.
 9. ASTM C932 - Standard Specification for Surface-Applied Bonding Agents for Exterior Plastering.
 10. ASTM C933 - Standard Specification for Welded Wire Lath.
 11. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
 12. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
 13. ASTM C1032 - Standard Specification for Woven Wire Plaster Base.
 14. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
 15. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 16. ASTM C1328 - Standard Specification for Plastic (Stucco) Cement.
 17. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

- B. Federal Specification Unit:
 - 1. FS UU-B-790 - Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant).
- C. National Terrazzo and Mosaic Association:
 - 1. NTMA - Terrazzo Specifications Guide.
- D. Portland Cement Association:
 - 1. PCA - Portland Cement Plaster (Stucco) Manual.
- E. Underwriters Laboratories Inc.:
 - 1. UL - Fire Resistance Directory.
- F. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

1.4 PERFORMANCE REQUIREMENTS

- A. Conform to ASTM E119 and applicable code for fire rated assemblies, and as follows:
 - 1. Fire Rated Partitions: Listed assembly by UL or WH.
 - 2. Fire Rated Ceilings Bulkheads, and Interior Soffits: Listed assembly by UL or WH.
 - 3. Fire Rated Structural Column Framing: Listed assembly by UL or WH.
 - 4. Fire Rated Structural Beam Framing: Listed assembly by UL or WH.
- B. Fabricate vertical elements to limit finish surface to 1:360 deflection under lateral point load of 445 N.
- C. Fabricate horizontal elements to limit finish surface to 1:360 deflection under superimposed dead load and wind uplift loads.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on plaster materials, characteristics and limitations of products specified.
- C. Samples: Submit two samples, size as directed, illustrating finish color and texture.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C926 and PCA Portland Cement Plaster (Stucco) Manual.
- B. Maintain one copy of each document on site.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.

- B. Exterior Plaster Work: Do not apply cement plaster when ambient temperature is less than 4 °C
- C. Interior Plaster Work: Do not apply cement plaster unless minimum temperature of 10 °C has been and continues to be maintained in building for minimum 48 hours prior to plaster application, during application, and until cured.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT PLASTER

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS:

- A. Plaster Materials:
 - 1. Cement: ASTM C150, Type I Portland cement.
 - 2. Aggregate: Natural sand, within the following sieve sizes and percentage retained limits:

| <u>Sieve Size</u> | <u>Percent Retained</u> |
|-------------------|-------------------------|
| 4.75 mm | 0 |
| 2.36 mm | 0 to 5 |
| 1.18 mm | 5 to 30 |
| 0.60 mm | 30 to 65 |
| 0.30 mm | 65 to 95 |
| 0.15 mm | 90 to 100 |
 - 3. Water: Clean, fresh, potable and free of mineral or organic matter capable of affecting plaster.
 - 4. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete and concrete masonry surfaces.
 - 5. Admixtures: Type as per manufacturer instructions.
 - 6. Fibers: 13 mm nominal length glass fibers meeting requirements of ASTM C1116.
 - 7. Color Pigment: ASTM C979 mineral oxide or synthetic type, color as selected by the Supervisor.
 - 8. Sand for finish coats shall be clean, graded silica sand, 100% passing a 30 mesh screen.
- B. Furring and Lathing:
 - 1. Expanded Metal Lath: ASTM C847, galvanized, to suit application.
 - 2. Woven Wire Plaster Base: ASTM C1032, having 25 mm openings.
 - 3. Welded Wire Lath: ASTM C933.
 - 4. Backing Material: FS UU-B-790 Grade D.
 - 5. Casing and Corner Beads, and Base Screed: Formed sheet steel, depth governed by plaster thickness, maximum possible lengths, expanded metal or solid flanges, with square, bullnosed, or beveled edges; galvanized.
 - 6. Corner Mesh: Formed sheet steel, minimum 0.5 mm thick, perforated or expanded flanges shaped to permit complete embedding in plaster, minimum 50 mm size; galvanized.

7. Strip Mesh: Expanded metal lath, minimum 0.5 mm thick, 50 mm wide x 600 mm long; galvanized.
8. Control and Expansion Joint Accessories: Formed sheet steel, accordion profile, 50 mm expanded metal or solid flanges each side, galvanized.
9. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.
10. Fasteners: ASTM C1002, self drilling, self tapping screws.
11. Polyethylene Sheet: Clear, 0.15 mm thick.

C. Acoustic Accessories:

1. Resilient Channels: Formed steel, minimum 0.5 mm thick; face, profile and width as indicated on drawings, splicing permitted; galvanized.
2. Acoustic Insulation: ASTM C665, friction fit type, unfaced; Thickness as per manufacturer's instructions.
3. Acoustic Sealant: Non-hardening, non-skinning type, for use with cement plaster system.

2.3 MIXES

- A. Except where hand-mixing of small batches is approved by the Supervisor, mechanical mixers of an approved type shall be used for the mixing of plaster. Frozen, caked or lumped materials shall not be used.
- B. Mechanical mixers, mixing boxes and tools shall be cleaned after mixing each batch and kept free of plaster from previous mixes. Plaster shall be thoroughly mixed with the proper amount of water uniform in colour and consistency. Retempering will not be permitted and all plaster which has begun to stiffen shall be discarded.
- C. All tools, implements, vessels and surfaces shall at all time be kept scrupulously clean and strict precautions shall be taken to avoid the plasterer or other materials becoming contaminated by pieces of partially set material which would tend to retard or accelerate the setting time.
- D. Spatterdash Coat (Rasheh): 1 part Portland cement and maximum 2 parts of sand, proportioned by volume.
- E. Internal plaster shall be (1:4) composed of 350 kg of cement per m³ of sand. Internal plaster shall be 15 mm thick for walls and ceilings.
- F. External plaster shall be (1:3) composed of 475 kg of cement per m³ of sand. External plaster shall be 20 mm thick.
- G. Internal and external plasters shall be executed in one single coat work in addition to the spatterdash (Rasheh). If more than one coat is required, approved galvanized wire mesh reinforcement shall be used.
- H. Mix and proportion cement plaster in accordance with approved methodology.
- I. Add glass fibers to plaster at rate of 8.0 kg per cubic meter of plaster.
- J. Add admixtures as instructed by the manufacturer.

- K. Mix only as much plaster as can be used prior to initial set.
- L. Add color pigments to finish coat.
- M. Mix materials dry, to uniform color and consistency, before adding water.
- N. Protect mixtures from freezing, frost, contamination, and excessive evaporation.
- O. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Masonry: Verify joints are cut flush and surface is ready to receive work of this section. Verify no bituminous or water repellent coatings exist on masonry surface.
- C. Concrete: Verify surfaces are flat, honeycomb and are filled flush, and surfaces are ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster bond.
- D. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.
- E. Mechanical and Electrical: Verify services within walls have been tested & approved.

3.2 PREPARATION

- A. Dampen masonry surfaces to reduce excessive suction.
- B. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- C. Roughen smooth concrete surfaces and apply bonding agent.
- D. Galvanized wiremesh reinforcement shall be provided wherever blockwalls abut against concrete columns, beams or slabs, and plaster finish is required to continue over both blockwork and concrete surfaces. The galvanized wiremesh reinforcement shall consist of 20 cm wide strips and shall cover the whole length of the joint, horizontally as well as vertically and shall be securely nailed, plugged or stapled in place to both surfaces at intervals not exceeding 40 cm at both edges.
- E. Plastering shall not be commenced until all mechanical and electrical services, conduits, pipes and fixtures have been installed complete and tested.
- F. All walls shall be wetted immediately prior to applying the first spatterdash coat (Rasheh) to provide key for subsequent coats.

3.3 EXISTING WORK

- A. Extend existing cement plaster installations using materials and methods as specified.
- B. Repair existing damaged Portland cement plaster which remains or to be remodeled.

3.4 INSTALLATION

- A. Installation of Lathing Materials:
 - 1. Apply one or two layers of Grade D building paper over substrate; lap edges 50 mm minimum. Fasten in place.
 - 2. Install metal lath in accordance with ASTM C1063.
- B. Installation of Accessories:
 - 1. Install accessories in accordance with ASTM C1063.
 - 2. Place corner bead at external wall corners; fasten at outer edges of lath only.
 - 3. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
 - 4. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
 - 5. Install door and glazed frames plumb and level in opening. Secure rigidly in place.
 - 6. Position to provide convenient access to concealed work requiring access.
- C. Control and Expansion Joints:
 - 1. Install interior control and expansion joints as indicated on Drawings.
 - 2. Install exterior contraction joints after initial set, scribed as indicated on Drawings by cutting through 2/3 of cement plaster depth, neatly, in straight lines.
 - 3. For horizontal exterior surfaces, install control and expansion joints as indicated on Drawings.
 - 4. For vertical exterior surfaces install control and expansion joints as indicated on Drawings.
 - 5. Establish control and expansion joints with specified joint device.
- D. Plastering:
 - 1. Plaster shall be thoroughly mixed with the proper amount of water until uniform in colour and consistency. Retempering will not be permitted and all plaster which has begun to stiffen shall be discarded.
 - 2. All plastering shall be executed in a neat workmanlike manner and corners shall be true, straight and plumb.
 - 3. All tools, implements, vessels and surfaces shall at all times be kept scrupulously clean and strict precautions shall be taken to avoid the plaster or other materials becoming contaminated by pieces of partially set materials which would tend to retard or accelerate the setting time.
 - 4. The temperature before, during and after application of plaster shall be uniformly maintained above 12°C. Heat shall be well distributed in all areas, and concentration or irregular heat on plaster surfaces shall be prevented.
 - 5. Ventilation shall be provided to properly dry the plaster during and subsequent to its application. Plaster shall be prevented from too-rapid drying.
 - 6. All ingredients entering the several mixes shall be proportioned and measured by means of calibrated boxes or containers of such nature that the quantities

can be accurately checked at any time. Ingredients shall be thoroughly mixed and then cleaned from the mixer and tools after each mix.

7. Plaster shall be rodded and straight-edged to uniform thickness in true planes flush to the required surface and flush with outlet boxes, and similar details and steel-troweled smooth and level with sharp, straight arises and true angles. Plaster shall be free from laps, cracks, trowels marks, or other structural defects or surface imperfections.
8. Where plaster finish is flush with adjoining surface or where tooled joint is indicated on the drawings, the plaster shall be grooved back with smallest available edging tool, to control any cracking at these points.
9. At doors and frames and other openings, all plaster shall be keyed in, except that across head of openings and 12 inches down each side plaster shall be cut free of frame, or grounds with edge of trowel, after stiffening but before setting, to allow for expansion.
10. All pressed metal door frames in walls shall be grouted full with Portland cement fine concrete after being completely anchored in place and prior to application of plaster. Rake grout to allow plaster to enter jamb.
11. Apply spatterdash coat (rasheh); allow to dry before rendering is commenced.
12. Moist cure each coat. Apply successive coat immediately following initial set of scratch coat.
13. After curing, dampen previous coat prior to applying finish coat.
14. Apply finish coat to indicated color and texture.
15. Plumb, square and level.
16. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.
17. Moist cure finish coat for minimum period of 48 hours.

E. Waterproof Plaster to External Surfaces

1. All surfaces to be plastered shall be clean and free from dust, grease, loose or projecting mortar and all traces of salts and are to be thoroughly sprayed with water but all free water shall be allowed to disappear from the surface before the plaster is applied.
2. Efflorescence shall be brushed off and all dust and foreign matter removed. All waterproof plastering shall be in two coats and shall contain 475 kg of cement per one meter cube of sand mixed with an approved waterproofing admixture compound and applied in accordance with manufacturer's instructions and shall be applied and allowed to dry before rendering is commenced. All walls shall be wetted immediately prior to applying the first coat of rendering and this shall be allowed to thoroughly dry out before the next coat is applied.

3.5 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation from Flat Surface: 3 mm in 3 m.

3.6 ADJUSTING

- A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

- B. Remove damaged or defective plaster by cutting and replace with specified materials to match adjacent plaster.
- C. Fog coat non-uniform or discolored plaster with finish coat materials spray applied to entire finish coat surface.

END OF SECTION

SECTION 09300

TILE

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes ceramic, ceramic mosaic, quarry, and paver, tile for floor and wall applications; tile stair treads using mortar bed application method; cementitious backer board as tile substrate; thresholds at door openings; and ceramic accessories. Scope of this section also includes removal of existing tiles in Toilet and Kitchen and complete preparation of the substrate to receive the work.
- B. Related Sections:
1. Section 03350 - Concrete Finishes: Wood and/or Steel Troweling of floor slab for tile application.
 2. Section 07140 - Fluid Applied Waterproofing.
 3. Section 07900 - Joint Sealers.
 4. Section 09220 - Portland Cement Plaster: Lath/Portland cement scratch coat.

1.3 REFERENCES (*Equivalent Equal Acceptable*)

- A. American National Standards Institute:
1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
 2. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
 3. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
 4. ANSI A108.1B - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
 5. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
 6. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
 7. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 8. ANSI A108.6 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.

9. ANSI A108.7 - Specifications for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar.
10. ANSI A108.8 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
11. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
12. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
13. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
14. ANSI A118.4 - Latex-Portland Cement Mortar.
15. ANSI A118.5 - Chemical-Resistant Furan Mortar and Grout.
16. ANSI A118.6 - Ceramic Tile Grouts.
17. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
18. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
19. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
20. ANSI A137.1 - Ceramic Tile.

B. ASTM International:

1. ASTM C847 - Standard Specification for Metal Lath.

C. Tile Council of America:

1. TCA - Handbook for Ceramic Tile Installation.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- C. Product Data: Submit instructions for using grouts and adhesives.
- D. Samples: Submit mounted tile and grout on two plywood panels, size as directed by the Supervisor, illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.

- B. Maintain one copy of each document on site.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Protect adhesives and grouts from freezing or overheating.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Do not install adhesives and grouts in unventilated environment.
- C. Maintain ambient and substrate temperature of 10 °C during installation of mortar materials.

1.10 EXTRA MATERIALS

- A. Section 01700 - Execution Requirements: Spare parts and maintenance products.
- B. Supply 3.5 Sq. meters (or two boxes, whichever is higher) of each type of tile furnished.

PART 2 PRODUCTS

2.1 TILE

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. Fully vitrified tiles shall have a water absorption not exceeding 0.3 %.
- C. The whole tiling installations, including bedding and jointing materials shall be capable of resisting the action of acids, oils or fats to which it can be expected to be subjected.
- D. Tiles used in wet areas (Toilet and Kitchen) shall have an approved anti-slip surface produced by the nature of the tile ingredients and not by ribbing, projecting studs or other form of surface profiling.
- E. Tiles used for steps shall be provided with special anti-slip grooves.

2.2 COMPONENTS

- A. Ceramic and Mosaic Tile: ANSI A137.1, and conforming to the following:
 - 1. Moisture Absorption: 0 to 0.5 percent.
 - 2. Size: As indicated on drawings.
 - 3. Shape: Square and/or Rectangular, as indicated on drawings.
 - 4. Edge: Square and/or Cushioned, as indicated on drawings.
 - 5. Surface Finish: Unglazed, Matte glazed, Mottle glazed, and/or Slip resistant, as indicated on drawings.
 - 6. Color: As selected by Supervisor.
 - 7. Mounted Sheet Size: As indicated on drawings.
- B. Ceramic Wall Tile: ANSI A137.1, and conforming to the following:
 - 1. Moisture Absorption: 0 to 0.5 percent.
 - 2. Size: As indicated on drawings.
 - 3. Shape: Square and/or Rectangular, as indicated on drawings.
 - 4. Edge: Square and/or Cushioned, as indicated on drawings.
 - 5. Surface Finish: Unglazed, Matte glazed, and/or Mottle glazed, as indicated on drawings.
 - 6. Color: As selected by Supervisor.
 - 7. Pattern: As indicated on drawings.
- C. Quarry Tile: ANSI A137.1, and conforming to the following:
 - 1. Moisture Absorption: 0 to 0.5 percent.
 - 2. Size: As indicated on drawings.
 - 3. Shape: Square and/or Rectangular, as indicated on drawings.
 - 4. Edge: Square and/or Cushioned, as indicated on drawings.
 - 5. Surface Finish: Unglazed, Matte glazed, and/or Non-slip, as indicated on drawings.
 - 6. Color: As selected by Supervisor.
- D. Paver Tile: ANSI A137.1, and conforming to the following:
 - 1. Moisture Absorption: 0 to 0.5 percent.
 - 2. Size: As indicated on drawings.
 - 3. Shape: Square and/or Rectangular, as indicated on drawings.
 - 4. Edge: Square and/or Cushioned, as indicated on drawings.
 - 5. Surface Finish: Unglazed, Matte glazed, and/or Non-slip, as indicated on drawings.
 - 6. Color: As selected by Supervisor.
- E. Skirting/Base: Match floor tile for moisture absorption, surface finish, and color:
 - 1. Length: Tile length: As indicated on drawings.
 - 2. Height: As indicated on drawings.
 - 3. Top Edge: Bull nosed, unless otherwise indicated.
 - 4. Internal Corner: Coved, unless otherwise indicated.
 - 5. External Corner: Bullnosed, unless otherwise indicated.
 - 6. Moisture Absorption: 0 to 0.5 percent.
 - 7. Surface Finish: Unglazed, Matte or Mottle glazed, as indicated on drawings.
 - 8. Color: As selected by Supervisor.

- F. Wainscot Cap: Match mosaic wall tile for moisture absorption, surface finish, and color, tile length and height as indicated on drawings, bull nosed top edge, unless otherwise indicated.
- G. Stair Tread and Riser: Match quarry tile and paver tile for moisture absorption, surface finish, and color:
 - 1. Tread Length and Width: As indicated on drawings.
 - 2. Riser Length and Height: As indicated on drawings.
 - 3. Nosing: Radiused and/or Bull nosed, as indicated on drawings.
 - 4. Tread Surface: Non-slip or Ribbed, as indicated on drawings.

2.3 ACCESSORIES

- A. Ceramic Accessories: Glazed and Unglazed finish, size as indicated on drawings; same color and texture as adjacent wall tile.
 - 1. Soap Dish: With or without handle, clam shell design, recess or surface mounted; cast strength sufficient to resist lateral pull force of 34 Kg.
 - 2. Toilet Tissue Holder: Recessed or Surface mounted, for single roll, with spring loaded holder.
 - 3. Towel Bars: Surface mounted with extensions for casting into small wall openings; cast strength sufficient to resist lateral pull force of 14 Kg.
 - 4. Other accessories listed under Section 10800.
- B. Adhesive Materials:
 - 1. Organic Adhesive: ANSI A136.1, thin-set bond type.
 - 2. Epoxy Adhesive: ANSI A118.3, thin-set bond type.
 - 3. Tile Setting Adhesive: Elastomeric, waterproof, and liquid applied.
- C. Mortar Materials:
 - 1. Mortar Bed Materials: Portland cement, sand, latex additive and water.
 - 2. Mortar Bond Coat Materials:
 - a. Dry-Set Portland Cement type: ANSI A118.1.
 - b. Latex-Portland Cement type: ANSI A118.4.
 - c. Epoxy: ANSI A118.3.
 - d. Furan: ANSI A118.5.
- D. Grout Materials:
 - 1. Standard Grout: Portland cement type, Sand-Portland Cement type, Latex-Portland cement type, and/or Silicone Rubber type as specified in ANSI A118.6.
 - a. Color Admixture: Site mixed type as recommended by manufacturer.
 - b. Color: As selected by Supervisor.
 - 2. Epoxy Grout: ANSI A118.8, modified epoxy emulsion grout, color as selected.
 - 3. Furan Grout: ANSI A118.5, furan resin type, color as selected by Supervisor.
 - 4. Silicone Rubber Grout: Silicone sealant, moisture and mildew resistant type, complying with ANSI A118.6, color as selected by Supervisor; use for toilet and kitchen floors and walls.
- E. Cleavage Membrane: 6.9 kg asphalt saturated felt or 0.1 mm thick polyethylene film.

- F. Waterproofing Paint to Floors: As specified in Sections 07140.
- G. Membrane at Walls: 6.9 kg asphalt saturated felt or 0.1 mm thick polyethylene film.
- H. Reinforcing Mesh: 50 x 50 mm size weave of 16/16 wire size; welded fabric, galvanized.
- I. Metal Lath: ASTM C847, Flat diamond mesh, of weight to suit application, galvanized finish.
- J. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 13 mm thick; 50 mm wide coated glass fiber tape for joints and corners.
- K. Crosses and Spacers of requisite sizes to suit tile placing and fixing.
- L. Thresholds: Type, color and finish as indicated on drawings, size by full width of wall or frame opening, beveled both sides, radiused edges from bevel to vertical face.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are ready to receive work at sole responsibility of Contractor.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Remove existing tiling and backing material and dispose of the same in an environmentally friendly way in line with Authority regulations. Protect the site from dust.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install cementitious backer board. Tape joints and corners, cover with skim coat of dry-set mortar to feather edge.
- F. Prepare substrate surfaces for installation.

3.3 EXISTING WORK

- A. Section 01700 - Execution Requirements: Requirements for maintenance service.
- B. Prepare and remodel existing tile installations using materials and methods as specified.

- C. Clean and repair existing tile which remains.

3.4 INSTALLATION

- A. Install tile, skirting, thresholds, stair treads and risers, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Place thresholds and edge strips at locations indicated and/or scheduled.
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, base and wall joints.
- E. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
 - 1. Ceramic and Ceramic Mosaic Tile: 1.6 and 3 mm.
 - 2. Quarry and Paver Tile: 6 and 10 mm.
- F. Form internal angles square or coved and external angles bullnosed or square, unless otherwise indicated.
- G. Install ceramic accessories rigidly in prepared openings.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep expansion and control joints free of adhesive or grout. Apply sealant to joints.
- J. Allow tile to set for a minimum of 48 hours prior to grouting.
- K. Grout tile joints. Use Resin-fortified Cement-based grout unless otherwise indicated.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- M. Installation - Floors - Thin-Set Methods:
 - 1. Over exterior concrete substrates, install in accordance with TCA Handbook Method F102, with standard grout.
 - 2. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat or F116, organic adhesive, with standard grout, unless otherwise indicated.
 - a. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
 - b. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F131.
 - c. Where furan bond coat and grout are indicated, install in accordance with TCA Handbook Method F133.
 - d. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F115.

3. Over wood substrates, install in accordance with TCA Handbook Method F142, with standard grout, unless otherwise indicated.
 - a. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F143.
- N. Installation - Floors - Mortar Bed Methods:
1. Over exterior concrete substrates, install in accordance with TCA F101, bonded, with standard grout.
 2. Over interior concrete substrates, install in accordance with TCA Handbook Method F111, with cleavage membrane and/or F112, bonded, unless otherwise indicated.
 - a. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCA Handbook Method F121.
 - b. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F132, bonded.
 - c. Where conductive tile are indicated, install in accordance with TCA Handbook Method F125, bonded.
 - d. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F114, with or without cleavage or waterproofing membrane.
 3. Over wood substrates, install in accordance with TCA Handbook method F141, with standard grout, unless otherwise indicated.
 4. Cleavage Membrane: Lap and seal watertight, edges and ends.
 5. Waterproofing Paint: Install as specified in Section 07140.
 6. Mortar Bed Thickness: 15 mm, unless otherwise indicated.
- O. Installation - Showers and Bathtub Walls:
1. At tiled shower receptors install in accordance with TCA Handbook Method B414, mortar bed floor, and W201, mortar bed over concrete or masonry walls or B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.
 2. At bathtub walls install in accordance with TCA Handbook Method B411, mortar bed on studs with waterproofing membrane; B412, over cementitious backer units with waterproofing membrane; or W202, thin-set over masonry.
 3. Grout with silicone rubber grout.
 4. Seal joints between tile work and other work with sealant Type specified in Section 07900.
- P. Installation - Wall Tile:
1. On exterior walls install in accordance with TCA Handbook Method W244, thin-set over cementitious backer units, with waterproofing membrane, W201, mortar bed over concrete and masonry with waterproofing membrane, or W202, thin-set over concrete and masonry with latex-portland cement grout.
 2. Over cementitious backer units install in accordance with TCA Handbook Method W244, using membrane at toilet rooms and kitchens; or W223, organic adhesive.

3. Over gypsum wallboard or wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-Portland cement bond coat, W223, thin-set with organic adhesive, unless otherwise indicated.
 - a. Where mortar bed is indicated, install in accordance with TCA Handbook Method W222, one coat method.
 - b. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCA Handbook Method W222, one coat method.
4. Over interior concrete and masonry install in accordance with TCA Handbook Method W202, thin-set with dry-set or latex-portland cement bond coat, or W211, bonded mortar bed without membrane.
5. Over wood studs without backer install in accordance with TCA Handbook Method W231, mortar bed, with membrane where indicated.
6. Over metal studs without backer install in accordance with TCA Handbook Method W241, mortar bed, with membrane where indicated.

3.5 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean tile and grout surfaces.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01700 - Execution Requirements: Protecting installed construction.
- B. Do not permit traffic over finished floor surface for 4 days after installation.

3.7 SCHEDULES

- A. As indicated on drawings and where directed by the Supervisor.

END OF SECTION

SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications.

1.2 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.
- B. Related Sections:
 - 1. Division 5 – Metals
 - 2. Division 6 - Wood and Plastic
 - 3. Division 8 - Doors and Windows

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- B. Painting and Decorating Contractors of America:
 - 1. PDCA - Architectural Painting Specification Manual.
- C. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.

1.4 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on finishing products and special coating.
- C. Samples:
 - 1. Submit two paper chip samples each 300 x 300 mm, illustrating color range and textures available for each surface finishing product scheduled.

2. Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded.

- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, and substrate conditions requiring special attention.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Deliver products to site in sealed/labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store at ambient temperature from 7°C to 32°C in ventilated areas.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- C. Do not apply exterior coatings during rain or snow and when relative humidity or moisture content of surfaces exceed those required by paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 7°C for interiors; 10°C for exterior.
- E. Minimum Application Temperature for Varnish Finishes: 18°C.
- F. Provide lighting level of 860 lx measured mid-height at substrate surface.

1.9 SEQUENCING

- A. Section 01100 - Summary: Work sequence.
- B. Sequence application to the following:
 1. Do not apply finish coats until paintable sealant is applied.
 2. Back prime wood trim before installation of trim.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Paint, Transparent Finishes, Stain, Primer Sealers, Block Filler, and Field Catalyzed Coatings Manufacturers: Any recognized manufacturers having an official technical agreement to conformity with standards for the products after approval of Supervisor.

2.2 COMPONENTS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; prepare coatings for good flow and brushing properties, capable of drying or curing, and free of streaks or sags.
- B. Use products of the same manufacturer for succeeding coats. Where primer is shop applied to steel, subsequent coats may be the product of another manufacturer provided the coatings are mutually compatible.
- C. Colors, textures and degree of luster shall be as selected by the Supervisor. Tint prime and undercoats approximately to the shade of the final coat but with sufficient variation to distinguish them from the preceding coat. Proprietary names used to designate colors or materials, are not intended to imply that products named are required, or to exclude equivalent products of other manufacturers.
- D. Colors of finishes shall not necessarily be manufacturer's stock colors. All materials for finishing coats shall be factory mixed and shall be of a standard quality equal to that of the standard colors of the material specified.
- E. Specular Gloss Range:
1. Ranges determined in accordance with ASTM D523:

| <u>Sheen</u> | <u>Geometry / Degree</u> | <u>Gloss / Range</u> |
|--------------|--------------------------|----------------------|
| Flat | 85 | Below 15 |
| Eggshell | 60 | 5 to 20 |
| Semi-Gloss | 60 | 30 to 65 |
| Gloss | 60 | Over 65 |
 2. In locations where ambient temperature and humidity conditions encourage the ready formation of mildew, use paints with additional mildew inhibitive agent incorporate during the manufacturing process, of type and in concentration recommended by the paint manufacturer to withstand such mildew formation.
- F. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- G. Patching Materials: Latex filler.
- H. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces and substrate conditions are ready to receive Work as instructed by product manufacturer and at full responsibility of Contractor.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Do not apply finishes unless moisture content of surfaces are below the following:
 - 1. Plaster: 12 percent.
 - 2. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
 - 3. Wood: 15 percent, measured in accordance with ASTM D 4442.
 - 4. Concrete Floors: 8 percent.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- C. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.
- D. Marks: Seal with shellac those which may bleed through surface finishes.
- E. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium or tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- G. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles. Apply latex based or compatible sealer or primer.
- H. Concrete Floors: Remove contaminations, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry.

Remove stains caused by weathering of corroding metals with solution of sodium meta-silicate after thoroughly wetting with water. Allow for drying.

- K. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- L. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- M. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- N. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- O. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- P. Glue-Laminated Wood: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- Q. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with clear sealer or tinted primer.
- R. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.
- S. Metal Doors Scheduled for Refurbishment Painting: fully scrub existing coatings and rust before applying zircon. Prime surfaces.

3.3 EXISTING WORK

- A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.4 APPLICATION

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- C. Sand wood and metal surfaces lightly between coats to achieve required finish.

- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- F. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- H. Finishing Mechanical and Electrical Equipment:
 - 1. Refer to "Division 15 - Mechanical" & "Division 16 - Electrical" for schedule of color coding and identification banding of equipment, duct, piping, conduit, etc.
 - 2. Paint shop primed equipment.
 - 3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
 - 5. Paint interior surfaces of air ducts and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 - 6. Paint exposed conduit and electrical equipment occurring in finished areas.
 - 7. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - 8. Color code equipment, piping, conduit and exposed duct work in accordance with requirements indicated or color schedule. Color band and identify with flow arrows, names and numbering.
 - 9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- I. Install Work in accordance with the drawings, to the manufacturer's instructions and to the satisfaction of the Supervisor.
- J. Repair any damage caused by painting activities.

3.5 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services and Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Inspect and test questionable coated areas in accordance with applicable code.

3.6 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.

- B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.7 SCHEDULES - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Shop primed items for site finishing are stated under "Division 5" (i.e.: section 05120, section 05121, section 05500, and section 05510).

3.8 SCHEDULES - EXTERIOR SURFACES

- A. Wood - Painted (Opaque):
 - 1. One coat of latex or alkyd primer sealer.
 - 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- B. Wood - Transparent:
 - 1. Two coats of stain or clear sealer.
 - 2. Two coats of varnish, gloss or semi-gloss.
- C. Wood - Shingles and Shakes:
 - 1. One coat of stain or clear sealer.
 - 2. Two coats of varnish, gloss or semi-gloss.
- D. Glue-Laminated Wood and Wood Timber Members:
 - 1. One coat of stain or sealer.
 - 2. Two coats of varnish, gloss or semi-gloss.
- E. Pavement Markings:
 - 1. Two coats of thermoplastic reflectorized paint, yellow or white.
- F. Concrete, Concrete Block, Restored Masonry and Cement Plaster:
 - 1. One coat of primer sealer latex or alkyd.
 - 2. Two coats of latex or alkyd, flat.
- G. Cement Plaster Soffits:
 - 1. One coat of primer sealer latex or alkyd.
 - 2. Two coats of latex or alkyd, flat.
- H. Steel - Unprimed:
 - 1. One coat of latex or alkyd primer.
 - 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- I. Steel - Shop Primed:
 - 1. Touch-up with zinc chromate or zinc rich primer.
 - 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- J. Steel - Galvanized:
 - 1. One coat galvanized primer.
 - 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- K. Aluminum - Mill Finish:
 - 1. One coat etching primer.

2. Two coats of alkyd enamel, gloss.

3.9 SCHEDULES - INTERIOR SURFACES

- A. Wood - Painted:
 1. One coat of latex or alkyd prime sealer.
 2. Two coats of alkyd or latex enamel, gloss, semi-gloss, eggshell or flat.
- B. Wood - Intumescent Coating:
 1. One coat of prime sealer.
 2. Two coats of intumescent coating.
- C. Wood - Transparent:
 1. Filler coat (for open grained wood only).
 2. Two coats of stain.
 3. One coat sealer.
 4. Two coats of varnish, gloss, satin or flat.
- D. Cabinet Interior:
 1. One coat of latex or alkyd prime sealer.
 2. One coat of alkyd or latex enamel, semi-gloss or flat.
- E. Glue-Laminated Wood and Wood Timber Members:
 1. One coat of stain or sealer.
 2. Two coats of varnish, gloss, satin or flat.
- F. Concrete, Concrete Block, Restored Masonry and Cement Plaster:
 1. One coat of primer sealer latex or alkyd.
 2. Two coats of latex or alkyd, flat or semi-gloss.
- G. Steel - Unprimed:
 1. One coat of alkyd or latex primer.
 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- H. Steel - Primed:
 1. Touch-up with alkyd or latex primer.
 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- I. Steel - Galvanized:
 1. One coat galvanized primer.
 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- J. Aluminum - Mill Finish:
 1. One coat etching primer.
 2. Two coats of alkyd enamel, gloss.
- K. Concrete Floors:
 1. One coat of alkali resistant or catalyzed epoxy primer.
 2. Two coats of alkyd floor enamel or catalyzed epoxy enamel, gloss.
- L. Plaster Walls:

1. One coat of alkyd primer sealer.
 2. Two coats of alkyd, latex or latex acrylic enamel, gloss, semi-gloss, eggshell or flat.
- M. Plaster Ceilings:
1. One coat of alkyd primer sealer.
 2. Two coats of alkyd, latex or latex acrylic enamel.
- N. Fire Retardant Finish:
1. One coat of fire retardant primer.
 2. Two coats of fire retardant finish, gloss.
 3. Flame and smoke rating of 25/50.

3.10 SCHEDULES - COLORS

- A. As indicated on drawings or as selected by the Supervisor from manufacturer's range.

END OF SECTION

SECTION 10522

FIRE EXTINGUISHER

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes Fire Extinguishers as shown in drawings.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.
- C. Manufacturer's Installation Instructions: Submit special procedures, and conditions requiring special attention.

1.4 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with placement of internal wall reinforcement and reinforcement of partitions to receive anchor attachments.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.
- B. PORTABLE, HAND-CARRIED FIRE EXTINGUISHER
 - 1. Fire Extinguishers:
 - a. 6Kg nominal capacity, one unit with dry chemical powder and the other with CO₂, compatible with gas and electric based fires in manufacturer's standard enameled container.
 - b. Valves: Aluminum.
 - c. Handles and Levers: Aluminum.

- d. Instruction Labels: Include pictorial marking system for use, documenting fire extinguisher location, inspections, maintenance, and recharging.
- e. Include galvanized steel mounting brackets
- f. Identify fire extinguisher with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Examine fire extinguishers for proper charging and tagging.
- C. Remove and replace damaged, defective, or undercharged fire extinguishers.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguisher and mounting brackets in location indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: 1.2 m above finished floor to top of fire extinguisher or as instructed.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 10800

TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 INTRODUCTION

- A. The requirements of this Section do not supersede any provision of the Special Conditions of Contract and of the General Conditions of Contract. In case of any discrepancy, the order of precedence is as follows: SCC, GCC and these Specifications. In case of any contradiction between the below specifications and the drawings, the latter shall prevail.

1.2 SUMMARY

- A. Section includes toilet and cafeteria accessories.
- B. Related Sections:
 - 1. Section 09300 - Tile.

1.3 REFERENCES *(Equivalent Equal Acceptable)*

- A. ASTM International:
 - 1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 4. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 5. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 6. ASTM C1036 - Standard Specification for Flat Glass.
- B. Federal Specification Unit:
 - 1. FS A-A-3002 - Mirrors, Glass.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Submit special procedures, and conditions requiring special attention.

1.5 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Any recognized manufacturer having an official technical agreement to conformity with standards for the product.

2.2 COMPONENTS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Furnish keys for each accessory to Purchaser.
- C. Stainless Steel Sheet: ASTM A666, Type 316.
- D. Stainless Steel Tubing: ASTM A269, stainless steel type 316.
- E. Galvanized Sheet Steel: ASTM A653, Z275 zinc coating.
- F. Mirror Glass: 6 mm thick clear glass.
- G. Adhesive: Two component epoxy type and/or contact type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.
- J. Primer: As instructed by the manufacturer.

2.3 TOILET and CAFETERIA ACCESSORIES

- A. Toilet Roll Holder, Cafeteria paper Roll Holder, Towel Ring Chrome, Robe Hook, Soap Dish Holder, WC Brush with Holder, etc.
- B. Hinged Support Rail, Door Pull rail, and Grab Bars: Wall mounted, stainless steel type 316, designed to aid handicapped persons and to prevent theft.
- C. Mirrors:
 - 1. Frameless.
 - 2. 6 mm thick clear glass, abrasion-resistant coated mirror.

3. Size: As indicated on Drawings and/or as directed.
4. Backing: Full-mirror sized, minimum 0.8 mm galvanized steel sheet and non-absorptive filler material.
5. Shelf:
 - a. Frameless;
 - b. 125 mm deep, full width of mirror, with concealed support for shelves more than 900 mm wide.

2.4 FACTORY FINISHING

- A. Stainless Steel: No. 4 satin brushed and/or No.8 mirror polished finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, Type SC 2, satin and/or polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy and/or electrostatic baked enamel.
- D. Galvanizing for Items Other than Sheet: ASTM A123/A123M to 380 g/sq m. Galvanize ferrous metal and fastening devices.
- E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply 1-coat primer and bake.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify exact location of accessories for installation.
- C. Verify field measurements are as indicated and as instructed by manufacturer.
- D. See other related Sections for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 EXISTING WORK

- A. Clean and repair existing toilet accessories which remain or are to be reinstalled.

3.4 INSTALLATION

- A. Install plumb and level, securely and rigidly anchored to substrate.
 - 1. Mounting Heights and Locations: As indicated on Drawings.
- B. Install work in accordance with the drawings and to the satisfaction of the Supervisor.

END OF SECTION

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

1 - GENERAL

1.01 SUMMARY

- A. This section generally specifies administrative and procedure requirements regarding mechanical work. Additional requirements are specified in various sections of Division 16 and also may be required during the execution work due to project conditions.
- B. The requirements of this Section do not supersede or take precedence over any provision of the General Conditions and Special Conditions, and should any discrepancy become apparent between these requirements and the General Conditions and Special Conditions, the Contractor shall notify the Supervisor, in writing, and the Supervisor shall interpret and decide such matters in accordance with the applicable provisions of the General Conditions and Special Conditions.
- C. Extent of Work
 - 1. The Contractor shall supply all labor, materials, equipment, tools, appurtenances, storage, services and temporary work, necessary to completely install, in accordance with these specifications and the drawings, the following mechanical installation of **CHIAH PUBLIC GARDEN**.
 - Domestic water systems.
 - Soil and waste drainage systems.
 - Sanitary fixtures installation.
 - Ventilation system.
 - HVAC system.
 - External Water Systems (Fountain).

NOTE:

Work, materials, equipment or services not specifically mentioned or implied in other clauses of these specifications or elsewhere, or indicated on the drawings but found necessary for the completion and perfect functioning of the installations must be included in the Contractor's price.

The work shall include also operation of the installations after completion and acceptance including maintenance and guarantee of the works as described hereinafter.

The work shall be designed and carried out in accordance with the contract drawings and specifications as well as the standards of the country of origin.

The following builder's work shall be considered as part of this work:

- 1. All work in connection with fixing supports, hangers, anchors, etc.

3. Cutting or forming all openings, mortar, chases, etc., in floors, walls and ceilings required for the installation and making good after.
4. Painting items of equipment and exposed pipes and supports.
5. Labeling.

D. Noise Level

1. Noise level shall not exceed 45 dBA measured at one meter from the unit. Also the noise level produced by the unit and measured at a distance of one meter from the closest air register shall not exceed 40 dBA. In case the above figures are being exceeded, sound absorbers shall be installed without any extra cost to the Purchaser.

1.02 QUALITY ASSURANCE

- A. Materials and equipment shall conform to the latest edition of reference specifications specified herein and to applicable codes and requirements of local authorities having jurisdiction.
1. Mechanical equipment shall conform to the latest version of ASHRAE Standard 90A-1980.
 2. Reference Standards (*Equivalent Equal Acceptable*)
 - a. Provide materials and equipment listed by Underwriters' Laboratories, Inc. except in those cases where an Underwriters' Laboratories listing is not available.
 - b. Comply with the latest applicable standards of the following:
 1. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Supervisors.
 2. American Plumbing code.
 3. UL - Under Writer's Laboratories.
 4. EN – European Norm.
- B. Locally manufactured products of same make and same quality could be approved by the Supervisor, however the Supervisor shall be the sole judge to determine whether the product is of the same quality or not.

1.03 SUBMITTALS

- A. Definitions: The required submittals of this division, in addition to the definitions of the General Conditions, and elsewhere in the contract documents, are further categorized for convenience as follows:
- B. Product data shall include manufacturer's latest standard printed literature such as manufacturer's installation instructions, catalog cuts, color charts, roughing diagrams, wiring diagrams and performance curves on materials, equipment and systems for this project. Product data shall include references to applicable specification section and item number. Product data shall be provided in addition to the required shop drawing submittals.
- C. Shop drawings and as built drawings shall submitted to Supervisor for Approval as described hereinafter.
- D. Samples shall include physical examples of materials in complete units for visual inspection. Samples shall indicate applicable specification section number and item numbers within that section.

- E. If nothing is mentioned in the general conditions and/or in the general contract documents, each submitted document must be presented with the appropriate data sheet as shown at the end of this section.

1.04 INTENT

The purpose of the drawings and specification is to provide an approach for intended complete installations, finished, fully adjusted, tested commissioned and put in perfect operating condition. The spirit as well as the letter of the drawings and specification shall be followed, and all work shall be executed according to the true intent and meaning of the drawings and specification.

1.05 DISCREPANCIES AND OMISSIONS

- A. It is the responsibility of the Contractor, to inform the Supervisor of any discrepancies in the drawings and specifications before signing the Contract, default of which will make him responsible for any errors or omissions in the drawings and specifications even though these have been approved by the Supervisor.
- B. All costs incurred by any changes or alterations necessitated by any errors or omissions shall be on the Contractor's own expense without having the right to ask the Purchaser for any compensation or indemnification.

1.06 SUPERVISOR'S DRAWINGS

- A. The Supervisor's drawings are generally diagrammatic and include general layouts and typical details of the various systems to be installed. No deviations from the drawings shall be made without receipt of prior written approval from the Supervisor.
- B. The drawings shall not be scaled. The Contractor shall base all measurements both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. All measurements shall be verified on Site and checked as to correctness of same as related to the work.
- C. The Contractor shall check all the Architectural, Structural and Electrical drawings in laying out work for verifying the adequacy of space in which work will be installed. Maximum headroom and space conditions shall be maintained at all points. Where headroom or space conditions appear inadequate the Supervisor shall be notified before proceeding with installation.

1.07 SHOP AND INSTALLATION DRAWINGS

- A. Prior to starting the work, the Contractor shall submit to the Supervisor for approval detailed shop and installation drawings showing to scale dimensions of equipment, pipes, etc. in plan and elevation with clearances and relation of same to the space assigned.

- B. Where the work will be installed in close proximity to, or will interfere with the work of other trades, the Contractor shall coordinate space conditions to make a satisfactory adjustment. The Contractor shall prepare composite installation drawings and sections to a suitable scale of not less than 1/50, clearly showing how work will be installed in relation with work of other trades.
- C. Prior to submissions of the drawings and approximately 30 days after award of the Contract, the Contractor shall submit lists of all equipment and materials with the names of proposed manufactures. Lists shall show submission dates. The drawings will not be accepted prior to submission of such lists. Drawings of interrelated items shall be submitted at approximately the same time.
- D. Drawings of equipment and material shall include detailed manufacturer's drawings, cuts of catalogues and descriptive literature, showing specifications, type, performance characteristics, construction, component parts, dimensions, size, arrangement, operating clearances, capacity, electrical characteristics, power requirements, motor, drive and testing information. Data of a general nature will not be accepted.
- E. Catalogues, pamphlets or manufacturers' drawings submitted for approval shall be clearly marked in ink for proper identification of the item being proposed.
- F. Deviations from the specifications and the drawings shall be indicated clearly with the reason for each deviation.
- G. All submissions for approval shall be furnished in three copies and submitted sufficiently in advance of requirements to allow the Supervisor ample time for checking and approving. Failure of the Contractor to submit the drawing in ample advance time shall not entitle him to an extension of contract time, and no claim for extension by reason of such default will be allowed.
- H. No equipment or material shall be purchased, delivered to the Site or installed until the contractor has in his possession the approved drawings for the particular equipment or material.
- I. Approval rendered on drawings shall not relieve the Contractor from his responsibility to provide equipment and material to meet the performance and quality standards as indicated on the drawings and as described in the specification or be of physical size to fit the space assigned for it.
- J. Material not covered by drawings such as pipe, fitting and incidentals shall be submitted for approval in letter form giving ratings and names of manufacturers.
- K. During the progress of the work drawings shall be submitted as required by the Supervisor and as specified elsewhere in this specification. These drawings shall comprise but not necessarily be limited to concrete bases for equipment with location of anchor bolts, manufacturers' certified installation drawings and instructions, certified performance characteristics of equipment, wiring diagrams of motor controllers and control systems, etc.
- L. Where required by the Supervisor, the Contractor shall submit for approval samples of material to be used and workmanship proposed. The Contractor shall not use material or workmanship that does not correspond to the approved samples.

1.08 COORDINATION WITH OTHER TRADES

- A. The Contractor shall plan and coordinate the work with all other trades in advance of requirements and shall provide all necessary resources to ensure compliance with the construction program.
- B. The Contractor shall coordinate the space requirements of all other trades involved and shall be responsible for the sufficiency of the size of shafts and chases and the adequate clearance in double partitions, hung ceilings, etc. for the proper installation of the work.
- C. The Contractor shall give full cooperation to all other trades to permit the work of the trades to be installed satisfactorily and with the least possible interference or delay.
- D. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation and coordination of adjacent work. The Contractor shall undertake to make, without extra charge, minor changes and modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.
- E. Any extra cost incurred by lack of coordination on the part of the Contractor shall be at his own expense.

1.09 RECORD DRAWINGS

The Contractor shall submit to the Supervisor for record a complete set of as-built drawings and electrical wiring diagrams, in hard copies and on CD on the latest version of AutoCad in "dwg" extension format, reflecting all the changes made from the original drawings during the progress of the work. The drawings and electrical wiring diagrams shall show all labeled equipment, valves, controls, instruments and electrical devices.

1.10 INSTRUCTION MANUALS AND SPARE PARTS LISTS

- A. The Contractor shall provide two copies of each instruction manual (as issued by manufacturer) containing the following:
 - Brief description of every system and equipment with basic operating features.
 - Descriptive literature of all equipment and components with manufacturer's name, model number, capacity rating and operating characteristic.
 - Manufacturer Service manual for every major piece of equipment giving operating and maintenance instructions, starting and shutdown instructions, lubrication instructions and possible breakdown and repairs.
 - Manufacturer's list of general spare parts for every piece of equipment with unit prices.
 - Manufacturer's list of recommended spare parts for one year of operation for every piece of equipment with unit prices.
 - Detailed and simplified one line, color coded flow diagram of every system with tag number, location and function of each valve and instrument.
- B. The instruction manual shall be submitted in draft form to the Supervisor for his review and approval as to the fulfillment of the specified requirements prior to final issue.

- C. The instruction manual shall be submitted to the Supervisor at least four weeks in advance of the complete date of the system to be available for the final inspection prior to acceptance of the respective systems.

1.11 DELIVERY, STORAGE AND HANDLING

Deliver products to the project properly identified with name, model number, types, grades, compliance labels and other information needed for identification.

1.12 EQUIPMENT AND MATERIAL QUALITY WORKMANSHIP

- A. All equipment and material provided by the Contractor shall be new, free from defects and of the same type, standard and quality as set forth in the specification.
- B. Equipment and material of similar application shall be of the same manufacturer unless otherwise specified.
- C. All workmanship shall be of the highest standard of the industry, of accepted engineering practice and to the entire satisfaction of the Supervisor. Poor workmanship shall be rejected and the work reinstalled when, in the judgment of the Supervisor, the workmanship is not of the highest quality.

1.13 SUBSTITUTION OF EQUIPMENT AND MATERIAL

- A. Reference in the drawings and specifications to any equipment or material by name, make or catalogue number, as well as any list of approved manufacturers, shall be interpreted as establishing a standard of quality and performance and shall not in any way be construed as an intention to eliminate the products of other manufacturers and suppliers having approved equivalent products.
- B. Approval of a manufacturer does not necessarily constitute approval of its equipment. After award of Contract and before commencement of construction, the Contractor shall submit for the approval of the Supervisor a complete summary of proposed equivalent to be furnished indicating service, manufacturer, figure number, type and pressure rating.
- C. The Tender shall be based on the approved proposed trade name and catalogue reference and products of the approved manufacturers.
- D. At all times the Supervisor shall be the only judge for approval of equipment and material. No alternative shall be implemented without the written approval of the Supervisor.
- E. Where the Contractor proposes to use equipment other than that specified or indicated which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the works, all such redesign, new drawings and detailing required shall be prepared by the Contractor at his own expense. All additional costs resulting from such substitution, if approved by the Supervisor in writing, shall be paid by the Contractor.

- F. Where such approved substitution requires a different quantity or arrangement of piping, wiring, conduit and equipment from that specified or shown on the drawings the Contractor shall provide all such piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduits and any other additional equipment required by the system, at no additional cost to the Purchaser.

1.14 PROTECTION

- A. The Contractor shall order all equipment from the manufacturer specifying adequate packing for export at the factory to avoid damage during shipment to the Site.
- B. The Contractor shall be responsible for safe storage and the adequate protection of all material and equipment until finally installed, tested and accepted.
- C. He shall protect work against theft, injury or damage and shall carefully store material and equipment received on Site in their original crates or containers until they are installed. This responsibility shall embrace any delay pending final testing of systems and equipment due to any condition.
- D. The Contractor shall close open ends of work with temporary covers or plugs during construction and storage to prevent entry of obstructing material.
- E. The Contractor shall coordinate the protection of the work of all trades and shall be liable for any damage sustained to other trades resulting from his work.
- F. If any equipment is damaged during shipment or before it is tested and accepted, the Contractor shall replace or repair the equipment, depending on the extent of damage and as determined and decided by the Supervisor, on the Contractor's own account and without additional cost to the Purchaser.

1.15 ACCESSIBILITY

- A. Contractor shall be responsible for determining in advance of purchase that equipment and materials proposed for installation shall fit into the confines indicated areas, allowing adequate space for maintenance.
- B. All work shall be installed so as to be readily accessible for operation, maintenance and repair. Deviations from the drawings may be made to accomplish this, after the written approval of the Supervisor.
- C. Concealed valves and devices shall be grouped together in as practical a way as possible in order to be accessible through access doors.

1.16 ACCESS DOORS

- A. The Contractor shall arrange for access doors and frames to be provided for easy access to concealed equipment, controls, valves, traps, vents, drains, cleanout and other devices that require periodic operation, inspection or maintenance.

- B. However, the dimensions and locations of access doors shall be the responsibility of the Contractor and shall have the approval of the Supervisor before the work is installed.
- C. Requirements of access doors shall be submitted in sufficient advance time to be installed in the normal course of the work.
- D. The Contractor shall be responsible for the correct identification of access doors by means of buttons, tabs or markers to indicate the location of concealed work. The method and schedule for identification of access doors shall be approved by the Supervisor.

1.17 NAMEPLATES

Each piece of equipment provided shall carry, at a conspicuous location, attached in a permanent manner to the equipment at the factory, a certified nameplate on which shall be printed or stamped clearly the name and address of the manufacturer, the equipment model number, serial number, date of manufacture, electrical characteristics, performance rating or duty, pressure, temperature or other limitations and all other pertinent data as deemed necessary by the manufacturer for any future reference to the equipment.

1.18 LABELING

- A. The Contractor shall label and identify all equipment, instruments, controls, electrical devices, valves, etc. as to duty, service or function.
- B. Labels on equipment shall be of laminated bakelite with black surface and white core, with incised lettering nomenclature written in English.
- C. Labels shall be attached to equipment, instruments, controls, electrical devices, etc. or to adjacent permanent surfaces, in an approved permanent manner.
- D. The Contractor shall submit to the Supervisor for his approval prior to installation a schedule of all equipment and devices to be labeled and the suggest nomenclature.
- E. Controls and electrical devices shall be labeled to indicate clearly which equipment they control.

1.19 GUARANTEE

The Contractor shall guarantee that the materials and workmanship of the works installed by him under these specifications are first-class in every respect and that he will make good any defect, not due to ordinary wear and tear or improper use or care, which may develop within one year from date of completion.

2 - PRODUCTS

Not Applicable

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the site where Mechanical Work is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions. Additionally, the contractor is deemed to have acquainted itself before submitting its bid of the site conditions whether visible or invisible at its sole responsibility.

3.02 PREPARATION

The Supervisor's drawings issued with these specifications show the approximate location of mechanical apparatus; the exact locations are subject to the approval of the Supervisor.

3.03 INSTALLATION

- A. Sequence, coordinate and integrate the various elements of mechanical systems, materials and equipment. Comply with the following requirements.
- B. Coordinate mechanical systems, equipment and material installation with other building components.
- C. Verify dimensions by field measurements.
- D. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.
- E. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- F. Sequence, coordinate and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- G. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
- H. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
- I. Install systems, materials and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Supervisor.
- J. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

- K. Install mechanical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- L. Install access panels or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Section 15050 - "Basic Mechanical Materials and Methods."
- M. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- N. Painting
 - 1. Follow manufacturer's recommendations for surface preparation and application procedures for paints and finishes.
 - 2. Thoroughly clean surfaces requiring prime painting of rust, loose scale, oil, grease and dirt by the use of wire brushes, solvent and other required means.
 - 3. Do not paint on damp or frosty surfaces or during wet, foggy or freezing weather.
 - 4. Spread and brush paint evenly to eliminate drips, runs or sagging.
 - 5. Fill voids, open or hollow places and irregularities with compound.
 - 6. Thoroughly clean and retouch damaged or dirtied shop coat surfaces.
 - 7. Do not paint controls, nameplates or labels.
 - 8. Paint thickness are as measured when dry.
 - 9. Machinery: Before shipment, paint machinery including fans, compressors, pumps and motors with the manufacturer's standard shop prime coat.
 - 10. Piping

Prime coat steel and cast iron piping and related pipe supports, immediately after installation, regardless of whether or not they will be subsequently covered with insulation and/or finish painted. Apply prime coat in accordance with manufacturer's specifications. Do not prime galvanized metals.

- O. Cutting and Patching
 - 1. Perform cutting and patching in accordance with the provisions of the Contract Documents. In addition to the requirements specified, the following requirements apply:
 - 2. Perform cutting, fitting and patching of equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Supervisor, uncover and restore Work to provide for Supervisor observation of concealed Work.
 - 2. Cut, remove and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of mechanical items indicated to be removed and items made obsolete by the new Work.
 - 3. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
 - 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installer's qualifications refer to the materials and methods required for the surface and building components being patched.
7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installer's qualifications refer to the materials and methods required for the surface and building components being patched.

3.05 FIELD QUALITY CONTROL

A. Tests

1. Perform tests on individual equipment, systems and controls in the presence of the Representatives of the Purchaser, Supervisor and such other parties as may have legal jurisdiction.
2. Supply labor, materials, properly calibrated instruments, power, etc., required for testing, unless otherwise indicated.
3. Before conducting any tests on system or equipment, thoroughly clean the associated systems or equipment just prior to testing.
4. Test equipment and systems which normally operate during certain seasons during the appropriate seasons. Where the equipment or system under test is interrelated with and depends upon other equipment, systems, and/or controls for proper operation, functioning and performance, operate the latter simultaneously with the equipment or system under test.
5. The duration of tests shall be as determined by authorities having jurisdiction, but in no case less than the time prescribed in each section of the specifications.
6. In general, apply pressure tests to piping only, before connection of fixtures, equipment and appliances. Do not subject any piping, fixtures, equipment or appliances to pressures exceeding their test rating.
7. Promptly repair or replace defective work and repeat the tests until the particular system and component parts thereof receive the approval of the Supervisor. Replace or replace any damages resulting from tests, as directed by the Supervisor.
8. Submit test records on reproducible sheets to the Supervisor for approval and include approved copy in the Instruction Manual. The Supervisor shall approve the format of the record sheet prior to actual testing of equipment.
9. During tests of equipment and system, fully instruct the Purchaser's representatives on the operation and maintenance of the equipment and systems. This period is in addition to any required special instruction, elsewhere specified.

B. Final Inspection

1. At final inspection, it is essential that certain trades be properly represented including the following:

- a. Mechanical Contractor including people thoroughly familiar with the project, its intent, equipment and system installation and operation.
 - b. Air conditioning equipment manufacturer.
 - c. The automatic control manufacturer representatives familiar with the installation who can demonstrate to the Purchaser's satisfaction that the controls perform according to the specified requirements.
 - d. The Electrical Contractor's, representatives familiar with the installation's wiring and interlocking.
2. The Mechanical Contractor shall verify the actual operation of equipment and controls prior to final inspection.

3.06 CLEANING, ADJUSTING AND BALANCING - GENERAL

- A. Thoroughly clean any apparatus before placing in operation. Restore finished surfaces if damaged and deliver the entire installation in an approved condition.
- B. Adjust and balance systems to operate as shown and specified.

3.07 MAINTENANCE OF EQUIPMENT AND SYSTEM PRIOR TO FINAL ACCEPTANCE

- A. Take necessary measures to insure adequate protection of equipment and materials during delivery, storage, installation and shutdown conditions. This responsibility shall include provisions required to meet the conditions incidental to the delays pending final test of systems and equipment under seasonal conditions.
- B. Operate the completed systems for a period of time prescribed by the Supervisor to determine the capability of the equipment and controls to conform to the requirements of the drawings and specifications.
- C. Maintenance period for mechanical works shall be 365 days from the date of issuance of taking over certificate.
- D. Make final operating tests with systems in simultaneous operation and building in normal operating modes.

3.08 DEMONSTRATION AND INSTRUCTION

The Contractor shall provide the services of the representatives of the control manufacturer and the Electrical Subcontractor for Purchaser's Representative instruction purposes, for a total period of seven, 8 hour days. This period shall follow the final inspection date and shall not necessarily consist of a single series of consecutive days. Apportion time between summer, winter and intermediate operating seasons as mutually agreed.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of basic mechanical materials and methods and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. Excavation for underground utilities and service
 - 2. Miscellaneous metals for support of mechanical materials and equipment.
 - 3. Access panels and doors in walls, ceilings and floors for access to mechanical materials and equipment.
 - 4. Mechanical equipment nameplate data.

1.02 QUALITY ASSURANCE

Materials and equipment shall conform to the latest edition of reference specifications specified herein and to applicable codes and requirements of local authorities having jurisdiction.

1.03 SUBMITTALS

- A. Submit the following submittals in accordance with Section 15010 "Basic Mechanical Requirements."
- B. Provide product data for the following products:
 - 1. Access panels and doors.
 - 2. Joint sealers.
 - 3. Pipe and duct sleeves.
- C. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.
- D. Coordination drawings for access panel and door locations in accordance with Section 15010 "Basic Mechanical Requirements."
- E. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shutoff of utility service, and details for dust, fire and noise control. Coordinate sequencing with construction phasing and Purchaser occupancy specified in the Contract Documents.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturer's recommendations to prevent their deterioration and damage.

2 - PRODUCTS

2.01 MATERIALS

- A. Mechanical Equipment Nameplate Data
 - 1. Nameplate: For each piece of mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location, as approved by Supervisor.
 - 2. Relocate nameplates as required and approved after installation to permit easy reading.
- B. Sealant
 - 1. Provide ready-to-use silicone penetration seal that will stop passage of fire, smoke, and water. Sealant will cure in the presence of atmospheric moisture to produce durable and flexible seal, and will form airtight and watertight bonds with most common building materials in any combination including cement, masonry, steel, and aluminum.
 - 2. Sealant Composition shall be one-part ready-to-use materials with consistency of soft caulk at temperatures ranging from -35 to 160 F, and extension and compression properties of plus/minus 40% of original gap.
- C. Access Doors
 - 1. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
 - 2. Frames: 16-gauge steel, with a 1 inch wide exposed perimeter flange for units installed in unit masonry, precast or cast-in-place concrete, ceramic tile or wood paneling.
 - a. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1 inch wide exposed perimeter flange and adjustable metal masonry anchors.
 - b. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.
- B. Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.
- C. Provide templates as required to related trade for location of support and anchorage items.
- D. Preparation for Joint Sealers
 - 1. Thoroughly clean surfaces, removing foreign matter such as dust, oil, grease, water, surface dirt and frost. Materials must be applied to the base surface.
 - 2. Prior to any priming and sealing, joints shall be masked by masking tape or other approved means to prevent soiling of adjacent surfaces.
 - 3. Immediately prior to application of materials test adhesion of materials to each substrate material and apply primer to any surface showing poor adhesion.
 - 4. Where required support material with damming materials specified herein. Where sealant materials require damming provide duct tape or compatible backer rod.

3.03 INSTALLATION, ERECTION AND APPLICATION

- A. Erection of Metal Supports and Anchorage
 - 1. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical, plumbing and HVAC materials and equipment.
 - 2. Attach to substrates as required to support applied loads.
- B. Installation of Access Doors
 - 1. Set frames accurately in position and securely attach to supports, with face panels plumb and level in relation to adjacent finish surfaces.
 - 2. Adjust hardware and panels after installation for proper operation.
 - 3. Location
 - a. Locate access doors in hung ceilings, walls, furred spaces, partitions and other components of the structure, where required to service fire dampers, smoke detectors, duct access doors, controls, valves, cleanouts and other items installed under this Division of the specification.
 - b. Contractor shall coordinate the exact location and quantity with mechanical, Engineering and electrical requirements. Access doors are not required in suspended acoustical lay-in tile ceilings unless specifically shown.

3.04 FIELD QUALITY CONTROL

- A. Inspect seal after 48 hours for complete adhesion, and seal and correct any deficiencies.

- B. Follow manufacturer's installation instructions precisely, including 4-point field quality control checks which consist of foam color, foam cell structure, snap time, and free foam density.
- C. Inspect seal after 24 hours. Remove damming materials to inspect under site.
- D. Correct any deficiencies by adding foam or sealant. Reinspect after 24 hours.

3.05 ADJUSTING AND CLEANING

- A. Clean excess cured sealant from nonporous surfaces with commercial solvent such as naphtha mineral solvents, following instructions on container label.
- B. Clean spills of liquid components with high-flash mineral spirit solvent, following instructions on container label. Trim excess foam with sharp knife or blade.
- C. Remove equipment, materials and debris. Leave area in undamaged, clean condition.

END OF SECTION

SECTION 15060

PIPES AND FITTINGS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of Piping and Fittings and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. Polypropylene pipes and fittings for cold and hot water systems.
 - 2. PVC drainage pipes for :
 - a. Soil and waste water drainage and venting system.
 - b. Rain water drainage system.
 - 3. inclusive of the removal of existing pipes in designated areas.
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050.
 - 3. Pipes, Fittings and Valves – Application – Section 15110.

1.02 QUALITY ASSURANCE

- A. Materials shall conform to the latest edition of reference specifications and industry standards specified herein and applicable, and to pertinent codes and requirements of municipal authorities.
- B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years subject to the pre-approval of the supervisor.

1.03 SUBMITTALS

- A. Submit the following in accordance with requirements specified under submittals in section 15010.
- B. Product Data
 - 1. Submit copies of manufacturer's latest published literature for each type of pipe and pipe fitting specified herein for approval. Obtain approval before ordering materials.
 - 2. Data shall include piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- C. Certificates: Submit certificates attesting to compliance with these specifications to Supervisor for approval. Obtain approval prior to ordering materials.

- D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual, as approved.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside; protect from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

- A. Polypropylene pipes and fittings shall be according to DIN 8077, 8078, PN20.
- B. PVC drainage pipes shall be of unplasticized polyvinyl chloride with solvent cemented socket joints and complying with NTF54.028 (EN 1329) for pipes inside the toilets and with rubber ring sealed socket joints and complying with DIN 19534 (EN 1401) for pipes outside the toilets.

2.02 PIPE ACCESSORIES AND FITTINGS

A. GENERAL

- 1. The accessories shall be of the same standard as the pipes on which they are fitted. They shall be flanged, threaded or welded depending on the type and the diameter of the pipe and the location in which the pipes are installed.
- 2. For PVC pipes, all fittings shall be made of PVC from the same series and by the same manufacturer of the pipes.
- 3. For HDPE pipes, all fittings shall be made of HDPE from the same series and by the same manufacturer of the pipes.

B. UNIONS AND FLANGES

Unions and flanges shall be installed at all equipment inlets and outlets, at all valve inlets or outlets, on all pipe branches and in general, at every 15 meters of pipe run.
Unions shall be used on all screwed pipes and shall be of the same quality and service.

C. PIPE SLEEVES

1. Pipe sleeves shall be supplied and installed wherever pipes cross slabs, walls partitions, ceilings, floors, etc.
2. For pipe sleeves passing from a fire zone compartment to another, foam should be used having the same fire rating as fire zone compartment.
3. Sleeves shall be cut of galvanized steel pipe of approved weight, having an internal diameter of not less than 1cm larger than the bare sleeved pipe or the insulated sleeved pipe depending on the particular condition.
4. Sleeves passing through wall partitions and ceiling shall terminate flush with finished wall or ceiling surface.
5. Sleeves passing through floor shall extend 5cm above the finished floor level.
6. Sleeves passing through roof shall extend 15cm above the finished surface and shall be provided with a 1mm lead flashing to prevent roof water penetration.
7. All gaps shall be plugged with a non-flowing, plastic and waterproof mastic paste.

D. STRAINERS

Strainers shall be of Y-type, bronze construction with stainless steel screen, designed for servicing without being dismantled from the pipe and suitable for 10bar working pressure. Strainers shall be installed at the inlets of pumps as shown on drawings.

E. EXPANSION JOINTS

Expansion joints shall be of the rubber or stainless steel bellow type suitable for 10 bars working pressure. The connection shall be in accordance with the pipe material.

The type, number and location of the expansion joints shall be approved by the Supervisor.

F. PIPE GUIDES

Pipe guides shall be used before or after expansion joints, the other side of the pipe being properly anchored. The guides shall be of a standard construction approved by the Supervisor.

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions. Additionally, the contractor is deemed to have acquainted itself before submitting its bid of the site conditions whether visible or invisible at its sole responsibility.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.
- B. Verify measurements and dimensions and check all capacities at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.
- C. Pipes and accessories in Kitchen and Toilet and wherever they exist need to be removed by the Contractor and properly disposed of in authorized sites in an environmentally friendly way.

3.03 INSTALLATION

A. PIPELINE SLOPES

Horizontal pipelines shall have the following slopes, unless otherwise indicated by the Supervisor.

- All water supply and water distribution : 0.2% to 0.5%.
- Soil, waste and rain water drains : 1% to 2%.

B. GENERAL REQUIREMENTS FOR PIPE INSTALLATION

1. All pipes shall be installed in straight parallel lines.
2. Pipes shall be spaced to permit their installation, maintenance and insulation.
3. Concealed pipes shall be installed in such a way as to permit their maintenance and inspection.
4. All pipes shall be so installed as to ensure easy and even flow of the water to and from all equipment and fixtures.
5. Pipelines shall be installed in a manner to allow for easy air escape and system draining. It shall be endeavored to obtain this naturally by gravity.
6. However, where this cannot be met, provision should be made to ensure quick and positive drainage and noiseless air discharge.
7. Automatic air vents shall be installed at all points in the pipelines where air gaps can form and drain valves shall be installed at all low points and at the lowest point of each riser leg and wherever required to permit complete drainage of all lines.
8. Drain pipes shall be joined together in a manner satisfying perfect running condition.
9. Vent pipes shall not be trapped and shall be graded to drip back to waste or soil line.
10. All vents for waste and soil stacks shall extend above the highest point of the roof and shall be equipped with a vent head and cap as specified.
11. Sleeves shall be supplied and installed wherever pipes cross slabs, walls, partitions, etc.
12. Connection of PVC and/or HDPE underground pipes to sump pit shall be made by means of a suitable manhole lining to ensure adequate bonding to the concrete.
13. Clean-outs shall be placed at all changes in direction whether shown on the drawings or not.
14. Copper pipes shall be round, clean, smooth and free from defects and deteriorious films in the bore.

C. CONDITIONS FOR PIPE ASSEMBLY

1. Before installation, all pipes shall be cleaned of all foreign matter and shall be reamed smooth after cutting. All trenches shall be cleaned up.
2. Pipes shall be carefully cut by hacksaw or by special pipe cutting machine.
3. Steel pipe ends shall be cleaned and smoothed on edge to avoid all roughness and unevenness before welding or threading.
4. Threading shall be done for the total length of joint or accessory with a reliable threading machine.
5. PVC or HDPE pipes when cut, shall be debarred and chamfered according to the instructions of the manufacturer to ensure a proper and easy assembly.
6. All changes in pipe size shall be made with fittings. Excentric reducing fittings shall be used to prevent pocketing.
7. Change in direction of piping shall be made with long radius fittings.
8. The exposed ends of incomplete or unconnected work shall be plugged. Plugging shall be perfect with gate valves, counter flange plugs or thread plugs.
9. All piping subject to expansion and contraction shall be installed with expansion bends, swing joints made up of fittings or other approved methods or devices. Branch lines from lines subject to expansion and contraction shall have a swing joint at the point of connection with the main. Expansion joints shall be installed even if not shown on the drawings or count for in the bill of quantities.
10. Copper pipes shall be cut perfectly square using a miter box and tube cutter or hacksaw. All burrs shall be removed from both the inside and outside of the tube using a reamer and a file, care being exercised not to expand the pipe while reaming. Both the inside of the fitting cup and the outside of the tube shall be cleaned and burnished to bright metal using wire brush or steel wool. The tube shall be cleaned to one and a half times the depth of insertion in the cup. Cleaned surfaces shall not be touched with hands or gloves.

D. JOINTING OF POLYPROPYLENE PIPES

Polypropylene pipes shall be jointed by electric welding.

E. JOINTING PVC PIPES

1. Solvent weld joints shall be made with the proper solvent cement furnished by the manufacturer for that purpose. Both, the inside of the socket and the outside of the spigot end of the pipe shall be roughened using sand paper. All grease and dirt shall be removed from the surface with a special cleaning fluid supplied by the manufacturer. Immediately after cleaning, solvent cement shall be applied and pipe pushed into the socket up to the shoulder without turning.
2. Rubber ring joints shall be made with the proper sealing ring furnished by the manufacturer for that purpose. After the spigot end has been lubricated, it shall be pushed fully into the socket and then pulled out by about 3mm per meter of pipe length (but in no case less than 1cm) to allow for longitudinal thermal expansion.
3. Cleaning and lubrication shall be as recommended by the manufacturer. No oil or grease should be used.

3.04 POOL FITTINGS

1. Inlet Fittings
 - a. The inlet fitting for pool shall be of adjustable type with full range of flow adjustment by turning the internal plate. Total opening area of the grating

should not be less than cross-section area of the connection pipe. It shall be constructed of ABS or chrome plate cast bronze.

- b. The inlet fitting for water feature shall be of chrome plate cast bronze construction, adjustable "eyeball" type with smooth rounded exposed surface. The minimum orifice diameter shall be 25 mm.

END OF SECTION

SECTION 15100

VALVES

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of Valves and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. Types of valves specified in this section include the following:
 - a. Gate Valves.
 - b. Check Valves.
 - c. Float Valves.
 - d. Water tap.
 - e. Concealed gate valves.
 - f. Strainers.
 - g. Union and flanges.
 - 2. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050.
 - 3. Pipes, Fittings and Valves – Application – Section 15110.

1.02 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of reference specifications, industry standards listed below and specified herein and to applicable codes and requirements of local authorities having jurisdiction, whichever is more stringent.
- B. Tests: Test valves in accordance with the appropriate section of the specification describing each system.

1.03 SUBMITTALS

- A. Submit the following in accordance with requirements specified under Submittals in Section 15010.
- B. Product Data: Submit copies of manufacturer's latest published literature for materials and equipment specified herein for approval; obtain approval before ordering materials.

1.04 DELIVERY, STORAGE AND HANDLING

Exercise proper care in the handling of work so as not to injure the finished surfaces, and take proper precautions to protect the work from damage after it is in place.

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

- A. Provide valves of same type by one manufacturer.
- B. Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

2.02 GENERAL

- A. All valves shall be designed for a working pressure of 6 bars.
- B. Valves shall be of the same diameter as the pipe served.
- C. A union shall be used with all gate, check and float valves.

2.03 GATE VALVES

- A. Gate valves shall be designed for working under pressure with valves opened or closed.
- B. Valves shall be of the wedge disc type and shall permit straight line flow and complete shut-off.
- C. The screwed valves shall have joints with B.S. pipe threads. Flanged valves shall have the bolt holes to match the equipment or pipes on which they are installed.
- D. Gate valves used in HVAC works of 2" and smaller shall be all bronze, with screwed ends, union bonnet, wedge disc.
- E. Gate valves used in sanitary works of 2" and smaller shall be brass, with screwed ends, union bonnet, wedge disc.
- F. Gate valves 2 1/2" and larger shall be all cast-iron, bolted bonnet flanged ends, bronze wedge disc faces and seats.

2.04 CHECK VALVES

- A. Check valves of the silent type shall be used on the discharge side of pumps and whenever shown on the drawings or requested by the Supervisor.
- B. Check valves used in HVAC works of 2" and smaller shall be bronze with screwed ends, screwed cap swing type.
- C. Check valves used in sanitary works, of 2" and smaller shall be brass, with screwed ends, screwed cap swing type.
- D. Check valves 2 1/2" and larger shall be all cast-iron with flanged ends, bolted cap swing type.

2.05 FLOAT VALVES

- A. Float valves shall be of all bronze construction including levers and arms, with PVC float and suitable for a cold water working pressure of 10 bars. Float valves shall have screwed inlets.
- B. Float valves shall be of the full bore, equilibrium ball type, designed to close tight against maximum pressure when half submerged. They shall have renewable synthetic rubber valve discs and balancing piston buckets.

2.06 WATER TAP

All valves shall be of the ball gate valves type.

2.07 CONCEALED GATE VALVES

- A. Gates valves concealed in wall with chrome plated cover shall be installed inside toilets. Valve shall be with wall sealing loose key and shield or with wall sealing handle to match sanitary fixtures mixers, and according to the Supervisor's requirements.
- B. Concealed gates valves shall be with polypropylene connections from the two sides.

2.08 AUTOMATIC AIR VENTS

- A. Automatic air vents shall be installed as shown on the drawings and where indicated by the Supervisor.
- B. Automatic air vents of the ball float type shall be installed at all high points in the piping systems. They shall support a working pressure up to 10 kg/cm².
- C. Mechanism of automatic air vent shall be interchangeable.

2.09 STRAINERS

Shall be with pattern for sizes 2" and smaller with screwed ends, flanged for sizes 2½" and larger.

2.10 UNION AND FLANGES

- A. Unions and flanges shall be installed at all equipment inlets and outlets, at all valves inlets or outlets on all pipes branches, to facilitate dismantling, repair or replacement without disturbing piping.
- B. Unions shall be used on all screwed pipes and shall be of the same quality and service. Flanges, suitable for welding, shall be used on all welded pipes, and shall be all steel construction to ASTM or BS. Flanged valves and equipment are connected to the pipes and shall conform to ASTM or BS standards.

3 - EXECUTION

Refer to section 15110 - PIPE, FITTINGS AND VALVES

END OF SECTION

SECTION 15110

PIPE, FITTINGS AND VALVES - APPLICATION

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of pipe, fittings and valves application and related work as indicated on the drawings and specified herein.

- B. Work Includes: The work shall include, but not be limited to, the following:

This section of the specifications consists of the application of the various types of Pipe, Fittings and Valves as described in Section 15060 "Pipe & Fittings" and Section 15100 "Valves."

- C. Related Work Specified Elsewhere

1. Basic Mechanical Requirements - Section 15010.
2. Basic Mechanical Materials and Methods - Section 15050.

1.02 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of reference specifications and industry standards specified herein and to applicable codes and requirements of local authorities having jurisdiction, whichever is more stringent.
- B. Fittings shall have the same wall thickness and schedule as the pipe.
- C. Pressure rating of fittings and valves shall exceed highest specified service pressure of the system in which installed.
- D. Materials, fittings and valves of any one type shall be from one manufacturer.

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

Refer to Section 15060 "Pipe and Fittings" and Section 15100 "Valves."

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions. Additionally, the contractor is deemed to have acquainted itself before submitting its bid of the site conditions whether visible or invisible at its sole responsibility.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.
- B. Verify measurements and dimensions and check all capacities at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.

3.03 INSTALLATION

- A. Pipe and Fittings
 - 1. Install pipes and pipe fittings, in accordance with recognized industry practices, which will achieve permanently leakproof piping systems capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes by use of reducing fittings.
 - 2. Locate piping runs, except as otherwise indicated, vertically and horizontally; pitch to drain and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2 inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any.
 - 3. Provide domestic water connections to equipment requiring them from valved outlets dedicated for this service.
 - 4. Cap or plug open ended valves for future connections, drains and vents.
 - 5. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.
 - 6. Pipe Joints - Mechanical
 - a. Make mechanical joints in strict accordance with the recommendation of the manufacturer using jointing material provided with the pipe.
 - b. Clean jointing surfaces thoroughly by wire brushing before assembly. Center spigot in bell, apply soapy water and slip the gasket over the spigot and into the bell.
 - 7. Arrangement and Alignment
 - a. Install piping in straight parallel lines.
 - b. Install pipe groups for plumbing and HVAC parallel with pipe of other trades.

- c. Space pipe supports, arrange reducers and pitch piping to allow air to be vented to system high points and to allow the system to be drained at the low points. Provide drain valves at the base of each riser, at low points and wherever required to permit complete draining of lines.
 - d. Provide automatic air vents at high points of water lines and wherever required to allow air to vent from system. Each vent shall have a drain line piped to nearest indirect waste.
 - e. Configure piping with loops, swing joints, anchors, base elbows, etc. as required and approved to assure proper expansion and contraction of elements of the piping system without damage to equipment, structure, or piping.
 - f. Provide runouts, risers and connections to coils, convectors and fan-coil units with double swing joint connections to withstand expansion and contraction.
 - g. Pipe and fittings furnished as part of factory fabricated equipment are specified as part of equipment assembly in other sections.
8. Fittings - General
- a. Make changes in size and direction of piping with fittings. Do not use miter fittings, face or flush bushings, close nipples or street elbows.
 - b. Make branch connections with tees as directed by the Supervisor.
 - c. Use eccentric reducing fittings or eccentric reducing couplings where required by the contract documents or where required to prevent pocketing of liquid or non-condensable.
 - d. Fittings shall be factory manufactured. Shop or field fabricated fittings are not acceptable.
 - e. A nipple shall be considered any piece of pipe 6 inches in length or less. Threaded nipples shall be extra heavy. Do not use close nipples.
 - f. Screw threads shall be cut clean and true; make screw joints tight without caulking. Caulking is not permitted; a non-hardening lubricant is acceptable. Bushings shall not be used. Make reductions, otherwise causing objectionable water or air pockets, with eccentric reducers or eccentric fittings. Ream out pipe after cutting to remove burrs.
9. Connections to Equipment and Control Valves
- a. Provide flanges or unions at final connections to equipment and control valves to facilitate dismantling. Offset connections to permit removal or servicing of equipment being serviced without dismantling the piping.
 - b. Provide automatic valves with a gate valve and a strainer on the inlet side.
 - c. Install supply piping to coils, pumps and other equipment including gate valves and strainers at line size. Make reductions in size only at the inlet to the control valve or pump. Install the outlet piping from the control valve at the full size of the tapping in the equipment served.
 - d. Install piping and dirt pockets or mud legs in return lines the full size of the tapping in the equipment served. Install piping, check valves and strainers in these return lines beyond the dirt pockets the size of the tapping in the trap.
 - e. Provide "quick-fill" connections from domestic water supply to circulating water systems. Connections shall be 1-1/2 inches minimum and shall have removable spool pieces or backflow devices in accordance with applicable codes.

B. Valves

1. General Requirements

- a. Install valves with handwheels horizontally or vertically upward unless specifically shown otherwise.
- b. Install valves in accessible locations to facilitate easy removal for repair or replacement.

- c. Connect threaded end valves installed in copper tubing lines where joints are ordinarily soldered or brazed to the tubing by means of adapters screwed into the valves and soldered or brazed into the tubing.
- d. Valves shall be full line size, unless otherwise indicated.
- e. Double regulating and check valve discs shall be in accordance with manufacturer's recommendations for the service.
- f. Valves shall be capable of being repackaged while wide open and operating at their rated pressure.
- g. Where angle valves are indicated or required, use equivalent of specified globe type.
- h. Provide 5 operating wrenches for each type of valve not equipped with handwheels.
- 2. Except as otherwise indicated, install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves to be accessible and so that separate support can be provided when necessary. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
- 3. Insulation: Where insulation is indicated, install extended-stem valves; arrange in proper manner to receive insulation.
- 4. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
 - a. Tube Size 2 Inches and Smaller: Soldered-joint valves.
 - b. Pipe Size 2 Inches and Smaller: One of the following, at Installer's option:
 - 1. Threaded valves
 - 2. Grooved-end valves
 - 3. Butt-welding valves
 - 4. Socket-welding valves
 - 5. Flanged valves
 - c. Pipe Size 2-1/2 Inches and Larger: One of the following, at Contractor's option, as approved by Supervisor:
 - 1. Socket-welding valves
 - 2. Flanged valves
 - 3. Wafer valves
 - 4. Mechanical joint end valves
 - d. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of valves. However non-rising stem shall not be accepted for fire fighting system.
 - e. Installation of Check Valves
 - 1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.
 - 2. Wafer Check Valves: Install between 2 flanges in horizontal or vertical position; position for proper direction of flow.
 - 3. Lift Check Valve: Install in piping line with stem vertically upward; position for proper direction of flow.

3.04 FIELD QUALITY CONTROL

A. Material Tests and Identification

- 1. In addition to the tests required for specific systems, the manufacturer shall test or guarantee material specified prior to delivery.

2. Inspect materials for defects. Identify materials with factory applied permanent stampings or markings designating their conformance with specified requirements.

B. Hydrostatic Pressure Tests

1. Test piping including valves, fittings and joints at a pressure equal to at least 1-1/2 times the rated or system pressure, as indicated. Perform the test hydrostatically unless directed otherwise. Minimum pressure shall be as indicated in Section 15110 "Pipe, Fittings and Valves - Application".
2. Blank off or remove elements such as traps, instruments, automatic valves, diaphragm valves, relief valves, pumps or any other equipment which may be damaged by test pressure. Open, but do not back seat, valves.
3. Fill the system with water and vent the system at high points to remove air.
4. Maintain the required test pressure for a sufficient length of time to enable complete inspection of joints and connections but no less than 4 hours.
5. Repair leaks or defects uncovered by the tests and retest the system.
6. After completion of tests, drain the system and blow out and clean it of rust and/or foreign matter. Clean strainers, valves and fittings of dirt, filings and debris.
7. Do not insulate or conceal piping until completion of tests and approval of the results.
8. Perform tests in the presence of, and to the satisfaction of, the Supervisor.

C. Testing of Piping - General

1. Test piping, mains, and joints for leaks, before any piping is enclosed, insulated, or concealed in any way. Follow specific procedures, if given, in the other specification sections.
2. Refrigerant piping. Test for leaks with a halide torch. Recharge each system as necessary after testing.
3. Provide temporary equipment for testing, including pump and gauges. Test piping system before insulation is installed, wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - a. Required minimum test period is 24 hours.
 - b. Test runs at pressures listed except where fittings are lower Class or pressure rating.
 - c. Test each piping system at 150 percent minimum of operating pressure indicated, but not less than 8 bars test pressure.
 - d. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5 percent of test pressure.
4. Repair piping system sections which fail required piping test by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
5. Drain test water from piping systems after testing and repair work has been completed.

3.05 CLEANING, FLUSHING, INSPECTING AND DISINFECTION

- A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings, if any. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

- B. Disinfect water mains and water service piping in accordance with AWWA C601.
- C. Cleaning - Piping Systems
1. Plug open ends of piping, valves and equipment except when actual work is being performed, to minimize accumulation of dirt and debris.
 2. After installation is complete, place temporary screens at connections to equipment and at automatic control valves where permanent strainers are not provided.
 3. Prior to the performance of tests, flush out piping that is to receive a hydrostatic test with clean water. Blow out piping that is to be air or gas pressure tested with compressed air.
 4. Remove dirt and debris collected at screens, strainers and other points from the system.
 5. After hydrostatic testing, blow out fuel oil lines with compressed air until dry.
 6. Where noted, flush out fuel oil pipe lines with clean oil after lines are dry.
- D. Supplemental Cleaning - Water
1. After the piping system is installed, tested and flushed, completely clean the system to remove organic, rust and other foreign matter and provide protection of the metal surfaces in preparation for permanent water treatment.
 2. Use a cleansing agent which will not in any way interact with any of the materials in the system to produce corrosion, form deposits, weaken, reduce the life or in any way have a detrimental effect on any system components.
 3. Fill the system with clean water and add sufficient cleaning preparation to provide a concentration adequate to perform complete cleaning. Add the cleaning preparation at a point which will assure good mixing and complete dispersal throughout the system.
 4. Provide temporary receivers or drums to accommodate any foam that may form.
 5. Circulate the mixture of cleanser and water for a sufficient length of time to complete the cleaning.
 6. Drain the system, flush with clean water, clean strainers and screens and refill the system.
- E. Disinfection Water Systems
- Disinfect new water systems prior to use whenever samples from the system show any contamination after making a bacteriological examination. Follow the following method:
1. Flush the pipe system with clean water until no dirty water appears at the outlets.
 2. Fill the system or part thereof with a water-chlorine solution containing at least 50 ppm of chlorine and valve off the system or part thereof and allow to stand for 24 hours or, fill the system or part thereof with a water-chlorine solution containing at least 200 ppm of chlorine and allow to stand for 3 hours.
 3. Following the prescribed standing time, flush the system with clean water until no excess chlorine remains in the water coming from the system.
 4. Repeat the procedure if it is shown that contamination still persists in the system.
- F. Valve Adjustment: After testing and putting piping systems into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.
- G. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touchup paint.
- H. Gaskets: Gaskets for HVAC system shall be as directed by the Supervisor.

END OF SECTION

SECTION 15140

SUPPORTS AND ANCHORS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of Piping and Fittings and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 15 sections.
 - 2. Supports and anchors shall be of approved type.
 - 3. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010
 - 2. Basic Mechanical Materials and Methods - Section 15050

1.02 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of reference specifications and industry standards listed below and specified herein and to applicable codes and requirements of local authorities having jurisdiction, whichever is more stringent.
- B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

1.03 SUBMITTALS

- A. Submit the following in accordance with the requirements specified under Submittals in Section 15010.
- B. Shop Drawings: Submit shop drawings for work specified herein for approval. Shop drawings shall show manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly or components.
- C. Product Data
 - 1. Submit copies of manufacturer's latest published literature for materials specified herein for approval; obtain approval before ordering materials.
 - 2. Data shall include manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support

schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.

1.04 DELIVERY, STORAGE AND HANDLING

Exercise proper care in the handling of work so as not to injure the finished surfaces, and protect the work from damage after it is in place.

2 - PRODUCTS

A. CLAMPS FOR PVC PIPES

1. PVC pipes shall be supported with galvanized steel clamps with rubber gasket as recommended by the pipes manufacturer.
2. Anchorage of the PVC pipe work shall be provided by using clamps with an in-laid plastic strip to ensure a firm hold after each group of fittings immediately following the last coupling, and using loose clamps between the fittings.
3. Horizontal and vertical lines shall be supported as the following table:

| Pipes Diameter | Distance between Supports for horizontal Pipes | Distance between Supports for vertical Pipes | Rod Diameter |
|----------------------|---|--|--------------|
| Till 1" | 75 cm | 150 cm | 8 mm |
| From 1" to 2" | 105 cm | 210 cm | 10 mm |
| From 2 ½" to 3" | 140 cm | 270 cm | 10 mm |
| For 4" | 150 cm | 300 cm | 10 mm |
| For 6" | 180 cm | 360 cm | 10 mm |
| For 8" and larger | 220 cm | 360 cm | 10 mm |

B. DUCT SUPPORT

1. Where cantilever brackets or other special forms of support are necessary, they shall be structurally strong enough to take the load and to transfer the load to the building structure.
2. Unless detailed otherwise ducts shall be supported at intervals and rod diameter according to the following table:

| Maximum half of duct perimeter P/2 (mm) | Pair of rod at maximum spacing (m) | Minimum rod diameter (mm) |
|---|--|------------------------------|
| 760 | 3 | 8 |

| | | |
|------|-----|----|
| 1830 | 2.4 | 8 |
| 2440 | 3 | 10 |
| 3050 | 2.4 | 10 |
| 4880 | 1.5 | 10 |

3. Flexible ducts or connections shall be supported at 1 meter centers.
4. No screws, bolts or other fittings for brackets or supports shall penetrate the air duct.

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions. Additionally, the contractor is deemed to have acquainted itself before submitting its bid of the site conditions whether visible or invisible at its sole responsibility.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section. Provide supplementary parts necessary to complete work, though not specifically indicated on Drawings or specified herein.
- B. Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.
- C. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- D. Prior to installation of hangers, supports, anchors and associated work, Contractor shall meet at project site with installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Supervisor for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION

- A. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to support together on trapeze type hangers where possible. Install supports as directed by the Supervisor. Where supporting piping of various sizes together by trapeze hangers, space hangers for smallest

pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

3.04 ADJUSTING AND CLEANING

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touchup paint.

END OF SECTION

SECTION 15175

TANKS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of Plumbing Equipment and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. Water storage tank.
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050.

1.02 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of industry standards, reference specifications listed below and specified herein and to applicable codes and requirements of local authorities having jurisdiction, whichever is more stringent.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 15010.
 - 1. Product Data

Submit copies of manufacturer's latest published literature for materials specified herein for approval; obtain approval before ordering materials.
 - 2. Shop Drawings: Submit shop drawings for work specified herein for approval.
 - a. A complete detailed set of construction and erection drawings for tank including bases indicating dimensions, materials of construction and methods of assembly.
 - b. Complete capacity and performance data including items indicated in the equipment schedules and specifications.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and handle so as to prevent the inclusion of foreign materials and the damage of materials.
- B. Store materials and equipment where designated and assume responsibility and security for materials and equipment. Take precautions for protection from detrimental conditions.

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

A. POLYETHYLENE STORAGE WATER TANK

Storage water tank shall be made of polyethylene complying with the following minimum specifications:

Manufactured with food grade resin complying with American FDA21-CFR177, 1526 and BS6920 for tests of effect on water quality.

Manufactured with heat and UV stabilized material with a minimum thickness of 4mm.

Tank shall be manufactured in one piece and shall withstand a temperature of 70°C without any deflection.

Tank shall have a minimum of five years guarantee against any leakage or manufacturing defects.

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.
- B. Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.

3.03 FIELD QUALITY CONTROL

A. Field Tests

1. Perform field test to demonstrate the ability of the equipment to meet contract requirements.
2. Should any part of the apparatus or system fail to meet the contract requirements, adjust, repair or replace any defective or inoperative parts and, on completion, again conduct the complete performance tests.
3. Refer to appropriate sections for additional required test data.

END OF SECTION

SECTION 15290

MECHANICAL INSULATION

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of Insulation and related work as indicated on the drawings and specified herein.
- B. Work includes: the work shall include, but not be limited to pipes and duct insulation
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050.

1.02 QUALITY ASSURANCE

Materials shall conform to the latest edition of industry standards and reference specifications specified herein and to applicable codes and requirements of local authorities having jurisdiction, whichever is more stringent.

1.03 SUBMITTALS

- A. Submit the following in accordance with the requirements specified under Submittals in Section 15010.
- B. Product Data: Submit names of manufacturer and copies of latest published literature including types, applications and thermal characteristics for materials specified herein for approval; obtain written approval before ordering materials.
- C. Samples: Submit samples of materials specified herein for approval; obtain approval before ordering materials.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and handle to prevent the inclusion of foreign materials and the damage of materials by water or breakage.
- B. Store materials and equipment where designated and within the manufacturer's recommended temperature range. Assume responsibility and security for materials and equipment and take precautions for protection from detrimental conditions

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

A. Fiber glass pipe Insulation

1. All pipes and fittings for chilled, heating and domestic hot water so indicated on the drawings shall be insulated with pre-formed Fiberglass pipe section with a protection applied during fabrication.
2. The protection shall be reinforced Kraft paper (ASJ) for heating and domestic hot water pipes, and of aluminum foil (FSK) for chilled water pipes.
3. Physical properties shall be as follows:
 - Density : 64 Kg/m³ or more.
 - Thermal conductivity "K" : 0.026 - 0.030 Kcal/Hr/M/°C
at 24°C (average temperature) (BTUxin/Hr/ft²/°F = 0.21 - 0.24)
 - Flammability : self extinguishing
 - Heat resistance : + 100 °C
 - Crushing resistance : 2 kg/cm²
 - Water absorption : 2-4% by volume
 - Thermal expansion : 0.0002 m/m °C
4. Insulation shall be applied on clean dry surface. All joints shall be butted firmly together and longitudinal jacket laps and butt strips shall be perfectly secured by means of aluminum adhesive tapes.
5. The minimum insulation thickness for the chilled, heating and domestic hot water pipe inside building shall be as the following table:

| PIPE DIAMETER (IN) | INSULATION THICKNESS (MM) |
|--------------------|---------------------------|
| up to 1 | 25 |
| up to 2 | 40 |
| up to 5 | 50 |
| up to 10 | 60 |
| up to 30 | 75 |

6. Insulation thickness of water piping in unconditioned spaces shall be one and half of the above mentioned table.
 7. All pipe insulation in technical rooms, on roof and/or as directed by the Supervisor shall be protected by a water proof acrylic emulsion coating applied on plastic wire mesh.
- B. Pipes Jacketing
1. Refrigerant pipes on roof shall be protected by galvanized steel jacketing per group of liquid and gas pipe in the same jacket as shown on the drawings.
 2. The jacketing shall be pre hot-dip galvanized steel sheet with a powder coating of not less than 60μ.

3. The jacketing must be weather resistance and have a special reinforced structure to withstand heavy load.

3 - EXECUTION

3.01 INSTALLATION AND PROTECTION OF PIPES INSULATION

- A. Before applying the insulation, surface shall be thoroughly clean and dry. All dirt, scale, rust, oil, grease or water shall be adequately removed.
- B. Insulation shall not be applied on valves above the bonnet, on strainer basket plus, nor on nameplate. Any part of equipment, that is normally removable for service, (i.e. heat-exchangers' heads) shall be insulated from the equipment. Pipes shall be individually insulated.
- C. Insulation shall be protected against humidity by a heavy aluminum foil vapor barrier, thickness not less than 4/10 mm. This protection shall be adequately fixed and held in place at an adequate number of non-corrodible bands.
- D. This finished insulated surface shall present a neat, uniform and parallel appearance, whether concealed or exposed to view.
- E. All insulated pipes in the open air shall be covered, in additions, with galvanized sheet jacket of not less than 0.5mm thickness.
- F. Insulation in the machine room shall receive two coats of finishing paint in accordance with a color code to be given to the Contractor during erection.

3.02 INSTALLATION OF DUCT INSULATION

Install all duct insulation in accordance with the following requirements:

- No insulation shall be applied until ducts have been tested and found correct.
- All insulation shall be applied by skilled laborers of a specialized sub-contractor in accordance with the best pipe covering practice.
- Insulation to be applied so as to give smooth homogeneous and fine surface. All flat surfaces truly plane and parallel and all edges straight.
- Insulation shall fit tight to the surfaces to be covered and any surface irregularities left shall be repaired.
- All insulation materials shall be properly stored in a suitable manner so as to protect them from damage or deterioration before installation.

END OF SECTION

SECTION 15420

DRAINAGE AND VENT SYSTEMS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of the Drainage and Vent Systems and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. PVC Floor drains with trap.
 - 2. Inspection cleanouts.
 - 3. Floor Cleanouts.
 - 4. In line cleanouts.
 - 5. Vent caps.
 - 6. Channel drains.
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050.

1.02 QUALITY ASSURANCE

Materials and work shall conform to the latest edition of industry standards, reference specifications listed below and specified herein and to applicable codes and requirements of local authorities having jurisdiction, whichever is more stringent.

1.03 SUBMITTALS

- A. Submit the following in accordance with the requirements specified under Submittals in Section 15010.
- B. Product Data
 - 1. Submit copies of manufacturer's latest published literature for materials specified herein for approval. Obtain approval before ordering materials. Data shall include the following:
 - 2. Manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Submit schedule showing manufacturer's figure number, size, location and features for each required piping specialty.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and handle so as to prevent the inclusion of foreign materials and the damage of materials.
- B. Store materials and equipment where designated. Contractor shall assume responsibility and security for materials and equipment. Protect from detrimental conditions.

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

A. PVC FLOOR DRAINS WITH TRAP

These floor drains shall be for installations executed under the floor tiles. They shall be of PVC with multiple waste inlet connections.

Cover plate and frame shall be of bronze chrome plated or PVC from the same manufacturer.

B. INSPECTION CLEANOUTS

Inspection cleanouts for connection of floor drain and WC to the main pipe made with double cross sanitary "T". They shall be of PVC with two 4" inlet connections and one 4" outlet connection.

Cover plate and frame shall be 15 x 15 cm PVC or bronze chrome plated. The cover shall be locked to the frame to ensure an air tight closure.

C. FLOOR CLEANOUTS

The cleanouts shall be of the same material and dimensions as the pipes to be cleaned and shall be placed under the floor slabs or extended through to terminate flush with the finished floor.

Floor cleanouts with covers shall be formed with a "Y", "F" or 45 elbow fitting of the same material and size as the pipe accommodated and provided with an adapter and a threaded brass plug.

Cover plate and frame shall be 15 x 15 cm bronze chrome plated. The cover shall be locked to the frame to ensure an air tight closure.

D. IN LINE CLEANOUTS

In line cleanouts shall be installed in all change in direction of even if not shown on the drawings. The cleanout shall be of the same material and dimensions as the pipe to be cleaned and shall be terminated with a screwed cap.

E. ROOF DRAINS

Rain water drainage from the roof shall be ensured by means of PVC roof drains with Horizontal or vertical discharge.

Each drain shall comprise a spherically shaped ball grate screwed to the body. The drain unit body shall be of conical shape with solvent socket joint and equipped with a plastic flange for clamping the waterproofing material.

F. VENT CAPS

Vent caps shall be of PVC material and of a minimum size equal to the size of the corresponding pipe.

G. CHANNEL DRAIN

Channel drain shall be made of roof drain unit installed in the channel.

3 - EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.
- B. Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.

3.03 INSTALLATION

- A. Pitch horizontal piping not less than 1/8 inch per foot down in direction of flow.
- B. Individually trap fixtures.
- C. Do not trap vent piping; grade to drip back to a waste or soil line.
- D. Make changes in direction of piping with long radius fittings.
- E. Set floor drains below the normal finished floor, with a gradual pitch extending away from the drain.
- F. Keep pipe and fittings clean; plug exposed ends of incomplete or unconnected work.
- G. Place cleanouts at changes in direction.
 - 1. Cleanouts on concealed piping shall be extended through and terminate flush with the finished floor.
 - 2. They shall be also provided at or near the foot of each vertical soil and waste stack.
 - 3. Cleanouts shall be installed such that the cleanout opens in a direction opposite to the flow of the drainage line or at right angles thereto.
- H. Make connections between dissimilar pipes with approved dielectric adapters.

- I. Flash floor drains above ground floor and roof drains with 6 psi lead sheet, unless otherwise approved.
- J. Clamp floor drains penetrating waterproofing membrane to the membrane.
- K. Supply clamping collars with drains where flashing is required or waterproofing membrane is penetrated.
- L. Make pipes and drains penetrating the ground floor watertight with an approved glass wool, rope or mastic sealing compound or modular, mechanical link assembly. Cap as required to assure fireproof integrity.

3.04 FIELD QUALITY CONTROL

- A. Perform tests in the presence of the authorities having jurisdiction and the Contracting Authority's representative.
- B. When the roughing-in work is completed and before connection of fixtures, subject drainage (drains and vents) systems to the following tests as a minimum requirement in addition to tests required by local authorities.
 - 1. Water Test
 - a. Apply the water tests to every part of each drainage system. Test each system in its entirety or in sections. Tightly close openings in the piping.
 - c. If testing the system in sections, tightly plug each opening, except the highest opening of the section being tested, and fill each section with water. Test every section with a head of water equivalent to the greatest floor-to-floor distance between floors with a minimum of at least a 10 foot head of water.
 - d. Keep the water in the system, or in the portion under test, for at least 15 minutes before inspection starts.
 - e. There shall be no leakage.
 - 2. Smoke Test
 - a. After connecting fixtures, perform a smoke test on the sanitary and laboratory drainage systems.
 - b. Fill traps with water, then produce a thick, penetrating smoke with one or more approved smoke machines and inject into the entire system. As the smoke appears at the stack openings on the roof, tightly close such openings and apply a pressure equivalent to a 1 inch water column.
 - c. Maintain pressure of 1 inch water column for at least 15 minutes before inspection starts.
 - d. Inspect traps. There shall be no leakage.
- C. Correct defects detected by any test and retest.

3.05 PROTECTION

The Contractor shall be responsible for repairing and replacing plumbing materials and equipment, whether or not installed, which are damaged due to freezeups, until the systems are approved by the Supervisor and turned over to the Purchaser.

END OF SECTION

SECTION 15430

PUMPING SYSTEMS AND CIRCULATORS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete installation of Pumping System and related work as indicated on the drawings and specified herein.
- B. Work Includes: The work shall include, but not be limited to, the following:
 - 1. Pressure Pumping Systems.
 - 2. Water Circulation & Filtration Systems.
- C. Pool Water Circuits: The pool water treatment plant consists of the following aspects:
 - 1. water circulation;
 - 2. filtration;
 - 3. pH control and chemical treatment;
 - 4. disinfection; and

A pool water circuit consists of pumps, filters, disinfection plant, chemical dosing system.
- D. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050

1.02 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of reference specifications, industry standards listed below and specified herein and to applicable codes and requirements of municipal authorities having jurisdiction, whichever is more stringent.
- B. Tests: Test pumping system in accordance with the appropriate section of the specification describing each system.

1.03 SUBMITTALS

Submit the following in accordance with requirements specified under Submittals in Section 15010.

- A. Product Data: Submit copies of manufacturer's latest published literature for materials and equipment specified herein for approval; obtain approval before ordering materials.
- B. Shop Drawing :
In addition to the stipulations for shop drawings given under General Requirements, the following shop drawings for each pump shall be submitted for approval prior to shipment from the factory.

1. Certified performance curves showing job number, customer order number, pump designation number shown on drawings, date of manufacture, model number, serial number, pump size, impeller diameter, impeller type, maximum impeller diameter pump can accommodate, rpm, flow head characteristics curve, consumed horsepower curve and pump efficiency curve.
2. Pump cross-sectional drawing showing major components with parts numbers and parts list.
3. Pump outline dimensional drawing showing overall dimensions, location of foundation bolt holes and size, location and rating of suction and discharge nozzles.
4. Recommended list of spare parts.
5. Installation, operation and maintenance instruction manual.
6. Details and wiring diagrams of factory or field supply electrical devices, controls or accessories.
7. Motor data such as make, model number, serial number, horsepower rating, rpm, voltage, phase, frequency, class of insulation, allowable temperature rise, full load amperes and locked rotor amperes.
8. Starter data such as make, model number, size, heater sizes, ampere rating, line voltage, control voltage and frequency.

1.04 DELIVERY, STORAGE AND HANDLING

Exercise proper care in the handling of work so as not to injure the finished surfaces, and take proper precautions to protect the work from damage after it is in place.

2 - PRODUCTS

2.01 MATERIALS / EQUIPMENT

A. Pressure Pumping Systems / Circulation

1. General

The automatic pressure maintaining pumps shall be supplied as a packaged unit, preassembled and factory tested with its wired up control panel.

The supply shall comprise:

- a. Two pumps and motors (one stand by) operated by pressure switches wired to the motor starters.
- b. One pressure vessel, precharged with air and containing an impermeable synthetic rubber diaphragm separating air and water.
- c. Necessary pressure switches, control and pressure gauges.

2. Pumps

- a. The water pumps shall be of the horizontal base-mounted, multi stage centrifugal type, with back to back impeller to balance axial thrust, directly connected to the electric motor through a heavy duty flexible coupling.
- b. The material for the pump casing and impeller shall be stainless steel, stainless steel shaft, intermediate bronze bearing and ceramic tungsten carbide bottom bearing and shaft seal.
- c. The impeller shall be of an enclosed type, accurately machined and keyed to the shaft.
- d. The shaft shall be machined and ground to fine tolerances.

- e. The motor shall be of the totally enclosed, fan cooled, drip-proof, squirrel-cage, induction type with permanently lubricated and sealed ball bearings, and class F insulation.
 - f. The performance specified in the drawings shall be achieved under continuous operation.
 - g. The base plate shall be provided with bolt holes for anchor bolts and shall be protected with anticorrosion paint.
 - h. The electric motor direction of rotation shall be clockwise when viewed from the drive end the pump shall be fitted with self-adjusting mechanical seal with carbon rotating face running against a stationary ceramic seat.
 - i. All wiring from control panel to motor and to pressure switch shall be run in flexible metal conduit.
 - j. The pressostat must have a precision of 0.6 bars maximum.
- 3. Stuffing Boxes and Drain Piping :
 - a. Stuffing Boxes shall have material same as the casing. Housing of cast iron stuffing boxes shall comply with ISO 185:2005 or BS EN 1561:1997 and shall be of ample length with bronze lined gland and neck bush, fitted with approved packing and lantern ring water seal. Drain outlet and piping to remove gland leakage shall be provided. Alternatively, a mechanical seal may be offered. The mechanical seal shall be of leak free operation. The mechanical seal shall be the product of a specialist proprietor and the materials used shall be suitable for the pumped liquid.
 - b. For vertical in-line pump, suction and discharge flanges shall be of equal size. The impeller shall be dynamically balanced. The shaft shall have stainless steel/bronze sleeves keyed to prevent rotation and secured against axial thrust. For multi-stage pump, each stage/section shall be interchangeable.
- 4. Plant Room Location
 - a. The Contractor shall check and assure that adequate working space must be provided to access for maintenance and sufficient headroom to lift the parts for repair is provided. For large pump, a hoist with travelling crane or other facility shall be provided over the pump location.
 - b. For an open loop system, the location of pump should be sited so that it will use the shortest and most direct suction and smallest vertical lift. Where possible, the pump centreline should be placed below the level of the liquid in the suction tank.
- 5. Contractor shall supply, install and test as well full installations (intakes, inlets, outlets, filters, overflow systems, drainage systems, disinfection feed equipment, etc.
- 6. Pump Accessories
 - a. Each pump shall be supplied complete with all necessary accessories and mainly :
 - Suction gate valve as specified in section 15100
 - Double regulating valve and check valve at discharge side as specified in section 15100
 - Strainer at suction side.
 - Flexible joints at both suction and discharge.
 - Vibration isolation pads.
- 7. Control Panel
 - a. The electric control panel shall be fabricated from heavy gauge mild steel sheet and finished with stove hammer paint both internally and externally, IP 55 protection.

- b. The control panel shall be complete with:
- c. Direct-on-line starting up to 10 kW (or Star Delta for higher ratings)
- d. Run indicator lights.
- e. Fault indicator lights.
- f. Control fuses.
- g. Power fuses (or circuit breakers instead of fuses).
- h. Mains isolator interlocked with door.
- i. An automatic device to alternate the two pumps at each start to maintain equal use.
- j. Hand-off-auto switch.
- k. Float switches on water reservoir.
- l. Provision must be made for remote alarm by providing volt-free contacts.
- m. The pump set shall also be provided with adjustable overload relays, all fully wired to motors and pressure switches requiring only connecting to mains supply.

3 - EXECUTION

3.01 GENERAL

Contractor shall be responsible for accurately checking all pumping heads, based upon the actual piping and equipment installation, and be responsible for furnishing pumps and motors of proper sizes for the actual service, regardless of those scheduled on plan.

Pumps shall be provided from the factory complete with their electric motors. Motors shall be either close- coupled to the pump or flexibly coupled to it as specified for the particular pump concerned.

Horizontal base mounted pumps shall have their motor mounted on a common cast iron or fabricated steel base and properly aligned at the factory.

The pump and motor base shall be supported on an isolated reinforced concrete foundation and the base shall be aligned and leveled throughout its entire length and width.

Where necessary, suitable shims shall be provided under the base to facilitate leveling.

The pump and motor base shall be secured to the foundation with proper size anchor bolts and completely grouted in to provide a rigid non-deflecting support.

The alignment of the pump and motor shall be checked and adjusted if necessary after grouting-in the base and connecting piping.

Piping shall be supported independently to prevent piping weight or stresses from bearing on or being transmitted to the pump.

Pumps shall be located in accessible locations for ease of repair and maintenance.

Drain from pump bases shall be piped to the nearest floor drain or sump.

Pumps shall be constructed of specified materials and shall have pressure ratings suitable for the service and operating conditions.

Where there is a possibility of problems with corrosion, the appropriate corrosion resistant materials and assembly methods shall be used including isolation of dissimilar metals against any electrolytic corrosion.

Pump impellers and rotating assemblies shall be statically and dynamically balanced at the factory.

Pumps shall be provided from the factory with plugged connections for casing vent, drain, suction and discharge pressure gauges. Heavy gauge coupling guards shall be provided. Low-level sensors will be installed to provide power cut-off and prevent the running of the pumps.

Before operating, care shall be taken to ensure that pumps are properly lubricated, rotating elements, rotate freely, the casings are vented and full of water, the direction of rotation is correct, the strainers are clean and the suction and discharge valves are open.

Pumps shall operate stably without pulsation, vibration, noise or cavitation throughout their full capacity range.

3.02 OPERATING CHARACTERISTICS

Pumps shall be selected such as that operating levels of flow and head fall near the point of maximum efficiency as obtained from the manufacturer's published data. Pumps shall never be selected to operate near the end of their curve.

A pump shall not be selected with the largest size impeller that it can accommodate.

The horsepower rating of pump motors shall be of such magnitude as to ensure non-overloading of the motor throughout the capacity range of the pump for the impeller diameter selected.

Electric motors shall always be specifically supplied for the available electric current characteristics of voltage and frequency.

3.03 PIPEWORK

1. Connections in Pipework

- a. For non-welded pipework, connections shall be by means of screwed fittings, flanges or unions. The use of "long screws" will not normally be permitted.
- b. Unless otherwise specified, flanges complete with appropriate gaskets, steel nuts, bolts and washers together with spring washers, all of stainless steel, shall be used to connect up all equipment, valve or device such that the pipework, equipment, valve or device can easily be removed for servicing or replacement.

2. Change in Pipe Size

- a. Change in pipe size can be facilitated at tees by reduction on branch or outlet. Reduction on bend elbow or by bush is not permitted without prior permission of the Architect. Reduction by means of straight through reducing socket is permitted.
- b. Care must be taken in carrying out reduction to ensure that air is not entrapped at high points. In such case, it shall be necessary to install eccentric reducing sockets with the "flat" at the top for horizontal pipework and concentric reducer for vertical pipe riser.

END OF SECTION

SECTION 15440

PLUMBING FIXTURES

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete supply and installation of Plumbing Fixtures and related work as indicated on the drawings and specified herein.
- B. All plumbing fixtures and mixers shall be of approved type.
- C. Work Includes: The work shall include, but not be limited to, the installation of the following:
 - 1. Lavatories.
 - 1. Water closets.
 - 2. Mixers and water fixtures and accessories for Sinks.
- D. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010.
 - 2. Basic Mechanical Materials and Methods - Section 15050.

1.02 QUALITY ASSURANCE

Materials and work shall conform to the latest edition of industry standards, reference specifications specified herein and to applicable codes and requirements of municipal authorities, whichever is more stringent.

1.03 SUBMITTALS

- A. Submit the following in accordance with the requirements specified under Submittals in Section 15010.
- B. Product Data: Submit copies of manufacturer's latest published literature for materials specified herein for approval, and obtain approval before ordering materials.
- C. Shop Drawings: Submit shop drawings for work specified herein for approval.
- D. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual in accordance with requirements of Section 15010.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and handle so as to prevent the inclusion of foreign materials and the damage of materials.
- B. Store materials and equipment where designated. Assume responsibility and security for materials and equipment and protect from detrimental conditions.

2 - PRODUCTS

2.01 MATERIALS/EQUIPMENT

- A. Toilet Wash hand basin (lavatory)
 - Vitreous china wash hand basin with concealed fixing brackets and leg with a single hole with single pillar tap.
 - ½" diameter chrome (hot/cold) basin mixer with single lever.
 - Two chrome angle valves with clamp ring, union and extension piece.
 - 1 1/4" diameter chromium plated trap, of the bottle type with extension tube of the required length and wall flange.
 - Pop-up waste, chrome.
- B. European (or equivalent) Water Closet
 - Vitreous china wash down water closet with close coupled cistern having button operated siphon fully installed (Single-flush tank-type gravity type).
 - Supports and all pipe works and accessories required for installation, connection to water supply and drainage, supports, fixing for satisfactory operation.
 - Wood toilet seat cover color to match the toilet and Closet.
 - Chromium plated angle valve with clamp ring union and extension piece.
- C. Mixer and water fixtures and accessories for Sink
 - ½" diameter Wash sink mixer for cold and hot water fully installed and operational.
 - Mixer shall be chrome with single swivel lever.
 - Two ½" diameter chrome angle valves with clamp ring, union and extension piece.
 - Trap 1 ¼ " diameter with strainer, overflow and waste plug for each bowl.
 - Drainers for sinks as per drawings.
 - Water outlets, fixtures, accessories to render mixers and taps fully operational.
- D. Accessories:

The Contractor shall supply and install the following accessories with the colors and models matching the different toilets fixtures and the wall tiles:

- Soap Holder near each Wash Hand Basin
- Paper Holder near the sink bowls
- Wall mounted towel hanger.

Moreover, the Contractor shall refer to section 10800 of these specifications.

3. EXECUTION

3.01 EXAMINATION

Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions.

3.02 PREPARATION

- A. Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.
- B. Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, so as not to delay job progress.

3.03 INSTALLATION

The installation and connection of all sanitary fixtures shown on the drawings or provided later shall satisfy the following specifications:

- After the piping has been pressure tested, and the fixtures have been set and trim piped, but prior to practical completion, each fixture supply and drain shall be flowed to observe proper dynamic action to the set.
- Contractor shall notify the Supervisor in writing at such time as the potable water systems, drainage, waste and vent piping, and plumbing fixtures are complete and ready to be flow tested on an acceptable basis.
- Ample application of petroleum jelly shall be applied to all surfaces of exposed chrome plated piping, valves and fittings and stainless steel fixtures immediately after installation.
- Concealed brackets, hangers and plates shall have a shop coat of paint.
- All exposed piping and trim shall be chrome plated and fully protected during installation. Strap or padded wrenches shall be used on chrome pipe fittings and valves.
- All exposed metal parts in the sanitary blocks shall be chrome plated.
- All exposed valves in the sanitary blocks shall be chrome plated of the recessed type.
- Plumbing fixtures shall be complete with all required trimmings, including faucets, waste plugs, traps, supplies, stop valves, escutcheons and casings and all necessary hangers, plates, brackets, anchors and supports.
- All fixtures shall be individually trapped.
- All fixtures shall be equipped with chrome plated angle valves, whether specified, shown on drawings or not.
- Fixtures shall be set in a neat, finished and uniform manner making the connection to all fixtures at right angles with the walls, unless otherwise directed by the Supervisor.
- Roughing for this work must be accurately laid out so as to conform with the finished wall material.
- Fixtures are not to be set until so directed by the Supervisor.
- The location and disposition of all items shall be as indicated on the relevant drawings.

- It is to be noted that all fixtures shall be approved for shapes and colors before ordering.

END OF SECTION

SECTION 15991

TESTING, ADJUSTING AND BALANCING OF MECHANICAL SYSTEMS

1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment and services, and perform operations required for complete Testing, Adjusting and Balancing of Mechanical Systems and related work as indicated on the drawings and as specified herein.
- B. Work Includes: The work of this section shall include, but not be limited to, the following:
 - 1. Perform balancing of air and water distribution/circulating systems, and air outlets etc. for HVAC systems.
 - 2. Contractor shall furnish non-testing, adjusting and balancing labor, including standby electrician, materials, instruments and power required for testing.
 - 3. Test equipment and systems which normally operate during certain seasons of the year during the appropriate season. Perform tests on individual equipment, systems and their controls. Whenever the equipment or system under test is interrelated and depends upon the operation of other equipment, systems and controls for proper performance, the latter shall be operated simultaneously with the equipment or system being tested.
 - 4. Completely balance fans and duct systems by the adjustment of sheaves, dampers, registers and other volume and diverting control devices, to obtain the air quantities indicated on the design drawings. The Installing Contractor shall replace sheaves if required to meet design conditions.
 - 5. Completely balance piping systems by the adjustment of plug cocks, double regulating valve or other control devices to obtain flow quantities required. Installing Contractor shall replace or have pump manufacturer machine impeller the proper diameter to produce field design conditions.
 - 6. Perform balancing of air distribution systems and adjusting of terminal devices, including:
 - Adjust and set dampers, deflecting vanes, discharge vanes and accessories to achieve proper air distribution and patterns in the supply and exhaust air systems including terminal devices.
 - Adjust and set belt driven fans to achieve design total delivered air quantities.
 - Perform air distribution duct systems leakage tests.
 - 7. Inspect the function and verify the operation of temperature control devices associated with the equipment and systems being balanced. Note deviations from specification requirements.
 - 8. Check installation of vibration isolators and test for design ratings.
 - 9. Prepare and submit reports and other data as specified.
 - 10. Provide instruments required for testing, adjusting and balancing operations. Retain possession of instruments and remove from site at completion of services.
 - 11. Refer to other sections of Division 15 for related requirements.
- C. Related Work Specified Elsewhere
 - 1. Basic Mechanical Requirements - Section 15010
 - 2. Basic Mechanical Materials and Methods - Section 15050

1.02 QUALITY ASSURANCE

- A. Submit proof of having balanced and tested at least 2 projects.
- B. The work performed by Balancing Contractor shall be under the direct supervision of a Registered Professional Supervisor, a full-time employee of the Balancing Contractor (to be approved by the Purchaser and the Supervisor). Technicians performing the work must be properly trained, experienced and full-time employees of Balancing Contractor.
- C. Air Distribution Duct Leakage Test Verification
 - 1. Installing Contractor shall perform leakage tests on duct systems. Verify and record the results of each test on standard test forms and submit copies of same to the Supervisor for review.
 - 2. Mark tested sections of ductwork with the date and initials of the balancing technician. Perform tests before duct sections are concealed and before systems are balanced.
 - 3. Verify and record the results of leakage tests, both successful and unsuccessful.

1.03 SUBMITTALS

- A. Submit the following in accordance with the requirements specified under Submittals in Section 15010.
- B. Submit copies of documentation to confirm compliance with Quality Assurance provisions:
 - 1. Organization supervisor and personnel training and qualifications.
 - 2. Specimen copy of each of the report forms proposed for use.
- C. At least 15 days prior to starting field work, submit copies of a complete list of instruments proposed to be used, organized in appropriate categories, with data sheets for each, showing:
 - 1. Manufacturer and model number.
 - 2. Description and use when needed to further identify the instrument.
 - 3. Size or capacity range.
 - 4. Latest calibration date.
- D. Supervisor will review submittals for compliance with Contract Documents, and will return one set marked to indicate:
 - 1. Discrepancies noted between data shown and Contract Documents.
 - 2. Additional, or more accurate, instruments required.
 - 3. Requests for re-calibration of specific instruments.
- E. Submit copies of written reports tri-monthly, during the course of construction, of potential or developing problems and delays relating to the work being provided where such problems may adversely affect the proper balancing of the equipment or systems. The last report shall be no later than 1 week before testing work is to begin.
- F. Submit written reports for review upon completion of each major phase of balancing work.
- G. Submit reports of delayed testing promptly after execution of those services.
- H. Form of Final Reports:

1. Each final reporting form must bear the signature of the person who recorded data and the seal and signature of the TAB supervisor of the reporting organization.
2. When more than one certified organization performs TAB services, the firm having managerial responsibility shall make the submittals.
3. Identify instruments used, and last date of calibration of each.
4. Submit final balancing report in accordance with requirements specified herein, modified and expanded to be compatible with the requirements of the installed systems.

1.04 JOB CONDITIONS

A. Procedures

1. Report and review the requirements of the work with Supervisor before starting any field balancing work.
2. Periodically visit the site, at a maximum of three month intervals, during installation of the work. Should any potential or developing problems be discovered relating to materials, equipment or methods being used in the work, and where such problems may adversely affect the testing and adjusting work, immediately report these findings in writing to the Supervisor with recommendations for correction.

B. TAB Preparations: Before the TAB Contractor performs the final testing, adjusting and balancing work, the Installing Contractor shall verify the following:

1. Ductwork systems are completely and satisfactorily installed and leak tested.
2. Piping systems are completely and satisfactorily installed and leak tested.
3. Equipment and apparatus fulfill the requirements of the Specifications and that equipment has been properly installed and checked for proper operating characteristics such as proper rotation and running amperage of fan and pump motors to prevent damage to equipment by overload.
4. Systems have been completely installed and operating and the automatic temperature controls have had their final adjustments.
5. New, clean filters have been installed in required systems.
6. Water systems have been completely filled and vented, and strainers cleaned proper to balancing, and that expansion tanks are at prior water level and makeup water valves are operating properly.

C. Coordination and Cooperation

1. Installing Contractors responsible for Work under Division 15 shall provide services outlined and described in other related Division 15 sections.
2. Enlist the aid of Installing Contractors or equipment suppliers, at no cost to Contracting Authority, whenever such aid is necessary for the timely and proper performance of the testing and balancing work.
3. Cooperate with Installing Contractors to effect smooth coordination of the balancing work with the project schedule.

1.05 WARRANTY

- ### A.
- After completion of the work specified under this Section, provide an extended warranty encompassing one full heating season and one full cooling season, during which time any balancing device which had been adjusted earlier as part of this work shall be rechecked and

reset when such additional work is deemed necessary by the Contracting Authority or the Supervisor.

2 - PRODUCTS

Not Applicable

3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. All works shall be inspected during erection and upon completion according to the directions of the Supervisor.
- B. All systems shall be thoroughly cleaned both externally and internally before tests are performed.
- C. All tests shall be made before systems are painted covered or enclosed in building construction whenever conditions permit.
- D. When so directed by the Supervisor, sections of the installations shall be blanked off so that they can be tested separately under suitable pressure.
- E. The Contractor shall supply the skilled staff and all necessary instruments and carry out any tests of any kind on a piece of equipment, part of system or on a complete system if the Supervisor requests such a test for determining specified or guarantee data, as given in the Specifications.
- F. Any damage resulting from the tests shall be repaired and/or damaged material replaced, all to the satisfaction of the Supervisor and at no additional cost.
- G. In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be redone after the adjustment or repair have been completed.
- H. Tests shall be performed in the presence of the Supervisor and such other parties as may have legal jurisdiction.
- I. In general, pressure tests shall be applied to piping only, before connection of equipment and appliances. In no case shall piping, equipment or appliances be subjected to pressure exceeding their rating.
- J. When all pressure tests of piping have been performed, a discharge test shall be carried out for each group at the normal operating pressure.
- K. After tests have been completed, the system shall be drained and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fillings and debris.

3.02 WATER PIPING TESTS

A. Leaks and Mechanical Resistance Test

1. Water piping shall be tested for the whole building.
2. All openings shall be vented and plugged, then subjected to pressure equivalent to one and a half times the maximum operating pressure.
3. The pressure must be maintained in the piping system at least four (4) hours.
4. Any pressure drop will mean improper and defective installation.
5. A test under pressure equivalent to the maximum effective pressure and maintained over a period of twelve (12) hours shall be carried out after several opening and closing of valves and cocks to detect leaking valves or cocks.

B. Flow Test

After the leaks and mechanical tests, the Contractor shall test all the sanitary fixtures connected to the pipes at full load according to the instructions of the Supervisor.

3.03 INTERIOR DRAINAGE TEST

- A. After completion of the installation related to the main stack for each floor, the connection openings together with the lower end of the stack shall be plugged and filled with clean water for a height of at least 3 meters above the tested joint, and the line inspected for any visible leaks.
- B. The water must remain without any dropping level for at least 8 hours and any such drop will mean improper and defective installation.
- C. The Contractor may perform the test after the complete installation of the sanitary piping. In this case, tee connections must be introduced on the stack at each floor interval in order to make it easy to plug the stack for testing purposes.

3.04 TANKS AND VESSELS

All tanks and vessels shall be tested for leaks under hydrostatic pressure equal to at least 1 1/2 times the specified working pressure, unless noted otherwise. Pipes tests procedures shall apply to the tanks and vessels.

3.05 FANS

Fans shall be tested for actual C.F.M. against design C.F.M. for actual R.P.M., B.H.P. and electric power consumption.

3.06 AIR OUTLETS

All air outlets shall be tested for actual C.F.M. against design C.F.M.

3.07 CONTROLS

All controls shall be tested for proper functioning in accordance with the requirements of the specifications

END OF SECTION

SECTION 16010

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

A. Generalities:

1. The Contractor must provide complete installations from the power supply terminals indicated on the drawings. The scope of work includes supply, installation of material and equipment as described in the specifications and/or shown on the drawings. Associated civil works including supporting structure are also the responsibility of the Contractor.

B. General Conditions and Requirements:

1. Work shall be carried out in accordance with the latest issue of the IEC publications.
2. Equipment and material are to be new and manufactured in compliance with the relevant recommendations of the International Electro-technical Commission (IEC) or approved equivalent standards.
3. Locations shown on the drawings indicate the approximate location of apparatus. Exact and final locations are to be coordinated with all other trades.
4. Work must be carried out in a neat and efficient manner in accordance with the specifications. Installations are to be complete ready for operation and fully coordinated with all other works.
5. Necessary items/accessories for operation of the systems are to be provided even if not mentioned in the specification/or shown on the drawings.
6. Wiring layout shown on drawings is to be used only as a guide. Electrical drawings must be checked against all other trades drawings.
7. Access doors and frames for shafts and openings are to be provided by others.

C. General Design Conditions:

1. Power will be delivered to the site by EDL. An earthing system should be provided.
2. Equipment shall be selected for continuous and trouble free service under climatic conditions of equipment location.

D. Contractor Responsibility:

1. The Contractor shall be responsible of the work covered in this division including the supply, transport, storage, installation, testing and delivering in good running conditions the electrical installations. The installation of all items shall be as specified and shown on drawings.

E. Coordination of Work:

1. The Contractor shall be responsible for coordinating the work of the electrical installations with that of other trades. It shall prevent interferences and shall be solely responsible for damages to work of other trades, already completed.

1.2 PERFORMANCE AND STANDARDS

- A. Site Tests:
 - 1. Acceptance tests should be carried in accordance with the regulations and standards. Equipment and labor for testing are to be provided by the Contractor.
 - 2. A visual inspection to check proper installation, connections and nameplate data must be carried on before testing.
 - 3. Lighting and power circuits, motors, etc. must be subjected to an installation resistance test with a Megger of at least 1000 Volts operating voltage. Communications and security systems must also be subjected to a resistance test.
 - 4. A continuity test to all major feeders and circuits must be done.
- B. Manuals:
 - 1. Complete 2 sets of instruction manuals must be provided. These should cover operation, maintenance and spare parts list of all equipment and systems.
- C. As-Built Drawings:
 - 1. Complete sets of as-built drawings must be provided, including:
 - a. Two hardcopies.
 - b. One soft copy.
- D. Manufacturer's Guarantee:
 - 1. One year warranty for equipment specified in this document must be provided.
- E. Contractor's Guarantee:
 - 1. The Contractor shall guarantee his works for the duration of one year from the date of the completion certificate.
 - 2. If during guarantee period any equipment or material proves defective or any of systems fails to function properly, equipment is to be replaced and defects and malfunctions corrected as directed by the Supervisor.
 - 3. If during guarantee period any piece of equipment is replaced or rebuilt, the guarantee period for this equipment is to be extended for a new period equal to the original guarantee period.
- F. Maintenance and Operation:
 - 1. The Contractor has to check all controls regularly during the implementation period to ascertain that they function as designed.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. The Contractor is responsible to prepare the following sets of shop drawings and ask for approval before any construction:
 - a. Two hardcopies.
 - b. One transparent copy.
 - c. One soft copy.
 - 2. These drawings are to show that the design concept is understood.

- B. The Contractor has to submit priced lists of recommended spare parts for one-year operation, after substantial completion.
- C. Documents relative to equipment to be supplied and installed must be submitted for approval. Therefore, no equipment shall be installed before getting prior approval.
- D. For approval, the Contractor has to submit detailed manufacturer's specifications, original catalogue cuts and drawings of equipment and materials to be used.
- E. The client reserves the right to operate operable defective equipment during guarantee period, until its repair or replacement. Spare parts shall be supplied and shall cover the items recommended by the manufacturer for two years operation.

1.4 TRAINING

- A. The Contractor shall, at no additional cost, demonstrate to operating personnel the functions and operation of all equipment before handing over. The operating personnel must be trained to perform necessary adjustments to equipment, appliances and effect routine maintenance.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 16110

CONDUITS AND WIREWAYS

PART 1 GENERAL

1.1 SCOPE

- A. Work is deemed to include:
 - 1. Heavy gauge PVC rigid conduits.
 - 2. Cable trays.
 - 3. Mounting fitting, fixing, etc.
 - 4. Cutting and jointing, bending, etc.
 - 5. Junction boxes, expansion joints connectors, etc.
 - 6. Components for earth continuity.

1.2 SUBMITTALS

- A. The following data (but not limited to) are to be provided:
 - 1. Manufacturers catalogue with specifications.
 - 2. Samples.
 - 3. Shop drawings showing the exact routing of conduits, cable trays, boxes and accessories with their types and dimensions.

PART 2 PRODUCTS

2.1 Manufacturers (PVC Rigid Conduits and Cable Trays/Ladders)

- A. Manufacturers: Any recognized manufacturer having an official technical agreement to conformity with standards for the product to be pre-approved by Supervisor.

2.2 RIGID HEAVY GAUGE PVC CONDUITS AND FITTINGS

- A. Material is to be of rigid unplasticized PVC, high impact, resistant to chemical corrosion, self-extinguishing. Conduits shall have a compression resistance of 750 N per 5 cm. Material shall operate in a temperature range of -5°C to 60°C. Conduits shall be marked at intervals of 1 to 3 meters.
- B. Inside and outside surfaces of conduits shall be free from burrs, flash and other similar defects.
- C. Wall thickness of conduits shall be uniform.
- D. Conduits shall comply with BS 6099-2-2.
- E. Flexible conduits of same material are to be used for connection to motors and to fixtures installed in false ceiling.

2.3 CABLE TRAYS

- A. Heavy-duty cable trays shall be of the return flange type slotted and perforated. Trays shall be Hot-dip galvanized after perforation protected by two pack epoxy finish, minimum 1mm thick (galvanizing in accordance with BS 729). Trays shall be jointed with flange coupling strops that virtually make the flanges continuous. These shall be secured in place with nuts and bolts.
- B. All cable tray runs shall be continuous and constructed of bends, tees and other accessories that are purpose made by the manufacturer of cable tray.
- C. Cable tray shall have adequate mechanical strength for the load to be carried and shall have provision for the addition of a minimum of 20% of the initial installed cable and/or load. The deflection shall not exceed that recommended by the manufacturers.
- D. The cable trays shall have engraving marks of the serial and identification numbers.

PART 3 EXECUTION

3.1 INSTALLATION - CONDUITS

- A. The installation and capacity of the conduits shall be in accordance with the I.E.E. Wiring Regulations.
- B. The installation shall be neat and tidy.
- C. Means shall be provided to prevent condensed or entrapped moisture remaining within the conduit system.
- D. The conduit system, joint boxes, loop boxes etc. shall be firmly supported.
- E. The system shall be clean and free of sharp edges, burrs etc.
- F. Due allowance shall be made for expansion and contraction.
- G. PVC rigid conduit shall be formed on site. Prefabricated conduit systems shall not be accepted.
- H. Standard circular or looping in boxes shall be installed at intersections. Small circular channel type inspection fittings will not be approved.
- I. Cables connected to different category circuits shall not be run through a common box.
- J. Standard conduit boxes shall be installed at all lighting points and shall be substantially fixed so as to be supported independent of the conduit system. Conduits shall terminate directly into fixed lighting fittings having provision for direct conduit entry.
- K. Conduit shall be installed at least 100 mm clear of, and preferably above, pipes and any other services.

- L. Under no circumstances shall accessories of one type of conduit system be used with another conduit system. e.g. black accessories may not be used with galvanized conduit.
- M. Not more than two right angle bends shall be allowed in any surface mounted conduit run without the provision of an inspection fitting for drawing in purposes between them.
- N. Surface mounted Conduits shall not be dismantled for wiring, and must be capable of being wired complete without draw wires being installed during erection.
- O. Sleeves for cable must be filled with a fire retardant compound to prevent fire spread from one compartment to another.
- P. Conduits specified to run on the surface shall be fixed by means of galvanized distance saddles to allow a 5mm space between the surface and the conduit.
- Q. Spacing of saddles for supporting of surface mounted PVC conduits is not to be greater than:

| Conduits size (mm) | Maximum spacing of supports (m) |
|--------------------|---------------------------------|
| 20 | 0.60 |
| 25-50 | 0.75 |
| 63-75 | 0.90 |
| 90-125 | 1.00 |

- R. Sizes of conduits not shown on the drawings are to be selected in accordance with the regulations and in relation to the number and size of conductors as shown in the table below:

| Number of Conductors Relating to Exterior Diameters of Conduits | | | | | | | | | |
|---|----|----|----|----|----|----|----|----|----|
| A | B | | | C | | | D | | |
| | 20 | 25 | 32 | 20 | 25 | 32 | 20 | 25 | 32 |
| 1.5 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 7 |
| 2.5 | 7 | 7 | 7 | 6 | 7 | 7 | 4 | 7 | 7 |
| 4.0 | 5 | 7 | 7 | 4 | 7 | 7 | 3 | 6 | 7 |
| 6.0 | 4 | 7 | 7 | 3 | 6 | 7 | 0 | 4 | 7 |
| 10 | 0 | 4 | 7 | 0 | 3 | 6 | 0 | 0 | 4 |
| A: Section of Conductors (mm ²) | | | | | | | | | |
| B: Straight Run | | | | | | | | | |
| C: Run with One Bend | | | | | | | | | |
| D: Run with Two Bends | | | | | | | | | |
| Minimum size of conduit is to be 20mm (external diameter), unless otherwise stated. | | | | | | | | | |

3.2 INSTALLATION - CABLE TRAYS

- A. All sizes of cable trays shall be attached to the building framework at intervals not more than that recommended by the manufacturer.
- B. Screws and bolts securing trays to brackets and joining trays shall be arranged so as to prevent damage to cables.

- C. Cutting and modification of straight tray ladder will not be permitted without prior approval.
- D. Additional protection of fireproof barriers should be provided where cable trays pass through walls and partitions.
- E. Cable tray ladders shall be earthen at maximum spacing of 30m, by a cable of 16mm² section.

END OF SECTION

SECTION 16120

WIRES, CABLES AND FEEDERS

PART 1 GENERAL

1.1 SCOPE

- A. Work is deemed to include:
 - 1. Low voltage power cables.
 - 2. Branch circuit wiring.
 - 3. Telephone wiring.
- B. The Contractor shall be responsible for all off loading and handling of cable on site and shall ensure that cables are delivered to site on drums properly protected against mechanical damage.
- C. The Contractor shall be responsible for finally checking the sizes of all cables to suit the load. The sizes of the cables and conductors shall take into account voltage drops, fault levels, over current setting of relays, route length, derating factors, method of laying and ambient conditions.

1.2 SUBMITTALS

- A. The following data (but not limited to) are to be provided:
 - 1. Full details, catalogues and manufacturer data.
 - 2. Samples.
 - 3. Shop drawings coordinated with all other trades showing exact routing of feeders, subfeeders, number and size of conductors in conduits, details of supports, details of connection, etc.
 - 4. List of all feeders and subfeeders with their sizes, route length, voltage drops, etc.

PART 2 PRODUCTS

2.1 Manufacturers

- A. Manufacturers: Any recognized manufacturer having an official technical agreement to conformity with standards for the product to be pre-approved by Supervisor.

2.2 MATERIALS

- A. Cables shall have stranded copper conductors for sections 4mm² for power cables and 1.5mm² for control cables.
- B. Cables shall be manufactured to IEC 502.
- C. Cable cores shall be color coded for identification.
 - 1. "Red", "Yellow" and "Blue" shall be used for phase conductors.
 - 2. "Black" for neutral.

3. "Green / Yellow" for earth conductors.
- D. Single conductor wires and cables for wiring and conduits are to have high conductivity, electrolytic annealed copper conductors insulated with PVC flame retardant, rated 450 / 750 V to IEC 227, and suitable for conductor temperature of 70°C.
- E. PVC insulated cables are to have high conductivity electrolytic annealed copper conductors insulated with PVC flame retardant suitable for conductor temperature of 70°C, bedded with suitable filler and sheathed with PVC. Cables are rated 0.6/1 kV.
- F. Control cables are to be multicore, PVC insulated and sheathed, rated 0.6/1 kV. Insulated conductors are to be numbered.
- G. Sheathed and insulated flexible cords shall be 300/500V rated to IEC 227 and shall only be used for lighting pendants.
- H. The minimum cross sectional area of conductors in flexible cords shall be 0.75mm² and the length not exceeding 400mm.
- I. Telephone cables for wiring to outlets are to be twisted PVC insulated and PVC sheathed 0.6mm diameter.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Conduit wiring system shall be used for final branch circuit wiring.
- B. Wiring termination and joints shall be made only at switches, isolators and appliance fittings.
- C. Installation of each conductor is to be color-coded. Contractor has to maintain coding throughout the installation.
- D. Before any cables are installed, the conduit installation and erection of distribution boards shall be complete, dry, clean and free of burns.
- E. Cables required to be run on walls, ceilings, or other structures should be carried on cable trays or cable ladders.
- F. All cables shall be neatly run vertically or parallel to adjacent walls, beams or other structural members. Allowance shall be made for expansion and contraction of the cable.
- G. The Contractor shall take all precautions to ensure that cables are not subjected to excess heating from adjacent service pipes.
- H. Where cables are routed externally and are subject to exposure to direct sunlight, they shall be protected with a suitably ventilated cover to shade the cables and to allow adequate ventilation. Where changes in direction occur in cable runs, bends having a

radius of curvature not less than the minimum-bending radius recommended by the manufacturer shall be used.

- I. All cables run between defined terminal points shall be installed without intermediate joints.
- J. Every cable shall be permanently identified using purpose made indelible markers.
- K. Single cables are to be fixed directly to walls or ceilings. Where three or more cables are run in parallel, they are to be fixed on cable trays.
- L. Power cables shall be terminated in suitable boxes arranged for bolting to switchgear, motor starters and motors. Each cable entry into a terminal box shall be made through a suitable gland.
- M. At terminations the cores of the cables shall be left of sufficient length beyond the termination to form cable tails for connecting to the equipment. Tools shall be adequately insulated and end cable core shall have its phase identification clearly marked.
- N. A sufficient number of terminals shall be provided to terminate all control cable cores.
- O. Terminal blocks for different voltage or circuits type should be segregated into groups and distinctively labeled.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SCOPE

- A. Work is deemed to include:
 - 1. Supply and installation of electrical fittings including wiring devices, switches, automatic and manual lighting control equipment, sockets, disconnecting switches, outlet boxes and plates, etc., as shown on the drawings.
 - 2. Wiring devices are deemed to include: outlets, wires with protective earthing conductors, conduits, trunking, and other raceways and fittings from outlet back to upstream outlet or controlled circuit (for switches, etc.), or to final branch circuit panelboard.
 - 3. Fixing and supporting material.
- B. All devices are to be standard manufactured items, uniform and modular.

1.2 SUBMITTALS

- A. The following data (but not limited to) are to be provided:
 - 1. Manufacturer's catalogue cut with complete detailed specifications, catalogue number, rating, overall dimensions, etc.
 - 2. Shop and construction drawings showing exact location of each outlet box, installation details, wiring diagrams, etc.
 - 3. Samples of each type of device along with material approval requests.

PART 2 PRODUCTS

2.1 Manufacturers

- A. List of Pre-approved manufacturers include (Tcino (Italy), Gewiss (Italy), or Legrand (France) or equivalent).
- B. Other Manufacturers: Any other recognized manufacturer having an official technical agreement to conformity with standards for the product to be pre-approved by Supervisor.

2.2 OUTLET BOXES AND COVERS

- A. Surface or recessed boxes should be suitable for the type of related conduit or cable system. Shapes and sizes of boxes are to be of compatible standards as switches, socket outlets and lighting fixtures selected and of various types and mounting methods required. Blank plates are to be installed on outlet boxes on which no apparatus is installed or where apparatus installed does not have suitable cover for box. Blank plates for wall outlets are to be attached by a bridge with slots for horizontal and vertical adjustment.

- B. Moulded plastic outlet boxes and covers used with PVC conduit systems should be heavy gauge pressure moulded plastic (minimum 2 mm thickness), self-extinguishing, with softening point not less than 85 deg. C. Boxes should have provision for securely terminating conduits and are to be manufacturer's standard for the required application. Boxes should have brass inset threads to receive cover screws and for mounting devices or accessories, push-fit brass earth terminals, and steel insert clips to provide additional support for pendants or for heat conduction. Neoprene gaskets should be provided for weatherproof installations.
- C. Plates should be square, rectangular or round, designed to cover outlet box and to closely fit electrical device, and with polished chromium plated recessed head fixing screws. Combination plates are to be used for grouped outlets and devices.
- D. Cord extension plates should have threaded cord grip bushings of same material and finish as plates.
- E. Plastic plates are to be heavy gauge, break resistant, pressure moulded plastic, for general use. Color as shown on drawings or to be determined by the Supervisor.
- F. Cable/cord outlet is to be used for up to 45 A, 250 V rating for connection of power/control cable of fixed appliances. Plate should have threaded cord grip to anchor cable securely to cover. Box should include fixed terminal block and cable clamp for termination of cable/cord within.

2.3 SWITCHES

- A. Switches are to be of the quick-make, quick-break type with silver alloy contacts in arc resisting moulded base. Types: single, two-way or intermediate, single pole or double pole, as shown on the Drawings. Color as per drawings or to be determined by the Supervisor.
- B. Single pole switches are to switch the phase wire. Switches are to be mounted with long dimensions vertical and operating handle up when in the "OFF" position.
- C. GENERAL LIGHTING SWITCH: 10 A, 250 V a.c., rocker operated, grid-switch, for indoor installations in general (surface or flush mounted), unless otherwise indicated.
- D. GENERAL LIGHTING SWITCH: 10 A, 250 V a.c., flush mounted, with adequate mounting box for indoor installation, IP 44 enclosure.
- E. DOOR SWITCH: compact, recess mounted, with wire leads, galvanized box and cover, long lasting silver contacts, pressure operated adjustable moulded plunger, single pole, and rated 5 A, 250 V.
- F. WEATHERPROOF SWITCH: 10 A, 250 V, for installation outdoors, with weatherproof plate, synthetic gasket, weatherproof outlet box, on/off indication, IP 55 enclosure.

2.4 SOCKET OUTLETS

- A. Socket outlets are to have injection moulded plastic base with self-adjusting, non-expanding contacts to prevent permanent distortion, arranged for side or back

connection with screws accepting all required branch circuit wires. Duplex sockets are to be mounted in parallel under one common plate with break-off feature for two circuit connection.

1. 16A sockets shall be compliant with German standards
 2. 20A sockets shall be compliant with French standards
- B. STANDARD EUROPEAN SOCKET: single phase, two wire, for plug with 3 mm round pins at 19 mm centers, with grounding and rated 10/16 A, 250 V a.c.
- C. STANDARD EUROPEAN SOCKET: single phase, two wire, with grounding and rated 10/16 A, 250 V a.c, IP 44 enclosure.
- D. POWER SOCKET: single outlet, single phase, three wire, 20 A, 250 V, with grounding and matching plug, IP 44 enclosure.
- E. INDUSTRIAL SOCKET OUTLET: 3 phase, 32 A, 3P+N+E, 400 V, with matching plug, IP 44 enclosure.

2.5 PLUGS

- A. Plugs should be compatible with type of socket outlet specified, break resistant, of impact resistant moulded insulating material (separable construction), with solid brass pins and cord grip and of shape providing easy hand-grip for removal.

2.6 ISOLATING SWITCHES

- A. Used to interrupt loads, rated as shown on drawings, 250 V AC with tumbler operating handle to give positive indication of "ON/OFF" position of contacts.
- B. Housing should be made of die cast aluminum with anti-corrosion paint, weatherproof IP55.

2.7 SWITCH DISCONNECTOR (DISCONNECTING SWITCH)

- A. 500 V, 2, 3 or 4 pole, load break, short-circuit make, in accordance with IEC 408, utilization category 22 for heating and lighting loads, category 23 for motor circuits, and with ampere rating shown on the Drawings. Switch disconnectors are to be non-fusible, air-break type, single throw, safety type, housed in separate metallic enclosure with arc quenching devices on each pole.
- B. Operating mechanism type to be quick-make, quick-break, independent of operator, with external operating handle mechanically interlocked to prevent opening door unless switch is in open position. Position of handle is to be positive and clearly indicated on cover. Contacts to be silver plated.
- C. Enclosure of the general purpose sheet steel for indoor use IP 42, and weather-proof type cast-metal or sheet steel for outdoor installations IP 65, unless otherwise required or shown on the Drawings. Locking of operating handle is to be possible in open and closed positions.

2.8 DOOR ENTRANCE SYSTEM (Bell)

- A. Door bell push button to be momentary contact, low voltage, with illuminated label holder under glass, flush box and stainless steel plate.
- B. Chime to be electronic, with built-in double-wound transformer, 8V - 12V secondary protected by fuses; primary voltage to correspond with building power supply voltage at location. Chime is to be two-tone, double insulated, 80 dB at 1 m distance, adjustable output. It should be possible to operate chime by 9 V alkaline battery.
- C. Wiring to be minimum 1 mm², PVC insulated copper conductor, run in separate conduit from all other services.

2.9 CONNECTORS FOR JUNCTION BOXES

- A. Connectors for junction boxes shall have the following features:
 - 1. Body made of self extinguishing material, from the polyamide
 - 2. Screw less connector
 - 3. Cage clamp technology
 - 4. Vibration free

PART 3 EXECUTION

3.1 INSTALLATION

- A. Locations shown on drawings are approximate. Exact locations are to be shown on shop drawings. Switches are to be located at strike sides of doors. Unless otherwise shown or instructed, lighting switches are to be mounted at 120cm from finish floor level, socket outlets are to be mounted at 30cm from finish floor level. Mounting heights for outlet boxes and similar equipment are to be uniform within the same or similar areas.
- B. Mount switches with long dimension vertical and operating handle, if of the toggle type, up when in the on position.
- C. Single pole switches are to switch the phase wire. Do not run neutral wire through switches having neutral shunt or bridge.
- D. Additional outlets to those shown on the Drawings are to be provided as required by equipment manufacturers for control or other wiring.
- E. Exposed outlet boxes are to be securely fastened to wall with machine screws to permanent inserts or lead anchors.
- F. Recessed outlet boxes installation: make neat openings, to the satisfaction of the Supervisor, allowing for thickness of finishing, and use extension rings if required.
- G. Repair damaged finishing to original condition before installation of fittings or plates.
- H. Waterproof fittings installation: follow manufacturer's instructions for installation and connection to conduit system to fully achieve required degree of protection.

- I. All fittings are to be visually inspected for fixing, workmanship and operation to the satisfaction of the Supervisor.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

- A. Work is deemed to include:
 - 1. Supply and installation of main distribution board, and distribution panelboards.
 - 2. All civil works required for the installation.
 - 3. Termination of incoming cable glands and other accessories, etc.
 - 4. All connections and wiring.
- B. All components shall comply with relevant IEC standards and mainly with IEC 439-1 for panelboards and with IEC 947 for circuit breakers and contactors.
- C. Total discrimination between circuit breakers shall be achieved.

1.2 SUBMITTALS

- A. Contractor is to submit for approval all detailed description of components supported by the original catalogue cuts. Technical data used for the selection and sizing of internal components such as busbars, earthing breakers, contactors, metering instruments, etc. are also to be submitted for approval.
- B. In addition to the above, Contractor to submit for approval prior to ordering equipment "Shop and Construction drawings" illustrating at least the details of panelboard (plan and elevation, built-in equipment, dimensions), installation details and clearances with the assigned room, single line diagram, internal wiring details, etc.

PART 2 PRODUCTS

2.1 Manufacturers

- A. List of Pre-approved manufacturers include (Siemens (Germany), Merlin Gerin (France), Westinghouse (USA), or Socomec (France) or equivalent).
- B. Other Manufacturers: Any other recognized manufacturer having an official technical agreement to conformity with standards for the product to be pre-approved by Supervisor.

2.2 MAIN DISTRIBUTION PANELBOARD

- A. Contractor shall supply and install main distribution boards with all components and accessories as required and shown on the drawings.
- B. Enclosure must be sized to fit breakers, and all equipment indicated on the drawings.

- C. Panelboard shall be minimum 600V class, IP as shown on the drawings, totally enclosed, factory assembled and tested, ready for installation. Construction must meet IEC requirements 529.
1. Cubicles must be of the interior type, floor mounted with provision in the base for fixing to a concrete plinth. Cubicles shall be extendible at both ends.
 2. Frames are to be constructed from folded steel angles strengthened by horizontal and vertical folded channels and corner gaskets.
 3. Frameworks are to be enclosed by electrozincated phosphated sheet steel of minimum thickness of 1.5mm.
 4. Boards shall be modular; each module shall have lifting eyes. When lifting eyes are bolted to the enclosure, suitable in fills are to be provided so that the defined IP is not derated.
 5. Panels are normally divided up in columns.
 6. Doors are to be fitted with gaskets so as to protect the interior against the ingress of dust and water when the door is closed. Doors are to be rigid to prevent any distortion.
 7. Hinges on doors are to allow for the doors to be opened to greater than 90°.
 8. Internal separation to be in accordance with the requirements of "Form 2B" to IEC 439- 1.
 9. Spare enclosure represents a fully equipped enclosure with switchgear and space enclosure is an enclosure ready to receive a switchgear.
 10. The interior compartment mounting plates shall be constructed from a minimum of 2mm flat sheet steel and are to be rigidly fixed into the compartment.
 11. Panel steelwork shall be protected against climatic conditions by degreasing the steelwork with rust inhibitor and applying electrostatically two coats of primer and two top enamel finish top coats and epoxy powder baked.
 12. Standard color is RAL 7032.
 13. The steelwork paint finish shall be subjected to a corrosion resistance test at ambient temperature.
- D. Busbars and busbars connections shall be capable of carrying continuously their rated normal current with a temperature rise taken into account in addition to withstanding the short circuit current for 1 second. Limit of temperature rise shall be based on a peak value not exceeding 45°C.
1. Busbars and busbars connections shall be hard drawn, electrotinned, high conducting, hard copper running the complete length of the panel and shall be supported by synthetic bounded paper or synthetic bounded laminated wood and shall be capable of safely withstand stresses and short circuit. Busbars are to have a minimum breaking capacity of 250 N/m². A full size neutral bar is to be provided as well as an earth bar.
 2. Busbars bends shall be carried out in a cold state with dedicated tools in order not to devalue the mechanical, thermal and dielectric properties of the busbars.
- E. Switchboards shall be supplied with a horizontal earth bar 20x10mm located in the bottom of panel. Vertical earth bar sized 20x5 mm shall be located in the cable compartment of cubicles and shall run along the full height of the compartment.
1. Minimum clearances for open indoor insulated busbars and busbar connections shall be 19mm between phase and earth and 25.4mm between phases.

- F. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, white characters on black background. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchgear designation, voltage ampere rating, short circuit rating, manufacturer's name, general order number and item number.
1. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc. shall be suitably marked for identification corresponding to appropriate designation on manufacturer's diagrams.
- G. The following are typical forms of separation by barriers or partitions inside the panelboards:
1. Form 1: No separation
 2. Form 2: Separation of busbars from the functional units.
 3. Form 3a: Separation of busbars from the functional units and separation of all functional units but not of their terminals for external conductors, from one another. The terminals for external conductors need not be separated from the busbars.
 4. Form 3b: Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the functional units, but not from each other.
 5. Form 4: Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit.
- H. Panelboard will include an undervoltage, overvoltage and phase sequence relay.

2.3 COMPONENTS

- A. Molded Case Circuit Breakers (MCCB):
1. Circuit breakers are of the totally enclosed molded case construction from an approved manufacturer and with front operated handle mechanism for manual operation in addition to automatic operation under over current conditions.
 - a. Each pole is to have thermal bi-metallic inverse time-delay over current element for overloads and instantaneous magnetic over current trip element for operation under short circuit conditions.
 - b. Frame sizes are to be related to the minimum acceptable short circuit interrupting ratings and discrimination. Trip current rating indicates nominal rating at which thermal overload element operates.
 2. MCCB rated 160A and below shall have an adjustable threshold thermal trip unit.
 3. MCCB rated 200 A and above shall have an electronic solid-state trip unit.
 4. The following minimum features for the MCCB(s) shall be included:
 - a. Mechanical open, close and tripped indication
 - b. Trip-free mechanism
 - c. Facility for padlocking
 - d. At least one volt free changeover auxiliary contact wired to outgoing terminals
 5. Molded case circuit breakers shall be in accordance with IEC 947-2.
 6. The breaking capacity shall be as shown on the drawings.
- B. Miniature Circuit Breaker (MCB):

1. MCB to be of the thermal magnetic non-adjustable type, short circuit breaking capacity as shown on the drawings and according to IEC 947-2. MCB are to operate under overload and short circuit conditions and made from high quality molded insulating material.
 2. MCB to be of the plug-in type.
 3. Auxiliaries are to be provided as required by the design.
- C. Industrial Switches:
1. The switches will be of the moulded case type. They will conform to the requirements of IEC 947.1 and IEC 947-3.
 - a. The switches will have an impulse withstand voltage of 8 kV.
 - b. The switches will have a rated operational voltage of 690V AC (50/60 Hz)
 - c. The switches will have a short circuit withstand current (I_{cw}) for 1 second of 3 kA for ratings up to 80A and 5.5 kA for ratings above.
 2. Switches to be of the positive contact indication type according to IEC 947-3, to the exclusion of all other mechanisms. This function is to be certified by tests carried out by the constructor.
 3. The switch operating mechanism will ensure rapid opening and closing (operator independent) and will conform to §2-12 at IEC 947 - 3. The closing of all poles, including the neutral, will be simultaneous as required by IEC 947 - 3.
 4. To ensure positive contact indication as described in IEC 947 - 3 § 7-2-7.
 - a. The operating handle will only indicate the O (OFF) position if the main contacts are actually separated. They will be achieved by design of the operating mechanism.
 - b. The switches will be designed to be locked on the OFF position by 3 padlocks (with locking in the ON position possible)
 - c. The distance between open contacts will be greater than 8 mm.
 5. All the switches will be double insulated by construction.
 6. The moulded case switches will be designed to allow the adaptation of two auxiliary contacts which will be contained within the switch frame.
 - a. These auxiliaries will be common with all of the range.
 - b. The auxiliaries will carry out indifferently the following 3 functions: OF contact, early make contact and early break contact.
- D. Metering Instruments:
1. The metering instrument shall be suitable for measurement, storage and supervision of electrical quantities. Its dimensions shall not be less than 96x96mm.
 2. The metering instrument shall be able to give the minimum following measurements:
 - a. Voltage: phase and line.
 - b. Current.
 - c. Power: active, reactive and total values.
 - d. Power factor.
 - e. Frequency.
 - f. Energy: active and reactive
 - g. Harmonics: residual and total harmonic content for each harmonic order up to the 20th per phase, both for voltage and current values.
 3. The multimeter shall be equipped with an LCD display and function keys to select and check the measured values.

4. The multimeter shall be equipped with a memory of minimum 128K capacity to store the measured values.
 5. Necessary software shall be provided for the visualization of online measured values.
 6. The measurement accuracy shall not exceed $\pm 1\%$.
 7. The display refresh time shall be less than 2s.
- E. Miscellaneous:
1. Wiring to be neatly arranged on terminal blocks with suitable numbering. Control wires are to be copper, PVC insulated, 600V grade.
 2. Anti-condensation heaters with disconnect switches and pilot lamps are to be provided in the switchboard controlled by a thermostat.
 3. Power and control diagrams are to be provided and suitably located within the cubicles.

2.4 DISTRIBUTION PANELBOARD

- A. Panelboard cabinet shall be of the general-purpose type for recessed or surface mounted installation, made from hot galvanized sheet steel (1.5 mm).
1. Enclosure must be sized to fit breakers, contactors and all equipment indicated on drawings.
- B. Panelboards shall be minimum 600V class, protection degree (IP) as shown on the drawings. Construction must meet IEC requirements 529.
1. Joints are to be welded and reinforced where necessary. Gutter spaces are to be at least 100 mm on all sides.
 2. The front is to be of the cold rolled sheet steel of not less than 2.5 mm. Doors shall be provided with concealed hinges and flush lock. A coat of zinc chromate primer and one coat gray enamel finish are to be applied. Directories are to be provided on doors and typed to identify panelboards and indicate clearly circuit number and description of associated branch circuit.
- C. Interior of panelboard consists of branch circuit breakers mounted on buses or on rails. Buses must be 98% pure electrolytic copper based on total temperature rise of 30°C over ambient of 50°C. Aluminum is not to be used for interior panelboard parts.
1. Buses are to be supported rigidly and mounted on moulded insulators. These should carry the maximum short-circuit duty of main protective device, which is at least the maximum short circuit at point of application, without showing signs of deterioration.
- D. Screws and bolts used for making copper connections are to have lock washers.
- E. Panelboards are to have ground earthing connector or bar welded to cabinet.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Main switchboards are to be installed on concrete bases, leveled. Concrete foundations are to be constructed in accordance with equipment manufacturer drawings. Any painted surface damaged during handling and installation is to be rectified before commissioning.

- B. Main switchboard is to be tested on site for its completeness, component ratings, types, sizes and connections. Main and control circuits are to be checked for insulation. All tests required by the standards are to be carried on to the satisfaction of the Supervisor.

END OF SECTION

SECTION 16500

LIGHTING INSTALLATIONS

PART 1 GENERAL

1.1 SCOPE

- A. Work is deemed to include supply and installation of:
 - 1. Lighting fixtures.
 - 2. Wires/cables including protective earthing conductors, conduits, trunking and other raceways and fittings from outlet back to upstream outlet or to final branch circuit panelboard.
 - 3. Lamps.
 - 4. Fixing and supporting materials.
- B. All fixtures are to have two cable entry holes.
- C. Fluorescent lamp fixtures.
 - 1. With built-in ballast. Single or two lamp ballasts are to be used in any one fixture. Two lamp ballasts are to be lead-lag series type.
 - 2. Each ballast is to have an external fuse and fuse holder rated in accordance with manufacturer's instruction.
 - 3. The ballast is to be of conventional type, with the following characteristics:
 - a. High power factor (greater or equal to 0.9)
 - b. Low power loss (less or equal to 10% of the lamp wattage)
 - c. Low self-warming (less or equal to 30°C)
 - d. Total harmonic factor <20%.
 - 4. The ballast is to shut down:
 - a. In response to component faults.
 - b. In response to lamp failure.
 - c. In no load operation.
 - 5. The ballast is to be manufactured and certified for the specific lamp it controls.
 - 6. The starter shall be of the electronic type.
- D. High Intensity Discharge Lamp Fixtures:
 - 1. Fixtures are to be supplied with mounting fixtures and control gear.
 - 2. The ballast is to be of high power factor (greater or equal to 0.9).
 - 3. RF suppression circuit is to be provided.
- E. Lighting levels:
 - 1. The required lighting levels and color temperatures are the following:
 - a. Office: 500 lux
 - b. Archive: 400 lux
 - c. Technical Room: 250 lux
 - d. Sorting Area: 200 lux
 - e. Curing Area: 100 lux
 - 2. The uniformity ratio should be in accordance with CIE standards.

1.2 SUBMITTALS

- A. The following data (but not limited to) are to be provided:
 - 1. Details on each fixture, lamp and control gear including manufacturer's catalogue cuts, catalogue number, rating, material specification, overall dimensions, operating characteristics, photometric data, etc.
 - 2. Installation details.

PART 2 PRODUCTS

2.1 Manufacturers

- A. Manufacturers: Any recognized manufacturer having an official technical agreement to conformity with standards for the product to be pre-approved by Supervisor.

2.2 LIGHTING FIXTURES

- A. Unless otherwise specified, fixtures are to be manufacturer's standard series.
 - 1. Fixtures are to be fabricated, assembled and wired entirely at the factory. Site work is to be restricted to reassembling parts dismantled at the factory for packing and transportation.
- B. Housing is made of not less than 0.6 mm thick sheet steel.
 - 1. Sheet steel for reflectors should not be less than 0.8 mm thick.
 - 2. Aluminum sheet for reflectors should not be less than 1.0 mm thick.
- C. Light reflecting surfaces are to be finished with white baked enamel paint having a reflection factor not less than 80%.
 - 1. Finish is to withstand 72 hours exposure to an ultra-violet RS lamp placed 100 mm from surface.
- D. Wiring to be not less than 1mm², insulated for 220 V supply. Wiring is to be terminated on screw type insulated, terminal blocks.

2.3 TUBULAR FLUORESCENT LAMPS AND FIXTURES (26mm DIAMETER)

- A. Normal start, bi-pin, rated as described on the drawings as per IEC 81 (SSA 138 and SSA 139). Guaranteed rated life is to be above 10000 hours if with conventional control gear and above 13000 hours if with electronic control gear. The luminous output shall be above:
 - 1. 1200 lumens for 18w lamps (600 mm long)
 - 2. 3250 lumens for 36w lamps (1200 mm long)
- B. Lamp holders are to comply with IEC 400, heavy duty, moulded white plastic with non-corroding spring contacts.
- C. Ballasts are to comply with IEC 82. Only single or two-lamp ballasts are to be used in any one fixture. Two-lamp ballasts are to be lead-lag, series type. Equipment is to be enclosed in sheet steel casing with corrosion resistant finish. Each ballast is to have one-time external fuse and fuse holder rated in accordance with manufacturer's instructions.

- D. Ballasts are of the switch start, power factor corrected to above 0.9, having manufacturer's lowest case temperature. Sound rating is not to exceed level given in the Standards. Ballasts are to be manufactured and certified for the specific lamp they control and for operation from nominal power supply, with voltage and frequency equal to nominal voltage and frequency of distribution network.
- E. Capacitors are to be to IEC 566, having snap-type connectors and fastening, bolt type M8, for fixing to fixture.
- F. Starters are to comply with IEC 155 and are to be selected in conjunction with respective ballast and lamp.

2.4 PL FLUORESCENT LAMPS

- A. Compact, with special bi-pin socket, rated as described on the drawings. Guaranteed rated life is to be above 13000 hours and luminous output above the following:
 - 1. 1200 lumens for 18w lamps
 - 2. 1800 lumens for 26w lamps

2.5 METAL HALIDE LAMPS

- A. Lamps shall be rated as described on the drawings. Color of light is to be warm white with excellent color rendering properties.
- B. Lamps are to comprise quartz discharge tube enclosed in clear tubular hard-glass outer bulb, operating on same principle as all gas discharge tubes with iodide additives indium, thallium and sodium in the mercury discharge, to increase intensity in three spectral bands; blue, green and yellow-red with high color rendering. Lamps are to be to IEC 188 with E40 base. Guaranteed average life is not to be less than 10000 hours and luminous outputs, after 100 hours burning, are to be above the following:
 - 1. 12000 lumens for 150 W lamps
 - 2. 32500 lumens for 400 W lamps
 - 3. 90000 lumens for 1000 W lamps
 - 4. 190000 lumens for 2000 W lamps.
- C. Permissible base temperature is to be not greater than 250 deg. C, and maximum bulb temperature not greater than 550 deg. C. Lamp burning position for 2000 W, 220 V lamp is to be possible up to 75 degrees.

2.6 INCANDESCENT LAMPS AND FIXTURES

- A. Incandescent Lamps for General Lighting Service (GLS) are to have screw base type ES for lamps 200 W and below and type GES for lamps 300 W and above. Inside frosted (IF) lamps are to be used unless otherwise specified. Guaranteed rated life is to be above 800 hours and luminous output above the following:
 - 1. 950 lumens for 75 W lamps
 - 2. 1350 lumens for 100 W lamps
 - 3. 2200 lumens for 150 W lamps
 - 4. 3100 lumens for 300 W lamps.

- B. Incandescent Lamp sockets to be to IEC 61 and IEC 238, high grade porcelain; E27 (ES) screw sockets for lamps not exceeding 200 W and E40 (GES) screw sockets for lamps 300 W and over.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fixtures are to be installed aligned, leveled and at uniform heights within one room or area. Fixtures are to be supported with hangers to support weight of fixture.
- B. Submit details of hangers etc. and method of fastening for approval. Rigidly secure fixtures mounted on outlet boxes to fixture studs. Install hooks or extension pieces, when required, for proper installation. Provide one point of support in addition to the outlet box fixture stud for individually mounted fixtures longer than 600 mm.
- C. Exact position of fixtures must be coordinated with the reflected ceiling plan.
- D. Recessed fixtures in suspended ceilings are to be coordinated with exact dimensions of ceiling tiles.
- E. Install cover plates over fixture outlet box or opening in ceiling or structure when left unused.

END OF SECTION

SECTION 16502

POSTS AND STANDARDS

PART 1 GENERAL

1.1 SCOPE

- A. Work is deemed to include supply and installation of:
 - 1. Public Garden Lighting Posts.

1.2 SUBMITTALS

- A. The following data (but not limited to) are to be provided:
 - 1. Details on each post type including manufacturer's catalogues, material specification, shop drawings, etc.
 - 2. Installation details.

PART 2 PRODUCTS

2.1 Manufacturers

- A. Manufacturers: Any recognized manufacturer having an official technical agreement to conformity with standards for the product to be pre-approved by Supervisor.

2.2 STEEL POLES

- A. Steel used shall conform to the following ASTM designations:
 - 1. Shaft (sheet steel): A570 Grade C (50 - 80,000 psi range)
 - 2. Base Plate: A36 (slot tolerances shall be 0mm)
 - 3. Castings A27 Grade 65-35
 - 4. Luminaire Arm (where applicable): A53 Grade B or A120 (standard pipe)
 - 5. Bolts: A449
- B. Poles must be galvanized to ASTM A123. Minimum 50 year life. Debur all edges prior to galvanizing and painting. The contractor must exercise proper caution after galvanizing, during transportation and storage to protect against wet storage staining.
- C. Pole dimensions shall be as specified. It is the responsibility of the contractor to verify and attest that the material sizes proposed are structurally adequate and in full compliance with this specification. Poles are to be capable of supporting banners, security cameras and additional lights.
- D. Off set light poles a minimum distance of 1 meter from the edge of paths and greater than 750 mm from the edge of kerbs. Ensure location of light poles in relationship to other park infrastructure does not create obstacles for the operation of grass mowing equipment.
- E. All steel welding shall conform to AWS D1.1. Welding and related operations shall conform to applicable provisions of the Structural Welding Code, AWS D1.1, of the American Welding Society. All welding shall be performed in accordance with the

written procedures using only those joint details which have pre-qualified status when performed in accordance with AWS D1.1. Use of electroslog or electrogas welding processes or the short circuiting transfer mode of the gas metal arc process will not be acceptable. Welding shall be performed only by welders or operators who have been qualified in accordance with AWS D1.1. The qualification test records shall be made available to the inspector on request.

- F. When sections are butt-welded together, the welded seams on adjacent sections shall be placed to form continuous straight seams from base to top of standard in accordance with this section. The butt-welded transverse joints shall be strengthened by inserting a welded sleeve at each joint. The sleeve shall be 3.5 mm nominal thickness or thicker steel having the same chemical composition as the steel in the standard. The sleeve shall have a minimum length of 25mm. The sleeve shall be centered at the joint and have the same taper as the standard so that the outside of the sleeve is in full contact throughout its length and circumference.
- G. All welds shall be continuous. The weld metal at the transverse joint shall extend to the sleeve, making the sleeve an integral part of the joint. No transverse weld shall occur within 75mm of mast arm fittings. All longitudinal welds shall be performed by the submerged arc process. All exposed welds, except fillet welds and welds on top of mast arms shall be ground flush with the base metal.
- H. All painting shall be accomplished using a two-part epoxy / polyurethane system consisting of equivalent High solids epoxy primer and Polyurethane top coat (or approved equal) of a color approved by Supervisor. Coating system used must meet a minimum level of testing criteria. The testing criteria are as follows:
 - 1. Abrasion: < 60.5 mg after 1000 cycles (per ASTM D4060)
 - 2. Accelerated Weathering: No blistering, cracking or delamination. 72% gloss retention after 4 weeks of exposure (per ASTM G53 4/8 cycle)
 - 3. Adhesion: Rated 5B (per ASTM D3359 Method B)
 - 4. Humidity (Cleveland): No blistering, cracking or delamination of film (per ASTM D2247 at 1000 hours of exposure).
 - 5. Salt Fog Exposure: No face corrosion, face blistering or loss of adhesion. Less than 1.5mm creepage from scribe (per ASTM B 117 at 2000 hours exposure.)
 - 6. Impact Resistance: as per ASTM D2794
 - 7. Paint Thickness: Minimum topcoat thickness of 3 MILS DFT (Dry Film Thickness), Minimum primer thickness of 75 microns (Dry Film Thickness).
- I. All fasteners shall be stainless steel.

2.3 ALUMINUM POLES

- A. The aluminum pole shaft assembly shall be spun from one piece of seamless tubing and after fabrication, it shall have mechanical strength of not less than T6 temper. The cross section of the pole shall be round, and the shaft shall be fabricated in a continuous true taper from at least 15cm above the handhole to the top of the shaft. The shaft shall have no longitudinal or circumferential welds, except at the lower end joining the shaft to the base. Cast Aluminum shall be 319 alloy.
- B. Pole dimensions shall be as specified. It is the responsibility of the contractor to verify and attest that the material sizes proposed are structurally adequate and in full

compliance with this specification. Poles are to be capable of supporting banners, security cameras and additional lights.

- C. The shoe base shall be a permanent mold casting. The base shall be free of cracks, pits, and blow holes and of sufficient size and strength to withstand full design loads. The base shall telescope the shaft; and the one weld shall be on the inside of the base at the end of the shaft, while the other weld shall be on the outside at the top of the base. The shoe base and the two (2) welds shall develop the full strength of the pole assembly.
- D. Aluminum used shall conform to the following ASTM designations:
1. Shaft (aluminum): B209M
 2. Castings: B26/B26M
 3. Luminaire Arm (where applicable): B429-90a
 4. Spun Shaft: B241/B241M
 5. Square Extruded Shaft: B429
- E. All aluminum welding shall conform to AWS D1.2. Welding and related operations shall conform to applicable provisions of the Structural Welding Code, AWS D1.2, of the American Welding Society. All welding shall be performed in accordance with the written procedures, using only those joint details which have been qualified in accordance with AWS D1.2. Welding shall be performed only by welders or operators who have been qualified in accordance with AWS D1.2. The qualification test records shall be made available to the inspector on request.
- F. Anodizing Processes:
1. Aluminum components shall not be anodized until all forming and fabricating operations, including welding, have been completed.
 2. The interior of tubular sections need not be anodized.
 3. The contractor shall protect the anodized finish on the aluminum components from any damage through all erection operations to the final acceptance of the work.
 4. Finish Designations
 - a. Type I Finish shall be Aluminum Association designation AA-M10c21-A41 clear color.
 - b. The minimum coating thickness shall be 17.5 microns measured according to ASTM B 244-68.
 - c. The minimum coating weight shall be 50g/sq. m. measured according to ASTM B 137-45 (1967).
 - d. The coating seal shall be tested according to ASTM B 136-72 (Dye Stain Test).
 - e. Color variations of anodized aluminum components shall be limited to the range established by the approved process control samples. Components shall be subject to visual comparison during production finishing and at the time of final acceptance of the work. Each component shall be marked for field installation so as to minimize color variation of adjacent components in the same plane.
- G. All fasteners shall be stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Posts are to be installed aligned, vertical and rigid at uniform heights as shown on drawings.
- B. Submit details of installation for approval.
- C. Foundations shall be constructed and poles erected using baseplates and anchor bolts at a minimum depth of 20cm below finish level. Backfill and surface finishing above foundations shall be fully as per the pole surrounding surface. Alternatively, Rubber wear pads shall be furnished for pole foundations, at the discretion of the Supervisor.

END OF SECTION