Division 1 General Specification

SECTION 01010 - SUMMARY

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: The Project comprises the construction of a building to house a Potable Water Pump Station and install and commission Owner supplied pumps and control equipment.

1. Project Location: Arboretum Fort Hill Road, Devonshire
2. Owner: Ministry of Public Works

B. Engineer Identification: The Employer's Requirements and Tender Documents for the Project, dated _____, were prepared by the Ministry of Public Works, 3rd Floor, Post Office Building, P.O. Box HM 525, Hamilton HM CX, Bermuda

C. The Work comprises the construction of a single storey block work building with SKB roof, 13 feet 4 inches wide x 16 feet 4inches long x 12 feet high, together with all associated civil, mechanical and electrical works.

1. The Work includes but is not limited to:
   a) Fabrication and procurement of all materials for the whole of the works
   b) Construction of the whole of the works, including mechanical and electrical installations and finishing works.
   c) Installation and Commissioning of Owner Supplied Pumping Unit
   d) Site Works including excavation, fencing, Landscaping and a soak away.

D. Project will be constructed under a general construction contract.

1.2 USE OF PREMISES

A. General: Contractor shall have full use of site for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by the access required by the Employer's right to perform work or to retain other contractors on portions of Project.

B. Security of the Site: The contractor is responsible for maintaining the security of the site area. Particular care is required when dealing with existing potable water supply pipework and systems. No interference of operational equipment is permitted without prior authorization.

1.3 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections based on the 1988 Edition 16-division format and CSI/CSC's "MasterFormat" numbering system.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred, as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01010

SECTION 01025 – APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 PAYMENTS SCHEDULE

A. Coordination: Coordinate preparation of the Payment Schedule with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Application for Payments Certificate with other required administrative forms and schedules, including Submittals Schedule.
2. Submit the Application for Payments Certificate to Engineer at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Tender Price Analysis as a guide to establish line items for the Application for Payments Certificate. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Application for Payments Certificate:

    a. Project name and location.
    b. Name of Engineer.
    c. Engineer's project number.
    d. Employer’s Purchase Order Number
    e. Contractor's name and address.
    f. Date of submittal.

2. Arrange the Application for Payments Certificate in tabular form with separate columns to indicate the following for each item listed:
    a. Description of the Work.
    b. Name of subcontractor.
    c. Name of manufacturer or fabricator.
    d. Name of supplier.
    e. Change Orders (numbers) that affect value.
    f. Dollar value.

        1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Application for Payments Certificate for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the Application for Payments Certificate for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Application for Payments Certificate for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Application for Payments Certificate shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Application for Payments Certificate or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the Application for Payments Certificate before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.

    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: The date for each progress payment is the 15th day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.

D. Transmittal: Submit 1 signed original copy of each Application for Payment to Engineer by a method ensuring receipt within 24 hours.

    1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

E. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Rates.
3. Contractor's Construction Schedule (preliminary if not final).
4. Submittals Schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. Certificates of insurance and insurance policies.

F. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment less retention showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

G. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Evidence that claims have been settled.
5. Final meter readings for utilities, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. See Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

C. Requirements in this Section apply to mechanical and electrical installations. See Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.2 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Engineer's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.3 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

1.4 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01731

SECTION 01050 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. See Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate

and verify the existence and location of underground utilities and other construction affecting the Work.

1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and engineer that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify local utility and engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without local utility and engineer written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
2. Allow for building movement, including thermal expansion and contraction.

F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01050

SECTION 01090 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Installer": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

J. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

K. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

ACI American Concrete Institute/ACI International

ANSI American National Standards Institute

ASCE	American Society of Civil Engineers
ASTM	ASTM International (American Society for Testing and Materials International)
AASHTO	American Association of State Highway and Transportation Officials
AWPA	American Wood-Preservers' Association
CSA	Canadian Standards Association
CSI	Construction Specifications Institute (The)
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
RSIC	Reinforced Steel Institute of Canada
SAE	SAE International
SSPC	SSPC: The Society for Protective Coatings

Code Agencies:

Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

BOCA	BOCA International, Inc.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

SECTION 01140 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to designated areas.
2. Owner Occupancy: Allow access across the site to the Employer and Parks Maintenance Personnel.
3. Driveways and Entrances: Keep driveways and entrances serving the Arboretum facilities free from obstructions.
4. The Contractor shall not affect any existing public water supply systems without prior authorization

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01140

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General Project coordination procedures.
2. Coordination Drawings.
3. Project meetings.

B. See Division 1 Section 01700 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.

5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

1.3 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1.4 PROJECT MEETINGS

A. Preconstruction Conference: The Engineer will schedule a preconstruction conference before starting construction, at a time convenient to the Contractor, but no later than 15 days after execution of the Agreement. The conference will be held at the Project site or another convenient location. The purpose of the meeting is to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing.
    d. Designation of responsible personnel.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for processing Applications for Payment.
    g. Distribution of the Contract Documents.
    h. Submittal procedures.
    i. Preparation of Record Documents.
    j. Use of the premises.
    k. Responsibility for temporary facilities and controls.
    l. Parking availability.
    m. Office, work, and storage areas.
    n. Equipment deliveries and priorities.
    o. First aid.
    p. Security.
    q. Progress cleaning.
    r. Working hours.

3. Minutes: The Engineer will record significant discussions and agreements achieved. The meeting minutes will be distributed to everyone concerned within **3** days of the meeting.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities and controls.
    q. Space and access limitations.
    r. Regulations of authorities having jurisdiction.
    s. Testing and inspecting requirements.
    t. Required performance results.
    u. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Progress Meetings: Engineer will organize progress meetings at bi-weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.
14) Documentation of information for payment requests.

3. Reporting: Engineer will distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

a. Schedule Updating: Contractor will revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule within 3 days of the meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. See Division 1 Section "Summary of Multiple Contracts" for division of responsibilities for temporary facilities and controls.

C. See Division 1 Section "Execution Requirements" for progress cleaning requirements.

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Engineer, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Engineer and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Engineer, testing and inspecting agencies and personnel of authorities having jurisdiction.

1.4 SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.5 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by **Engineer**. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm) 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

C. Gypsum Board: ASTM C 36, minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

E. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

F. Water: Potable.

2.2 EQUIPMENT

A. Field Offices: Prefabricated, mobile units, or job-built construction with lockable entrances, operable windows, and serviceable finishes; air conditioned; on foundations adequate for normal loading.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

D. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

D. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Provide rubber hoses as necessary to serve Project site.
2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Use of Owner's existing toilet facilities will not be permitted.
3. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
4. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.

    a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

5. Drinking-Water Facilities: Provide bottled-water, drinking-water units.

    a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

H. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground, unless overhead service must be used.
2. Install power distribution wiring overhead and rise vertically where least exposed to damage.

I. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas:
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
2. Prepare temporary signs to provide directional information to construction personnel and visitors.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that

minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Site Enclosure Fence: Before construction operations begin, install enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
1. Set portable chain-link fence posts in concrete bases.
2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

H. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

I. Temporary Fire Protection: .

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

    a. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01500

SECTION 01561: ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 Environmental Measures

A Meet or exceed the requirements of all Bermuda environmental legislation and regulations, including all amendments up to project date provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

B At all times during the Works the Contractor shall maintain the Site and surrounding areas in a clean and orderly manner.

PART 2 – PRODUCTS

A Not Applicable.

PART 3 - EXECUTION

3.1 Fires

A Fires and burning of rubbish on site will not be permitted.

3.2 Disposal Of Wastes

A Burying of rubbish and waste materials on site will not be permitted.

B Collect all rubbish and waste material and dispose of in accordance with the latest editions of the Ministry of Works and Engineering, Waste Management Plan.

C Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

D When cleaning with needle scabblers, provide enclosures, screens and traps to confine and contain all material and paint debris and other extraneous material.

E Do not allow any paint debris or other foreign material to enter the water.

F Hazardous waste such as lead paint debris should be double-bagged (as asbestos would be) and sent to proper waste stations. Manifest will be required by the Employer’s Representative.

3.4 Drainage

A Provide temporary drainage and pumping as necessary to keep site free from water.

B Do not pump water containing suspended materials into waterways, sewer or drainage systems.

C Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Bermuda authority requirements.

3.5 Plant Protection

A When, in opinion of Employer's Representative, negligence of Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond work areas as shown on contract drawings, the Contractor shall be responsible, at his expense, for complete restoration including replacement of trees, shrubs, grass, etc. to satisfaction of Employer's Representative.

3.6 Pollution Control

A Maintain temporary erosion and pollution control features installed under contract.

B Control emissions from equipment and plant to Bermuda authorities' emission requirements.

C Prevent extraneous materials from contaminating air, land or water, by vacuum, temporary enclosures, screens, traps or other devices.

D Spills of deleterious substances should be immediately contained and cleaned up in accordance with provincial regulatory accordance with provincial regulatory requirements. Spills should be reported forthwith to the Employer's Representative.

E Noise levels emitted from construction activities are subject to Bermuda Government requirements.

3.7 Storage And Handling Of Fuels And Dangerous Fluids

A Locate fuel storage facility a minimum of 100 m from any water body in an area approved by the Employer's Representative and construct impermeable dykes so that any spillage is contained

B Prevent spillage of gasoline, diesel fuel and other oil products into the water and on land. Clean up spills promptly at own cost in accordance with Bermuda regulatory requirements. Report any fuel spills immediately to Employer's Representative

C Proper use of primers, grouts, bonding adhesives and other hazardous substances will be undertaken to prevent their entry into the water. Substances are to be stored and mixed on protected surfaces away from site to prevent their entry into waterways and contamination of soils.

D Collect and dispose of used oil filter cartridges and other products of equipment maintenance at industrial waste facility to satisfaction of Employer's Representative.

*** END OF SECTION 01561 ***

SECTION 01700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

B. See Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.

C. See Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover of all utilities.

12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

B. Record Drawings: Refer to Section 01720 for details

C. Record Specifications: Refer to Section 01720 for details

D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom-clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
q. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01700

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Final design calculations.
2. Record Drawings.
3. Record Specifications
4. Record Product Data.

B. See Division 1 Section "Closeout Procedures" for operation and maintenance manual requirements.

C. See Divisions 2 through 16 Sections for specific requirements for Project Record Documents of products in those Sections.

1.2 SUBMITTALS

A. Final design calculations: One complete set in paper and electronic format

B. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up Record Prints.
2. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal: Submit one electronic set and one set of plots, from corrected Record CAD Drawings and one set of marked-up Record Prints. Engineer will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Engineer will return plots and prints for organizing into sets, printing, binding, and final submittal.

b. Final Submittal: Submit one set of marked-up Record Prints and one set in electronic form, and the following:

1) Record paper copies: One set.
2) Record CAD Drawing Files and Plots: One set each.
3) Copies printed from Record Plots: Three Print each Drawing, whether or not changes and additional information were recorded.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

D. Record Product Data: Submit one copy of each Product Data submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Engineer. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
2. Refer instances of uncertainty to Engineer for resolution.
3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Engineer will make the Contract Drawings available to Contractor's print shop.

C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Engineer. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:

1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.
4. Engineer will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.

a. Engineer makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
b. CAD Software Program: The Contract Drawings are available in AutoCAD 2002, Windows 2000.

D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include complete set, identify Drawings included.
3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Engineer.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, Record Drawings**,** and Product Data where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, Record Drawings**,** and Product Data where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION 01720

Division 2 Siteworks

SECTION 02220 - EARTHWORK

PART 1 - GENERAL

1.1 Summary

A This Section includes the following:

Excavation for foundations
Excavating and backfilling for utility trenches.

1.2 Definitions

A Backfill: Soil material used to fill an excavation

- Initial Backfill: Backfill placed beside and 4"over pipe in a trench, including haunches to support sides of pipe.
- Final Backfill: Backfill placed and compacted in layers up to 8" deep over initial backfill to fill the trench.

B Base Course: Course placed between the sub base course and hot-mix asphalt paving.

C Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

- Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Employer's Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
- Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Employer's Representative. Unauthorized excavation, as well as remedial work directed by Employer's Representative, shall be without additional compensation.

F Sub base Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk

G Utilities: On-site underground pipes, conduits, ducts, and cables.

1.3 Project Conditions

A Existing Utilities: Do not interrupt utilities serving water systems occupied by Owner or others unless permitted in writing by Employer's Representative and then only after arranging to provide temporary utility services according to requirements indicated.

PART 2 - PRODUCTS

2.1 Soil Materials

A General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B Bedding Course& Initial Backfill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 Preparation

A Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

3.2 Excavation for Utility Trenches

A Excavate trenches to indicated gradients, lines, depths, and elevations.

B Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 30 inches higher than top of pipe or conduit, unless otherwise indicated.

- Clearance: Excavate a minimum width of 2" on each side of pipe.

Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

- Excavate trenches 4 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.3 Excavation for Foundations & Site Grading

A Excavate foundations to indicated levels. In the event that there is an over excavation the required levels are to be reinstated using lean mix concrete unless otherwise agreed by the Employer's Representative.

3.4 Hard Rock

A In the event that the trenching machine cannot remove harder than normal rock during excavations then, after notification to, and by agreement with, the Employer's Representative this rock shall be removed by hammering. The rates for hammering shall be charged on an hourly basis as per the prices described in Schedule of Rates on The Form Of Tender.

3.5 Unforeseen Conditions

A In the event that during excavations, the Contractor encounters conditions that are deemed by agreement with the Employer's Representative to be outside the conditions expected, it may make a claim for both an extension of time and increased costs to continue with the excavations.

B Hard Rock shall not be deemed to be an unforeseen condition.

C Unforeseen conditions shall require immediate notification to the Employer's Representative who shall inspect the Works immediately.

3.6 Utility Trench Backfill

A Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B Place and compact initial backfill of sub base material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

- Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

C Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.7 Compaction of Soil Backfills

A Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by hand-operated tampers.

3.8 Protection

A Where settling occurs before the Maintenance Period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

- Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.9 Disposal of Surplus and Waste Materials

A Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it.

B Since the Works are to be carried out on public roads, debris shall not be allowed to accumulate and the Contractor shall remove any debris at the instruction of the Employer's Representative should he deem it to be a hazard to the public.

*** END OF SECTION 02220 ***

SECTION 02720 – FRP GRATE

PART 1 - GENERAL

1.1 Summary

A This Section includes the following:

1. FRP Grating: Shop Fabricated fiberglass reinforced Plastic(FRP) Molded High Load Capacity (HLC)

1.2 Submittals

A Submit manufacturer's shop drawings of all fabricated gratings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners and connection details.

Submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable and design calculations for systems not sized or designed in the contract documents.

Submit sample pieces of each item specified herein, manufactured by the method used in the Work and as to quality and color.

1.3 Quality Assurance

A All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of at least five (5) previous, separate, similar successful installations in the last five (5) years.

Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.

Manufacturer shall be certified to the ISO 9001-2008 standard.

PART 2 – PRODUCTS

2.1 General

A All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

C Resin shall be {Vinyl Ester, Isophthalic Polyester, Polyester - *choose one}*, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

D All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E All grating products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall not burn past the 25 mm reference mark and will be classified HB per ASTM D635.

F All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.2 Molded High Load Capacity (HLC) Grating

A Manufacture: Grating shall be of a one-piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a rectangular mesh pattern and have substantial bi-directional strength. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 1/8" below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 45% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements.
After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas

B Resin system: The resin system used in the manufacture of the grating shall be any of the following: Vi-Corr®, FGI-AM®, Corvex®

C Depth: 1-1/2” or 2” with a tolerance of plus or minus 1/16".

D Mesh Configuration: 1” x 2” with a tolerance of plus or minus 1/16" mesh centerline to centerline

E Grating bar intersections are to be filleted to a minimum radius of 1/16” to eliminate local stress concentrations and the possibility of resin cracking at these locations.

F Panel Size: 4’-0” x 6’-0” with load bars parallel to the 4’- 0” direction.

2.3 Grating Fabrication

A Measurements: Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work

B Layout: Each grating section shall be readily removable, except where indicated on drawings. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.

C Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

2.4 Hardware

A Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced as per the recommendation of the manufacturer.

PART 3 - EXECUTION

3.1 Installation

A Contractor shall install gratings in accordance with manufacturer’s assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

*** END OF SECTION 02720 ***

Division 3 Concrete Specification

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Shop Drawings: For steel reinforcement.

D. Material test reports.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. CSA Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. CAN/CSA-A23.1 “Concrete Materials and Methods of Concrete Construction” (latest edition).
2. CAN/CSA-A23.2 “Methods of Testing for Concrete” (latest edition).

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

1. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated after fabrication and bending.

B. Deformed- Galvanized-Steel Welded Wire Reinforcement: ASTM A 184, fabricated from deformed steel wire into flat sheets.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to RSIC's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II.

B. Normal-Weight Aggregates: ASTM C 33, graded, 3/4-inch (19-mm) nominal maximum coarse-aggregate size.

1. Fine Granite Aggregate: Free of materials with deleterious reactivity to alkali in cement.

2. Granite aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Imported Limestone aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 6 mils (0.15 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to CAN/CSA-A23.2.
   1. Pavement design mixture to include the use of granite aggregate only.

B. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength:

Location	**Minimum Specified 28 Day Compressive Strength**
Footings	30MPa
Column Bases	30MPa
Slabs and pavement	30MPa
Concrete Block Fill	25MPa
Rock Fill (For foundations)	25MPa

2. Maximum Water-Cement Materials Ratio: 0.45

2.8 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to RSIC's "Manual of Standard Practice."

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork according to CAN/CSA-S269.3 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of CAN/CSA-S269.3.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 12 inches (300 mm) and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

A. General: Comply with RSIC's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

2. Alternative bar sizes to the size specified on the drawings will not be allowed.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction/Contraction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Induced Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to CAN/CSA-A23.1.

C. Hot-Weather Placement: Comply with CAN/CSA-A23.1.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot (3.05-m) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive hot temperatures. Comply with CAN/CSA-A23.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to CAN/CSA-A23.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by the Ministry of Works and Engineering and Housing. Remove and replace concrete that cannot be repaired and patched to the Ministry of Works and Engineering and Housing approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Testing Services: Tests shall be performed according to CAN/CSA-A23.2.

END OF SECTION 03300

Division 4 Masonry Specification

SECTION 04220 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with RSIC's, "Manual of Standard Practice." Show elevations of reinforced walls.

C. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

1. For masonry units include material test reports substantiating compliance with requirements.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.3 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in CAN/CSA-A371 "Masonry Construction for Buildings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONCRETE MASONRY UNITS (CMUs)

A. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.

2.3 CONCRETE LINTELS

A. General: Provide concrete lintels complying with requirements below.

B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 3 Section "Cast-in-Place Concrete."

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Masonry Cement: ASTM C 91.

D. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.5 REINFORCEMENT

A. Hot-Dip galvanised Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

2.6 TIES AND ANCHORS

A. Materials:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Wire: Fabricate from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.

E. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For interior non-load-bearing partitions, or for applications not specified, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use concrete fill to masonry walls according to section 03300 “Cast In Place Concrete”
2. Provide grout with a slump of 5 inches (125 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

D. Comply with tolerances in CSA-A371 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/2 inch (12 mm) maximum.

3.2 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.4 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.5 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in CSA-A371.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in CSA-A371 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 40 inches (1120 mm) or five courses.

3.6 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

3.7 PARGING

A. Parge masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm) with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours and protect parging until cured.

3.8 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

3.9 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
2. Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04220

SECTION 04230 REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 Scope

A. Blockwork shall be reinforced in the locations indicated on the drawings and accurately fixed in the positions indicated.

B. The minimum clearance to block cells shall be 3/4" (19mm); the minimum lap lengths of bars under shall be 50 bar diameters unless otherwise indicated.

PART 2 PRODUCTS

2.1 Reinforcing steel

C. Reinforcing steel including bed joint reinforcement shall comply with the following British Standards:

BS 8666: 2000 Carbon Steel Reinforcing Bars for Concrete
BS 4482: 1985 Cold Reduced Steel Wife for Reinforcement for Concrete
BS 4483: 1985 Steel Fabric for Reinforcement

D. Reinforcement shall be galvanised after manufacture in accordance with BS 729.

2.2 Concrete

E. Unless specified otherwise on the drawings. concrete infill for blockwork shall be grade 20 minimum 28 days characteristic compressive strength.

2.3 Aggregate

F. The maximum size of aggregate shall not exceed 50% of the specified cover to reinforcement.

2.4 Admixtures

G. Construction admixtures in accordance with BS 5075: Part 1 may be used with the prior approval of the Engineer’s Representative.

PART 3 EXECUTION

3.1. Slump

H. The slump of all mixes shall be appropriate to the size and configuration to be filled but shall be between 3" (75mm) and 7" (175mm) for unplasticised mixes.

3.2. Mix and method of placement

I. Details of the infill concrete mix and method of placement shall be agreed with the Engineer's Representative prior to the start of construction.

J. Unless otherwise shown on the drawings, all filled block shall have two bars of 1/4" (6mm) horizontal masonry reinforcement correctly laid in bed joints at 2' (600mm) vertically. Bars shall be laid in the flanges of blocks and not through the centre of cells. The minimum lap length shall be 12" (300mm). Any proposal to substitute purpose manufactured masonry reinforcement with an alternative shall require the approval of the Engineer's Representative.

K. Block is to be filled in maximum 5 course lifts with all blockfill rodded thoroughly.

L. Cavities, cells or voids in blockwork shall be thoroughly cleaned before placing grout or infill.

M. Concrete infill shall be placed to within 2" (50mm) of the level of the last course laid.

N. Care shall be taken to ensure that adequate lap length is maintained in vertical reinforcing after a lift.

END OF SECTION 04230*

SECTION 04550 MASONRY VENEER

PART 1 - GENERAL

1.1 Definition

A. All stone shall be Bermuda stone unless otherwise stated.

B. This Section shall be read in conjunction with related Sections including those for water, sand and cement contained elsewhere in the Specification.

1.2 Sample Veneer

A. Prior to construction, a control sample shall be prepared for the Employer's Representative's approval.

PART 2 - PRODUCTS

2.1 Bermuda stone

A. Bermuda stone shall be freshly cut and squared native stone of good texture, unless otherwise stated, and be uniformly dense without earth streaks and other stains, and free from cracks and sand holes.

B. Bermuda stone for a project shall be obtained from a single quarry and be consistent in colour, range and texture.

2.2 Mortar

A. Stone shall be laid in a 1:3:8 cement: lime: sand mortar.

B. Where used as a facing, stone shall be laid with stainless steel twist type cavity wall ties at 2.5 per sq. yd. to the inner blockwork leaf.

C. Mortar plasticiser conforming to BS 4887 may be substituted for lime.

PART 3 EXECUTION

3.1. Bond

A. Stone shall be built plumb to lines with all courses level; half lap stretcher bond shall be used for all stonework, unless otherwise indicated on the drawings.

B. To hold veneer in place use stainless steel twist type cavity wall ties. Space ties every 32” horizontally and every 16” vertically and offset the rows so that ties do not line up.

3.2. Jointing

A. A uniform joint size must be maintained.

B. All joints must be raked out 3/4" (19mm) before mortar sets, keeping the face of the stone clean.

C. After mortar sets, the Contractor shall wet rake joints and pack solidly with pointing mortar, unless otherwise specified.

D. Joints shall be tooled slightly concave, unless otherwise indicated on the drawings.

3.3. Cleaning

A. Stonework shall be kept clean of all mortar deposits and excess mortar.

B. Stonework shall be cleaned within six days of placement with clean water and stiff bristle brushes.

Division 6 Timber Specification

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood framing.
2. Wood supports.
3. Wood blocking.
4. Wood cants.
5. Wood nailers.
6. Wood furring.
7. Wood grounds.
8. Wood sheathing.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product indicated.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses.

C. Research/Evaluation Reports: For the following:

1. Treated wood.
2. Engineered wood products.
3. Metal framing anchors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive stained or natural finish, mark grade stamp on end or back of each piece.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: **AWPA C2 (lumber).**

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.4 DIMENSION LUMBER

A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Framing Other Than Non-Load-Bearing Partitions: "Structural Light Framing No. 2" grade and the following species:

1. Southern pine; SPIB.

2.5 TIMBER AND MISCELLANEOUS LUMBER

A. For timbers of 5-inch nominal (117-mm actual) size and thicker, provide material complying with the following requirements:

1. Species and Grade: Southern pine, No. 1 grade; SPIB.

B. Provide miscellaneous lumber for support or attachment of other construction, including the following:

1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.
5. Furring.
6. Grounds.

C. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content of any species.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners:

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Power-Driven Fasteners: CABO NER-272.
3. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Manufacturers: Simpson Strong-Tie Company, Inc. or similar approved

2. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show

compliance of metal framing anchors, for application indicated, with building code in effect for Project.

3. Allowable Design Loads: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.

D. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

E. Framing Standard: Comply with WCD-1, “Details for Conventional Wood Frame Construction," unless otherwise indicated.

F. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

G. Fastening Methods:

1. Combination Subfloor-Underlayment: Glue and nail to wood framing.
2. Subflooring: Glue and nail to wood framing.
3. Roof Sheathing: Screw to wood framing.
4. Underlayment: Nail to subflooring.
5. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION 06100

Division 8 Doors Specification

PART 1 - GENERAL

SECTION 08110 – STANDARD STEEL DOORS

1.1 SUMMARY

A. This Section includes standard hollow-metal steel doors and frames.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, [**fire-resistance rating,**] [**fire-resistance and temperature-rise ratings,**] and finishes for each type of steel door and frame specified.

B. Shop Drawings: Provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings.

C. Product test reports.

1.3 QUALITY ASSURANCE

A. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Test Pressure: Test according to [**NFPA 252 or UL 10C**] [**UBC Standard 7-2**]. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to [**NFPA 257 or UL 9**] [**UBC Standard 7-4**]. Label each individual glazed lite.

C. Smoke-Control Door Assemblies: Comply with [**NFPA 105 or UL 1784**] [**UBC Standard 7-2**].

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark Doors; a division of General Products Co., Inc.
3. Ceco Door Products; an ASSA ABLOY Group Company.
4. CURRIES Company; an ASSA ABLOY Group Company.
5. Deansteel Manufacturing, Inc.
6. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
7. Kewanee Corporation (The).
8. Mesker Door Inc.
9. Pioneer Industries, Inc.
10. Republic Builders Products Company.
11. Steelcraft; an Ingersoll-Rand Company.
12. <**Insert manufacturer's name.**>

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.

H. Grout: Comply with Division 4 Section "Unit Masonry Assemblies."

I. Grout: Comply with ASTM C 476, with a slump of 4 inches (102 mm) for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

J. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

K. Glazing: Comply with requirements in Division 8 Section "Glazing."

L. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces. Comply with ANSI A250.8.

1. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
2. Vertical Edges for Single-Acting Doors: [**Beveled edge**] [**Square edge**] [**Beveled edge unless square edge is indicated**] [**Square edge unless beveled edge is indicated**].

a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
2. Level 2 and Physical Performance Level B (Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
3. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**] [**3 (Stile and Rail)**].
4. Level 4 and Physical Performance Level A (Maximum Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
2. Level 2 and Physical Performance Level B (Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
3. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**] [**3 (Stile and Rail)**].
4. Level 4 and Physical Performance Level A (Maximum Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners[**and seamless face joints**].
2. Frames for Level 1 Steel Doors: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].
3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet[**, unless otherwise indicated**].

4. Frames for Level 3 Steel Doors: [**0.053-inch- (1.3-mm-)**] [**0.067-inch- (1.7-mm-)**] thick steel sheet[**, unless otherwise indicated**].
5. Frames for Level 4 Steel Doors: [**0.067-inch- (1.7-mm-)**] [**0.093-inch- (2.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.

1. Fabricate frames with mitered or coped and welded face corners [**and seamless face joints**] [**, unless otherwise indicated**].
2. Fabricate knocked-down frames with mitered or coped corners, for field assembly[**where indicated**].
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 1 Steel Doors: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].
5. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet[**, unless otherwise indicated**].
6. Frames for Level 3 Steel Doors: [**0.053-inch- (1.3-mm-)**] [**0.067-inch- (1.7-mm-)**] thick steel sheet[**, unless otherwise indicated**].
7. Frames for Wood Doors: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] [**0.067-inch- (1.7-mm-)**] [**0.093-inch- (2.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].
8. Frames for Borrowed Lights: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].

D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

E. Jamb Anchors: Masonry, stud-wall, compression, or postinstalled expansion type; not less than 0.042 inch (1.0 mm) thick.

F. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick.

G. Plaster Guards: Formed from same material as frames, not less than 0.016-inch (0.4-mm) thick.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.6 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and

tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide fixed stops and moldings welded on secure side of door or frame.
2. Provide loose stops and moldings on inside of doors and frames.

2.7 FINISHES

A. Steel Finish: Factory priming for field-painted finish.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Remove welded-in shipping spreaders installed at factory.

B. Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

C. Standard Steel Frames: Install standard steel frames for [**doors**] [**sidelights**] [**transoms**] [**borrowed lights**] and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

D. Standard Steel Doors: Fit hollow-metal doors accurately in frames. Shim as necessary.

1. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
2. Smoke-Control Doors: Install doors according to [**NFPA 105**] [**UBC Standard 7-2**].

E. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

F. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

G. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 08111

SECTION 08710 - LOUVRES AND VENTS – FIXED LOUVRES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminium louvres.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvres, including comprehensive engineering analysis by Manufactures qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvres shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louvre components, noise or metal fatigue caused by louvre blade rattle or flutter, or permanent damage to fasteners and anchors.

1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For louvres and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminium Extrusions: ASTM B 221, Alloy 6063-T6.

B. Aluminium Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. For fastening aluminium, use aluminium or 300 series stainless-steel fasteners.

2. For colour-finished louvres, use fasteners with heads that match colour of louvres.

D. Bituminous Paint: Cold-applied asphalt emulsion.

2.2 FABRICATION, GENERAL

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

C. Horizontal, Drainable-Blade Louvre:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide Greenheck Fan Corporation.., Models EDK-401 and 402 Blade-Drainable.

3. Louver Depth: 4 inches.

4. Frame and Blade Nominal Thickness: Not less than 0.081 inch for blades and 0.081 inch for frames.

5. Louver Performance Ratings:

a. As specified on drawings

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVRE SCREENS

A. General: Provide screen at each exterior louver.

B. Louvre Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louvre Screening:

1. Bird Screening: Aluminium, 1/2-inch- square mesh, 0.063-inch wire.

2.4 ALUMINIUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in colour coat. Prepare, pre-

treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Colour and Gloss: Cambridge White.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvres and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

END OF SECTION 08520

SECTION 09920 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each type of finish-coat material indicated.

1.3 QUALITY ASSURANCE

A. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5.

1. Wall Surfaces: Provide samples on at least 40 sq. ft. (4 sq. m)
2. Small Areas and Items: Architect will designate items or areas required.
3. Final approval of colors will be from benchmark samples.

1.4 PROJECT CONDITIONS

A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.5 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: 5 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

C. Manufacturers' Names:

1) Contractor’s choice

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Colors: As selected from manufacturer's full range.

2.3 PREPARATORY COATS

A. Concrete Unit Masonry Block Filler: High-performance latex block filler of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

B. Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

1. Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.
2. Zinc-Coated Metal Substrates: Galvanized metal primer.
3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

C. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
2. Zinc-Coated Metal Substrates: Galvanized metal primer.
3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

2.4 EXTERIOR FINISH COATS

A. Exterior Flat Acrylic Paint:

1. Benjamin Moore; MoorLife Latex House Paint No. 105.
2. Coronado; 10-Line Premium Gold Collection Acrylic One Coat Flat House Paint.
3. ICI Dulux Paints; 2201-XXXX Dulux Ultra Latex Flat Finish.
4. Kelly-Moore; 1240 Acry-Shield Exterior Acrylic Flat Finish.
5. M. A. B. Paint; Sea Shore/Four Seasons Acrylic Latex House Paint 061 Line.
6. Pittsburgh Paints; 10 Line Pitt-Cryl Exterior Water Base Paint.
7. Pittsburgh Paints; 72 Line Sun-Proof Exterior Flat Latex House Paint.
8. Sherwin-Williams; SuperPaint Exterior Latex Flat House and Trim Paint, A80 Series.
9. Approved alternative

2.5 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint:

1. Benjamin Moore; Regal Wall Satin No. 215 Premium Interior Finishes Flat Finish.
2. Coronado; 26 Line Gold Acrylic Latex Flat Wall Paint.
3. ICI Dulux Paints; 1201-XXXX Dulux Ultra Velvet Sheen Interior Flat Latex Wall & Trim Finish.
4. Kelly-Moore; 550 Super Latex Interior Flat Wall Paint.
5. M. A. B. Paint; Rich Lux Wal-Shield Latex Flat 041 Line.
6. Pittsburgh Paints; 80-Line Wallhide Interior Wall Flat Latex Paint.
7. Sherwin-Williams; SuperPaint Interior Latex Flat Wall Paint, A86 Series.
8. Approved alternative

B. Interior Waterborne Clear Satin Varnish: Acrylic-based polyurethane.

1. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.
2. Coronado; 70-10 Aqua-Plastic Urethane Clear Satin.
3. ICI Dulux Paints; 1802-0000 WoodPride Interior Waterborne Aquacrylic Satin Varnish.
4. Kelly-Moore; 2097 Kel-Thane II Clear Acrylic Urethane--Satin.
5. M. A. B. Paint; Rich Lux Water Based Satin Polyurethane 088-900s.
6. Pittsburgh Paints; 77-49 Rez Satin Acrylic Clear Polyurethane.
7. Sherwin-Williams; Wood Classics Waterborne Polyurethane Satin, A68 Series.
8. Approved alternative

C. Paste Wax: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 APPLICATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
    c. If transparent finish is required, backprime with spar varnish.
    d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
    e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

    a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. Material Preparation:

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
5. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.

G. Sand lightly between each succeeding enamel or varnish coat.

H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Omit primer over metal surfaces that have been shop primed and touchup painted.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

L. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

M. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

N. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

O. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

3.2 CLEANING AND PROTECTING

A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.3 EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Masonry (Other Than Concrete Masonry Unit):

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Exterior concrete and masonry primer.
b. Finish Coats: Exterior flat acrylic paint

B. Concrete Unit Masonry:

1. Acrylic Finish: Two finish coats over a block filler.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Exterior flat acrylic paint.

C. Smooth Wood:

1. Acrylic Finish: Two finish coat over a primer.

a. Primer: Exterior wood primer for acrylic enamels.
b. Finish Coats: Exterior full-gloss acrylic enamel for wood.

D. Wood Trim:

1. Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Exterior wood primer for acrylic enamels.
b. Finish Coats: Exterior full-gloss acrylic enamel for wood

E. Plywood:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Exterior wood primer for acrylic enamels.
b. Finish Coats: Exterior low-luster acrylic paint.

F. Ferrous Metal:

1. Acrylic Finish: Two finish coats over a rust-inhibitive primer.

a. Primer: Exterior ferrous-metal primer (not required on shop-primed items).
b. Finish Coats: Exterior semigloss acrylic for ferrous and other metals.

G. Zinc-Coated Metal:

1. Acrylic Finish: Two finish coats over a galvanized metal primer.

a. Primer: Exterior galvanized metal primer.
b. Finish Coats: Exterior semigloss acrylic enamel for ferrous and other metals.

3.4 INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other Than Concrete Masonry Unit):

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior concrete and masonry primer.
b. Finish Coats: Interior flat acrylic paint

B. Concrete Masonry Unit:

1. Acrylic Finish: Two finish coat over a block filler.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Interior flat acrylic paint

C. Plaster:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior plaster primer.
b. Finish Coats: Interior flat acrylic paint

D. Wood and Hardboard:

1. Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior full-gloss acrylic enamel.

E. Ferrous Metal:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

F. Zinc-Coated Metal:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior semigloss acrylic enamel

3.5 INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stain-Varnish Finish: Two finish coats of varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.

1. Filler Coat: Open-grain wood filler.
2. Stain Coat: Interior wood stain.
3. Sealer Coat: Clear sanding sealer.
4. Finish Coats: Interior polyurethane-based clear satin varnish.

B. Natural-Varnish Finish: Two finish coats of varnish over a sealer coat and a filler coat.

1. Filler Coat: Open-grain wood filler.

2. Sealer Coat: Clear sanding sealer.
3. Finish Coats: Interior polyurethane-based clear satin varnish.

C. Wax-Polished Finish: Three finish coats of paste wax over a sealer coat and alkyd-based interior wood stain.

1. Stain Coat: Interior wood stain.
2. Sealer Coat: Clear sanding sealer.
3. Finish Coats: Paste wax.

END OF SECTION 09920

Division 09 Finishes Specification

Division 15 Mechanical Specification

SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS

PART 1 GENERAL

1.01 REFERENCES

.1 The "General Conditions", the "Supplementary Conditions", and all Sections of Division 1 apply to and are a part of this Section of the Specification.

1.02 APPLICATION

.1 This Section applies to and is an integral part of all Sections of Division 15 of the Specification.

1.03 DEFINITIONS

.1 The following are definitions of words found in Sections of Division 15 of the Specification and on associated drawings:

- .1 "concealed" - means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions;
- .2 "exposed" - means work normally visible, including work in equipment rooms, tunnels, and similar spaces;
- .3 "provide" (and tenses of "provide") - means supply and install complete;
- .4 "install" (and tenses of "install") - means secure in position and connect complete;
- .5 "supply" - means supply only;
- .6 "Ministry" – means Government of Bermuda, Ministry of Works and Engineering.

1.04 EXAMINATION OF SITE

.1 Carefully examine all conditions at the site that will or may affect mechanical work, and become familiar with site conditions, the building construction, finishes, and work associated with mechanical work in order that your Bid Price includes for everything necessary for completion of the mechanical work.

1.05 PLANNING AND LAYOUT OF WORK

.1 The exact locations and routing of mechanical and electrical services shall be properly planned, coordinated and established with all affected trades prior to installation such that the services will clear each other as well as any obstructions. Generally, give the right of way to piping

requiring uniform pitch and locate and arrange other services to suit.

.2 Prepare working detail drawings, supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of services and/or equipment occur, or where the work due to architectural and structural considerations involves special study and treatment. Submit working detail drawings to the Consultant in shop drawing form for review before the affected work is installed.

.3 Carry out all alterations in the arrangement of work that has been installed without proper co-ordination, study, and review, even if in accordance with the contract documents, in order to conceal the work behind finishes, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

1.06 DOCUMENTS

.1 The drawings and Specification are intended to be co-operative. Perform all work that is shown, specified or reasonably implied on the drawings but not mentioned in the Specification, or vice-versa, as though fully covered by both. When the scale and date of the drawings are the same, or when the discrepancy exists within the Specification, include the most costly arrangement. In the case of discrepancies or conflicts between the drawings and Specification, the documents will govern in the following order:

.1 the Specification;
.2 drawings of larger scale;
.3 drawings of smaller scale;
.4 drawings of later date when the scale of the drawings is the same.

.2 Sections of Division 15 are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections shall be read as a whole.

.3 The mechanical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. The drawings are intended to convey the scope of work and do not show architectural and structural details. The locations of materials and equipment shown may be altered, when reviewed by the Consultant, to meet requirements of the material and/or equipment, other equipment and systems being installed, and of the building. Provide all fittings, offsets, transformations, and similar items required as a result of

obstructions and other architectural or structural details but not shown on the mechanical drawings.

.4 The Specification does not generally indicate the specific number of items or amounts of material required. The Specification is intended to provide product data and installation requirements. It is necessary to refer to schedules, drawings (layouts, riser diagrams, schematics, details) and the Specification to determine correct quantities. In Division 15 of the Specification, singular may be read as plural, and vice-versa.

.5 The drawings and specifications are prepared solely for use by the party with whom the Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any party with whom the Consultant has not entered into a contract.

1.07 SHOP DRAWINGS

.1 Submit for review, properly identified and dimensioned shop drawings showing in detail the design, construction and performance of equipment and materials as requested in Sections of Division 15 of the Specification.

.2 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS", include your company name, the submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned for resubmittal. The number of copies of shop drawings shall be ten (10).

.3 The Consultant will review shop drawings and will indicate his review status by stamping shop drawing copies as follows:

.1 "REVIEWED" or "REVIEWED AS NOTED" - If the Consultant's review of shop drawing is final, the Consultant will stamp the shop drawing "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked);

.2 "RETURNED FOR CORRECTION" - If the Consultant's review of shop drawing is not final, the Consultant will stamp the shop drawing "RETURNED FOR CORRECTION", mark the submission with his comments, and return the submission. Revise the shop drawing in accordance with the Consultant's notations and resubmit.

.4 It is understood that the following shall be read in conjunction with the wording on the Consultant's shop drawing review stamp applied to each and every shop drawing submitted:

"THIS REVIEW BY THE CONSULTANT IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH THE GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT THE CONSULTANT APPROVES THE DETAIL DESIGN INHERENT IN THE SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH THE CONTRACTOR, AND SUCH REVIEW DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY FOR ERRORS OR OMISSIONS IN THE SHOP DRAWINGS OR OF HIS RESPONSIBILITY FOR MEETING ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT THE JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR CO-ORDINATION OF THE WORK OF ALL SUBTRADES".

1.08 WORK STANDARDS

.1 Where regulatory codes, standards and regulations are at variance with the drawings and Specification, the more stringent requirement will apply.

.2 Where any code, regulation, by-law or standard is quoted it means, unless otherwise specifically noted, the current edition including all revisions or amendments at the time of the contract. Where references are made to printed instructions, it means the current edition of such instructions.

1.09 PERMITS, CERTIFICATES AND FEES

.1 Obtain and pay for all permits required to complete mechanical work.

.2 Include in each copy of operating and maintenance instruction manuals, copies of inspection certificates issued by governing authorities to certify that the completed work is in accordance with the regulations of the governing authorities and is acceptable to them.

1.10 CHANGES OR REVISIONS TO THE WORK

.1 Wherever the Consultant proposes in writing to make a change or revision to the design, arrangement, quantity or type of any work from that called for on or in the contract documents, submit to the Consultant for approval, a detailed, itemized, estimate breakdown of the cost of all equipment, materials and labour entering into each change or revision.

.2 Do not execute any changes or revisions until written authorization for such changes or revisions has been issued by the Consultant

.3 Note: For any revision which includes deleted work as well as additional work, the total cost of the deleted work must be subtracted from the cost of the additional work before adding percentages for overhead and profit.

1.11 CLEANING UP

.1 During construction, and on a daily basis, keep the site reasonably clear of rubbish and waste material resulting from mechanical work to the satisfaction of the Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove all of your rubbish and debris, and arrange for and pay for the repair of any damage caused as a result of mechanical work.

1.12 PROTECTION OF EQUIPMENT AND MATERIALS

.1 Properly protect all mechanical equipment and materials on site from damage due to the elements, the mechanical work and the work of other trades, to the satisfaction of the Consultant. All equipment and materials must be in new condition when the work is substantially performed.

.2 Wherever possible, co-ordinate equipment deliveries with manufacturers and/or suppliers so that equipment is delivered to the site when it is required, or so that it can be stored within the building and protected from the elements.

1.13 TRIAL USAGE

.1 The Consultant reserves the right to use any piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the

same before final completion and acceptance of the work. Such tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment and/or materials due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials and/or workmanship of any kind. Supply all labour and equipment required for such tests.

1.14 RECORD (AS-BUILT) DRAWINGS

.1 The drawings for this project have been prepared on a CAD system using Autocad Release 14.0 software. For the purpose of producing record "as-built" drawings, copies of contract drawings shall be purchased from the Owner, at the Contractor's expense of $5.00 U.S., per drawing, but with total minimum charge of $25.00 U.S.

.2 When work begins at the site, clearly and accurately mark on a bound set of white prints of the contract drawings, on a daily basis, all changes and deviations from the routing of piping and ductwork and locations of equipment shown on the contract drawings. changes and deviations include those made by addenda, change orders, and site instructions, and changes and deviations indicated on supplemental drawings issued with addenda, change orders, and site instructions

.3 Pay particular attention to accurately dimensioning the location of all concealed services terminated for future extension, all buried work and services, and work concealed within the building in inaccessible locations.

.4 Before applying for a Certificate of Substantial Performance of the Work, update a copy of the contract document drawing disk set(s) in accordance with the marked-up "as-built" white prints, thus forming an "as-built" drawing disk set(s). Provide complete set(s) of white prints produced from the updated disk set(s). Submit the "as-built" site drawing white prints, white prints produced from the disk set(s) and drawing disk set(s) to Consultant for review.

.5 Use the reviewed "as-built" drawing disk(s) set to provide reproducible mylar drawing set(s) thus forming true "as-built" set(s) of contract drawings. Submit the "as-built" sets of white prints, mylar prints and disks to the Consultant.

.6 All submitted drawings shall be of the same quality as the original contract document drawings.

1.15 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

.1 For each item of equipment for which a shop drawing is required (except for drains, plumbing fixtures and trim, and similar simple equipment), supply two (2), specific, indexed copies of equipment manufacturer's operating and maintenance instruction data manuals. Consolidate each copy of the data in an identified hard cover three-ring binder. Each binder shall include:
- .1 a copy of each "reviewed" shop drawing;
- .2 complete explanation of operation principles and sequences;
- .3 complete part lists with numbers;
- .4 recommended maintenance practices and precautions;
- .5 copies of all inspection certificates issued by regulatory authorities, including pressure vessel inspection certificates;
- .6 complete wiring and connection diagrams;
- .7 a copy of each valve tag chart;
- .8 a copy of the mechanical systems testing and balancing reports.

.2 Submit the operating and maintenance instruction manuals to the Consultant before applying for a Certificate of Substantial Performance of the Work.

.3 When shop drawings are returned to you marked "REVIEWED AS NOTED" with revisions marked on the shop drawing copies, such shop drawings shall be revised by the equipment supplier to incorporate the comments marked on the "reviewed" shop drawings and a clean updated copy is to be included in the operating and maintenance manual.

1.16 WARRANTY

.1 Warrant the mechanical work to be in strict accordance with the contract documents and free from defects for a period of one (1) year from the date of issue of a Certificate of Substantial Performance of the Work.

.2 Repair and/or replace any defects that appear in mechanical work within the warranty period, ordinary wear and tear and wilful damage by or carelessness of the Owner's staff or agents excepted, without additional expense to the Owner. Where such defects occur, be responsible for all costs incurred in making the defective work good, including repair or replacement of building finishes, other materials, or damage to other equipment caused by such defects, or by subsequent replacement and repairs.

1.17 EQUIPMENT AND MATERIALS

.1 Products shall be supplied from manufacturer's authorized local representative, unless otherwise noted. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Underwriters Laboratories (UL) Standards and the requirements of the authorities having jurisdiction. Unless otherwise specified, similar products i.e.: all valves, all control components, all vibration isolation, etc., shall be the product of one (1) manufacturer.

.2 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.

.3 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimensions of such equipment differs from the specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected.

.4 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by

reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment.

.5 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.

.6 Only base specified products, specified acceptable products or equipment listed as alternate will be considered for acceptance by the School Ministry. No proposed substitutions will be accepted.

1.18 BREAKDOWN OF MECHANICAL WORK COST

.1 Submit to the Consultant a typewritten breakdown of the mechanical work cost with a schedule of values of the various parts of the work, aggregating the total cost of the mechanical work.

.2 The extent of the breakdown shall be as directed by the Consultant. The breakdown must be acceptable to the Consultant and is required to assist in evaluation of monthly progress draws.

.3 Submit the breakdown within ten (10) days of written notification of acceptance of Bid and award of contract.

1.19 SUB-CONTRACTORS TO THE MECHANICAL CONTRACTOR

.1 The Mechanical Contractor agrees to employ those sub-contractors proposed in the Mechanical Form(s) of Tender and accepted by the Ministry at the signing of the Contract with the General Contractor.

.2 The Ministry may, for reasonable cause object to the use of a proposed Sub-Contractor and consequently, may require the Mechanical Contractor to employ one of the other Sub- Contractors or Bidders.

.3 In the event that the Ministry requires a change from a proposed Sub-Contactor originally proposed by the Mechanical Contractor, the Contract Price shall be adjusted by the difference in cost.

.4 The Mechanical Contractor shall not be required to employ as a Sub-Contractor, a firm to whom he may reasonably object.

1.20 ENERGY EFFICIENCY OF PRODUCTS

.1 Unless otherwise specified, material and equipment supplied shall meet or exceed minimum efficiencies and/or minimum performances of ASHRAE Standard ASHRAE/IES 90.1-1999.

1.21 COMMISSIONING

.1 A Commissioning Authority will be appointed by the Owner to oversee the commissioning activities of the mechanical contract. Cooperate and coordinate with the Authority. Perform all commissioning activities for all aspects of work provided in Division 15. Perform all corrective work identified by the Authority."

PART 2 PRODUCTS

NIL

PART 3 EXECUTION

NIL

END OF SECTION 15010

SECTION 15050 – BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 REFERENCES

.1 Section 15010 in this Division of the Specification applies to and is part of this Section of the Specification.

1.02 APPLICATION

.1 This Section specifies products, common criteria and characteristics, and methods and execution that are common to one (1) or more Sections of Division 15. It is intended as a supplement to succeeding Sections of Division 15 and shall be read accordingly.

1.03 SHOP DRAWINGS

.1 Submit shop drawings for all products specified in Part 2.

.2 Shop drawings for fire stopping and smoke seal materials and assemblies shall each show proposed materials, reinforcement, anchorage, fastening and method of installation, all in accordance with actual installation conditions.

1.04 SUBMITTALS

.1 Submit an affidavit stating that lead free solder was used for all soldered joints in copper potable water, drainage and vent piping.

1.05 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 The following work which is related to the work of Division 15 is specified in other Sections of other Divisions of the Specification:
- .1 installation of access doors in building finishes;
- .2 provision of large access doors and panels in building finishes;
- .3 installation of loose motor starters, unless otherwise noted;
- .4 power wiring connections to motor control centres;
- .5 provision of 115 volt control and interlock wiring, unless otherwise noted;
- .6 finish painting of exposed mechanical work;
- .7 provision of concrete work, including reinforcing and formwork for mechanical work;
- .8 flashing for mechanical work penetrating the roof.

1.06 REFERENCE CODES AND STANDARDS

.1 Codes and/or Standards published by various Societies and Associations listed below, may be referenced throughout this Section and other Sections of Division 15:

.1 Associated Air Balance Council (AABC);
.2 Air Movement and Control Association (AMCA);
.3 American National Standards Institute (ANSI);
.4 Air - Conditioning and Refrigeration Institute (ARI);
.5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE);
.6 The American Society of Mechanical Engineers (ASME);
.7 American Society of Testing and Materials (ASTM);
.8 American Water Works Association (AWWA);
.9 National Standards of Canada (CAN);
.10 Canadian Gas Association (CGA);
.11 Canadian General Standards Board (CGSB);
.12 Canadian Standards Association (CSA);
.13 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
.14 Factory Mutual Systems (FM);
.15 Institute of Electrical and Electronic Engineers (IEEE);
.16 International Standards Organization (ISO);
.17 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
.18 National Environmental Balancing Bureau (NEBB);
.19 National Fire Protection Association (NFPA);
.20 Occupational Safety & Health Administration (OSHA);
.21 Ontario Building Code (OBC);
.22 Thermal Insulation Association of Canada (TIAC);
.23 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA);
.24 Underwriter Laboratories Inc. (ULC).

PART 2 PRODUCTS

2.01 PIPE SLEEVES

.1 Minimum No. 24 USS gauge (0.635 mm thick) galvanized steel with an integral flange to secure the sleeve to formwork construction.

.2 Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Schedule 40 mild galvanized steel pipe.

2.02 PIPE ESCUTCHEON PLATES

.1 One-piece chrome plated black steel or stainless steel plates, sized to cover pipe sleeves or wall or slab openings and to fit tightly around the pipe or pipe insulation.

2.03 CAST IRON PIPE, FITTINGS AND JOINTS

.1 Class 4000 cast iron pipe and fittings to CSA B70 and CGSB 77-GP-2a.

.2 Centrifugally cast ductile iron to ANSI/AWWA C151/A21.51-91 complete with a cement mortar lining to ANSI/AWWA C104/A21.4-90 and a protective coating of bituminous paint, standard cement lined cast iron mechanical joint fittings to ANSI/AWWA C110/A21.10-1987 painted as for pipe, and rubber gasket joints to ANSI/AWWA C111/A21.11-90 with electric conductivity strips to bridge joints.

2.04 COPPER PIPE FITTINGS AND JOINTS

.1 DWV grade hard temper copper to CSA H7 and ASTM B306-88 "Copper Drainage Water Tube (DWV)", with forged copper solder type drainage fittings and 95% tin/5% Antimony solder joints.

.2 Type "K", "L" and “M” hard drawn seamless copper to CSA H7.6 and certified to ASTM B88-88 "Specification for Seamless Copper Water Tube", with forged copper solder type fittings to suit the pipe, and soldered joints, Englehard Corp. "SILVABRITE 100" or equal 4% silver/96% tin for cold water pipe, 95% tin/5% Antimony or for other pipe.

.3 Type “L” soft copper certified to ASTM B88-88 “seamless copper water tube” and supplied in a continuous coil of proper length with no joints possible. Where joints are required, they shall be compression type flared joint couplings to ANSI B16.26-88.

2.5 PLASTIC PIPE, FITTINGS AND JOINTS

.1 IPEX Inc., "Ultra- Rib", or equal rigid PVC sewer pipe and fittings with gasketted joints, Certified to CAN/CSA-B182.4-92 and to ASTM F794. Joints shall withstand 345 kPa hydrostatic pressure.

.2 IPEX Inc., "BLUE BRUTE", or equal, Class 150 "Ring-Tite" rigid PVC pressure pipe,, FM approved to 150 psi (1034 kPa) and certified to CSA/CAN3-B 137.3 up to 235 psi (1620 kPa) hydraulically tested to

four (4) times class rated operating pressure and complete with matching fittings.

2.6 PIPING UNIONS

.1 Dart Union Co. Ltd., or equal malleable iron, ground joint, brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 250 psi (1725 kPa) steam at 500 degrees F. (260 degrees C.).

2.7 PIPING AIR VENTS

.1 Flair Hydronics (Johnson Paterson), No. 16 or equal, 1/8" (3.2 mm) diameter manual valve with a wooden handle.

2.8 BALL VALVES

.1 Bronze ball valves, minimum 250 psi (1750 kPa) W.O.G. rated, with lever handles unless otherwise specified, and as follows:
   .1 for copper water piping, Jenkins Valves, Fig. No. 902-A with TFE seats and soldering ends;

.2 Acceptable manufacturers are Jenkins Valves, Crane Inc., Nibco Inc., Newman Hattersley Ltd., Kitz, Milwaukee Valve, Watts Regulator Ltd., Toyo Red & White and Victaulic Co. Ltd.

2.9 LUBRICATED PLUG VALVES

.1 Neo Metals Ltd., No. AR40034 screwed and or No. AR40114 flanged or equal CGA approved, cast iron, 150 psi (1035 kPa) rated lubricated plug valves, each complete with a lubricant screw, a lubricant valve, lubricant receptacle, a loose operator, and a plug with lubricant grooves circling the passage in both the open and closed position to ensure a positive seal.

.2 Acceptable manufacturers are Neo Metals and Newman Hattersley.

2.10 VALVE IDENTIFICATION TAGS

.1 Embree Marking Systems or W.H. Brady Co., non-ferrous metal valve tags with a stamped consecutive number filled in with black paint, and a heavy-gauge non-ferrous metal chain, ring, or "S" hook for attaching the tag to a valve stem or handle.

2.11 PIPING STRAINERS

.1 Spirax Sarco Ltd., cast iron wye shaped strainers, type IF-125 screwed and/or type AF-250 flanged, each suitable for working pressures to

130 psi (890 kPa), and complete with a removable type 304 stainless steel strainer screen with perforations sized to suit the application.

.2 Spirax Sarco Ltd., Type IT, screwed and/or type AF-250 flanged cast iron strainers, generally as specified above but suitable for working pressures in excess of 130 psi (890 kPa).

.3 Strainers 2" (50 mm) diameter and larger shall be complete with blowdown pipe connection tappings.

.4 Acceptable manufacturers are Spirax Sarco Ltd., ITT-Hoffman, Crane Inc., Armstrong Machine Works, and Victaulic Co. Ltd.

2.12 PIPING HANGERS AND SUPPORTS

.1 For horizontal piping above ground - adjustable wrought steel clevis hangers and/or adjustable malleable iron swivel ring hangers and/or steel offset pipe hooks and/or heavy steel pipe clips as required.

.2 For 2" (50 mm) diameter and larger horizontal piping above ground conveying a medium with an operating temperature 100 degrees F. (37.7 degrees C.) and greater - adjustable roller hangers.

.3 For vertical piping - wrought steel riser clamps and/or heavy steel pipe clips and/or 1/2" (12 mm) thick welded black structural steel plate anchor assemblies.

.4 Spring hangers for portions of piping connected to motorized and/or vibration isolated equipment - spring hangers as specified in this Section in the article entitled "VIBRATION ISOLATION MATERIALS".

.5 For groups of pipe having the same slope - black structural steel angle wall brackets and/or black steel channels or angles of proper dimension supported by hanger rods, and/or Unistrut Ltd. or equal support assemblies.

.6 Hanger rods shall be black steel, round, threaded, to ASTM A36, sized to suit the loading but in any case minimum 3/8" (9.5 mm) diameter, complete with captive machine nuts with washers at hangers.

.7 Acceptable hanger and support manufacturers are Grinnell, Myatt, Hunt Manufacturing and Apex.

2.13 ELECTRIC MOTORS

.1 Motors shall conform to NEMA Standard MG1, applicable IEEE Standards, and applicable UL Standards unless otherwise noted.

.2 All motors located outside the building, and inside the building in areas exposed to the weather shall be totally enclosed fan cooled type unless otherwise noted, each with a service factor of 1.15 at 104 degrees F. (40 degrees C.) ambient temperature for all ratings.

.3 All other motors shall be open drip-proof type unless otherwise noted.

.4 Unless otherwise noted, motors less than 1/2 HP (0.4 KW) size shall be single phase, 115 volt, 60 cycle, A.C. condenser type.

.5 Unless otherwise noted, motors 1/2 HP (0.4 KW) size and larger shall be 3 phase, 60 cycle, 1750 RPM, EEMAC design "A", "B" or "C" for normal or high starting torque as required by the application.

.6 Motors 1 HP (.746 kW) and larger shall be T-Frame, A.C., 3 phase heavy duty service and have an motor efficiency level equal to or exceeding the Energy Policy Act of 1992 and Table 10.2 of ASHRAE 90.1-1999 as tested to either NEMA MG1, or IEEE 112B, and be approved under the National Electrical Code.

.7 Each motor shall be suitable for direct coupling or V-belt drive as required.

.8 The frame of each 3-phase motor shall be constructed of corrosion-resistant cast iron with integrally cast feet except for smaller drip-proof motors which may have a rolled steel frame and welded feet. End brackets shall also be constructed of cast iron with precision machined bearing fits. The stator core assembly of each motor shall consist of stacked laminations of specially selected electrical grade steel. Insulation materials shall be non-hygroscopic and meet or exceed Class "B" definition. Motor temperature ratings shall not exceed Class "B" temperature limits when the motor is operated at full load in a maximum ambient temperature of 104 degrees F. (40 degrees C.).

.9 Rotor windings shall be die-cast aluminum, surface treated for minimum rotor losses. Each shaft shall be dynamically balanced.

.10 Bearings, unless otherwise noted, shall be grease lubricated with readily accessible plugs or fittings to allow "in-service" regreasing. Bearings shall be ball type, double shielded, single row width, made from vacuum degassed steel, except for large belted frames where roller bearings are required.

.11 Acceptable manufacturers for motors 1 Hp. (0.75 kW) and larger are US Motors, TECO (Westinghouse Canada Inc.), WEG (V.J. Pamensky), Lincoln Electric Co. Ltd., and Toshiba International Corp.

.12 Acceptable manufacturers for motors less than 1 Hp. (0.75 kW) are Canadian General Electric Co. Ltd., Emerson Electric Canada Ltd., Baldor Electric Co. and LEESON Electric (Canada) Ltd.

PART 3 EXECUTION

3.01 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

.1 Unless otherwise noted, locate and arrange horizontal pipes and ducts above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.

.2 Unless otherwise noted, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas.

.3 Install all pipes and ducts parallel to building lines.

.4 Neatly group and arrange all exposed work.

.5 Do not make pipe joints in wall or slabs.

.6 Locate all valves, dampers and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical piping in shafts, pipe spaces or partitions, locate the accessories at the floor level.

.7 Make all connections between pipes of different materials using proper approved adapters. Provide cast brass dielectric type adapters at connections between steel and copper pipe. Do not make pipe joints in walls or slabs.

.8 Unless otherwise specified, provide a manual air vent at all high points of all water piping systems, at equipment connections, and wherever else shown and/or specified. Equip manual air vents with an air chamber consisting of a minimum 6" (150 mm) long length of the same type pipe as the piping in which the air vent is required, and with a diameter one (1) pipe size smaller.

.9 Provide unions or flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at all equipment connections, in long runs of piping at suitable regular intervals to permit removal of sections of piping, and wherever else indicated on the drawings.

.10 Ensure that equipment and material manufacturer's installation recommendations and instructions are followed unless otherwise noted herein or on the drawings, and unless such instructions and recommendations contradict governing codes and regulations.

.11 Carefully clean all ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.12 Install piping and ductwork which shall be insulated such that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the pipe or duct except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.

.13 Inspect surfaces and structure prepared by other trades before performing your work. Verify that surfaces or the structure to receive your work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of your work will constitute acceptance of such surfaces as being satisfactory.

.14 Ensure that exposed ferrous metal products, except ductwork and piping, have at least one (1) factory prime coat of alkyd metal primer, or paint such ferrous metal products with one (1) prime coat of alkyd metal primer on the job. Clean and wire brush ferrous metal products prior to application of prime coat.

.15 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work. Quality of repair to finish shall be equal to finish provided by equipment manufacturer.

3.02 PIPE JOINT REQUIREMENTS

.1 Ream all piping ends prior to making joints.

.2 Properly cut threads in screwed steel piping and coat male threads, unless otherwise noted, with red lead, Teflon tape or paste, or an

equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two (2) pipe threads shall remain exposed.

.3 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove all scale and oxide from the bevels and leave same smooth and clean. Ensure that personnel doing welding work are CWB certified welders and qualified for the particular pressure application worked on, and that all tests required by governing authorities are carried out, including X-ray tests where required for certain applications.

.4 Use Bonney Forge Ltd. or equal welding tees or welding outlet fittings for piping branches off mains, welded or socket type for pipes with welded fittings and threaded type for pipes with screwed fittings.

.5 Unless otherwise specified, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.

.6 Install mechanical joint fittings and couplings in accordance with the manufacturer's recommendations.

.7 Install PVC piping with gasketted joints in accordance with manufacturer's latest published specifications, instructions and recommendations with respect to pipe, coupling and fittings preparation and installation, and support anchoring and guiding of the piping system. Apply pipe and fitting manufacture supplied lubricant to gasket prior to mating components.

.8 For double wall piping, ensure split PVC jacket sleeve has been installed over end of pipe section prior to the connection of the carrier pipe. After carrier pipe has been joined and hydrostatically tested, centre split jacket over joint and hold in position with fibreglass tape. Mix field supplied insulation components and pour urethane foam into cavity around pipe joint through the opening in the split jacket. Trim cured urethane flush with jacket. Centre heat actuated shrink blanket over split jacket and position lap of shrink blanket over split in jacket to provide double layer protection. Adhere the shrink blanket tightly in place around the joint area using a propane torch. Ensure that all air pockets underneath the blanket have been worked out.

3.03 INSTALLATION OF PIPE SLEEVES

.1 Where pipes pass through concrete and/or masonry floors, walls, the roof, and any other such construction, provide pipe sleeves.

.2 Pipe sleeves in poured concrete slabs, unless otherwise noted, shall be minimum No. 24 USS gauge (0.635 mm thick) flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves.

.3 Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel pipe.

.4 Size sleeves, unless otherwise noted, to leave 1/2" (12 mm) clearance around the pipes, or where pipe is insulated, a 1/2" (12 mm) clearance around the pipe insulation.

.5 Pack and seal the void between the pipe sleeves and the pipe or pipe insulation for the length of the sleeves as follows:

- .1 pack sleeves in fire rated construction as specified hereinafter in the Article entitled “INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS”;
- .2 pack sleeves in non-fire rated interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound;
- .3 in exterior sleeves with water-tight with “Link-Seal” (Corrosion Service Company Ltd., Telephone No. 416-630-2600) mechanical seal assemblies installed between each sleeve and pipe;
- .4 pack sleeves in exterior walls with lead wool or oakum and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound.

.6 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.

.7 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 4" (100 mm) above the finished surface.

3.04 DUCT, DAMPER AND SIMILAR MATERIAL OPENINGS

.1 Duct openings, air inlet and outlet openings, and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.

3.05 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.

.2 Begin to prepare such drawings immediately upon notification of acceptance of tender and award of contract.

3.06 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitably secured over all exposed piping passing through walls, floors, ceilings, partitions, furrings, and similar construction in finished areas.

.2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

3.07 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide fasteners, anchors, braces and supports required to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner, capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where hangers are suspended from concrete slabs, install inserts before concrete is placed using inserts designed for the specific purpose.

.4 Where built-in inserts are inaccessible due to subsequent installation of ducts, pipes or other installations, use anchors appropriate to the load requirements, including safety factor.

.5 Where fastener installations are suspect, conduct on-site tests of installed fasteners, employing an independent testing laboratory acceptable to the Consultant, using properly engineered and calibrated force measuring meters.

.6 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure that is to support the products.

.7 Provide reinforcing or connecting supports where required to distribute the loading to the structural components.

.8 Do not use wood plugs and hammer impact fasteners. Anchors in floor topping fills are not acceptable. Secure anchors in floors to the structure.

.9 Fastenings which cause spalling or cracking of the structure or products to which anchorage is made are not acceptable.

.10 Space anchors within limits of load bearing or shear capacity and ensure they provide positive permanent anchorage.

3.08 INSTALLATION OF SHUT-OFF VALVES AND CHECK VALVES

.1 Provide shut-off valves in piping connections to equipment, to isolate piping risers and other sections of systems as shown, and wherever else indicated on the drawings.

.2 Ball valves shall not be installed in piping conveying fluid below 60°F (15°C).

.3 Valve stems in horizontal piping shall be pitched upward.

.4 Locate all shut-off valves in piping such that valve handles are positioned for easy operation. Wherever possible, install shut-off valves at uniform height.

3.9 INSTALLATION OF PIPING STRAINERS

.1 Provide strainers in piping where shown on the drawings and wherever specified herein or on the drawings.

.2 Equip strainers 2" (50 mm) diameter and larger with valved blowdown piping. Terminate blowdown piping over the nearest funnel and floor drain unless otherwise noted.

.3 Locate all strainers so they are easily accessible for service.

.4 Note that strainers are integral with inlet suction piping accessories specified in Section 15700 with vertical in-line pumps.

3.10 INSTALLATION OF PIPE HANGERS AND SUPPORTS

.1 Provide all required pipe hangers and supports.

.2 For insulated pipe, size the hanger or support to suit the insulated pipe and install the hanger or support on the outside of the insulation.

.3 Support underground pipe, unless otherwise noted, on a well tamped bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind.

.4 Support underground service piping penetrating building exterior walls or foundations in accordance with requirements of the detail.

.5 Ensure that all bedding and supports for underground pipes are flat and true and that allowances are made for pipe hubs, couplings, or other protrusions so that no voids are left between the pipe and the bedding.

.6 Hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in PART 2 of this Section, spaced in accordance with the following schedule:

PIPE MATERIAL	SIZE	PIPE HANGER OR SUPPORT SPACING
CAST IRON	ALL	AT EVERY JOINT - MAXIMUM 8'(2.4 m) INTERVALS
COPPER	TO 1" (25 mm)	6' (1.8 m) INTERVALS
	1-1/2" (38 mm) & UP	8' (2.4 m) INTERVALS
PLASTIC	ALL	IN ACCORDANCE WITH PIPE MANUFACTURER'S RECOMMENDATIONS

.7 Unless otherwise specified support vertical pipes by means of supports specified in PART 2 of this Section at maximum 12' (3.6 m) intervals or at every floor, whichever is lesser.

.8 Support vertical cast iron hub and spigot pattern piping at the hubs by means of a clamp bolted around the pipe and anchored to the floor or wall.

.9 Support all vertical cast iron plain end pipe (mechanical joint type), as for hub and spigot pipe but secure the clamp around the pipe under a flange integral with the pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support.

.10 Provide pipe covering shields, sized to suit insulated pipe, between insulated pipe and the pipe hanger or support for all piping not supported by roller hangers and/or supports.

.11 Support bare copper tubing using specially made copper or plastic coated copper tubing hangers, or provide proper plastic inserts or tape to isolate ferrous hangers and supports from contact with the bare copper tubing.

.12 Support galvanized piping with galvanized hangers.

.13 Where pipes having the same slope are grouped and a common hanger or support is used, space the hanger or support to suit the spacing requirement of the smallest pipe in the group.

.14 Where pipes change direction, either horizontally or vertically, provide a hanger or support on the horizontal pipe not more than 12" (300 mm) from the elbow. Where pipes drop from tee branches, support the tees in both directions not more than 2" (50 mm) on each side of the tee.

.15 Provide all additional structural steel channels, angles and similar accessories required for support of pipes.

.16 Do not use perforated band, wire, chain or solid ring hangers.

.17 Do not pierce ductwork with hanger rods, and do not support piping from ductwork or duct support hardware.

3.11 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 Protect all exposed rotating parts such as belts drives, couplings, fly wheels, and fan wheels on all mechanical equipment with a guard.

.2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

.3 Where equipment oil level gauges, oil reservoirs, grease cups or grease gun fittings are integral with the equipment but are not easily accessible for service, extend to accessible locations.

3.12 PIPE LEAKAGE TESTING

.1 After new piping has been placed in position and all branch piping installed, but before the piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test all piping in the presence of governing authorities, if required, and the Consultant or his authorized representative.

.2 Drainage & Vent Piping:

.1 Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of two (2) hours. After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipes, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Make a smoke test if required by the Municipality.

.3 Domestic Water Piping:

.1 Test piping with cold water at a pressure of 1-1/2 times normal working pressure and maintain the pressure for a minimum of two (2) hours.

3.13 CONCRETE WORK FOR MECHANICAL SERVICES (BY OTHERS)

.1 Unless otherwise noted, all concrete work, including reinforcing and formwork, required for mechanical work shall be provided as part of the work of Division 3.

3.14 EXCAVATION AND BACKFILL

.1 Do all excavation, backfill and related work required for your work. Perform such work in accordance with requirements of Division 2,

except as modified by this Article. Examine the soil test report during the tender period.

.2 Grade the bottom of trench excavations as required.

.3 In firm, undisturbed soil, lay pipes directly on the soil.

.4 In rock and shale, excavate to 6" (150 mm) below and a minimum of 8" (200 mm) to either side of the pipe, and backfill to the required invert with granular "A" material compacted to minimum 95% Standard Proctor Density.

.5 Prepare new bedding under pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls and at manholes and catch basins. Compact to maximum possible density and support the pipe by 8" (200 mm) thick reinforced concrete cradles spanning full length between firm supports. Install reinforcing steel in the cradles or construct piers every 7.87' (2.4 m) or closer, down to solid load bearing strata. Provide a minimum of one (1) pier per length of pipe. Use the same method where pipes cross.

.6 Where excavation is necessary in proximity to and below the level of any footing, backfill with 2,000 psi (13,800 kPa) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of repose as established by the Consultant.

.7 Provide support over at least the bottom one-third (1/3) segment of the pipe in all bedding methods. Shape the excavation to fit pipe hubs, couplings and similar items and ensure even bearing along the barrels.

.8 Keep walls of trenches straight to at least 18" (450 mm) within the pipe design limits. Have excavations inspected at least once a week by authorities. Break-up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless specifically approved by the Consultant.

.9 Before backfilling, test work for leakage and arrange for the work to be inspected by the Consultant. Remove all shoring during backfilling.

.10 Backfill trenches within the building with clean sharp sand in individual layers of maximum 6" (150 mm) thickness compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum 12" (300 mm) above the top of the pipe. Hand or machine compact the balance up to grade.

.11 Backfill trenches outside the building (not under roads, parking lots or traffic areas), up to a compacted level of 18" (450 mm) thick above the pipe with granular "A" material hand compacted to a density of 95% Standard Proctor. Backfill the balance in 6" (150 mm) layers with approved excavated material, compacted to 95% Standard Proctor density.

.12 Backfill trenches outside the building under roads, parking lots or traffic areas with 1/4" (7 mm) crushed stone or granular "A" gravel in layers not exceeding 6" (150 mm) thickness, compacted to 100% Standard Proctor density up to grade level.

.13 Do not use water for consolidation or during compaction of backfill.

.14 Fill all depressions to correct grade level with appropriate material, after an adequate period has passed to reveal any settlement. Use maximum possible compaction. Pay all costs required to make good all damage caused by settlement.

.15 Dispose of surplus excavated materials as specified in Division 2.

.16 Do pumping as required to keep excavations free of water.

.17 The inverts and locations of existing site services shown on the drawings are approximate and it is your responsibility to confirm and satisfy yourself that the inverts and locations as shown are correct, prior to commencing work. Where discrepancies are found, immediately inform the Consultant and await a direction.

.18 Note: You will be held responsible for any damage done to existing underground services caused by neglect to determine and mark out the location of such services prior to excavation work commencing.

.19 Ensure that all underground water and drainage piping outside the building has a minimum of 3’-0” (900 mm) of cover.

3.15 FINISH PAINTING OF MECHANICAL WORK

.1 Unless otherwise noted, finish painting of exposed mechanical work will be done as part of the work of Division 9.

.2 Provide touch-up paint of pre-finished equipment, provide zinc rich prime painting of all ferrous metal supports and bracket, provide identification painting of conduit, duct and equipment to the Consultant's approval. Confirm colour requirements prior to ordering.

3.16 INSTRUCTIONS TO OWNER

.1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment specified in succeeding Sections of this Division of the Specification. Obtain in writing from the Consultant a list of the Owner's representatives to receive instructions.

.2 Arrange and pay for the services at the site of qualified technicians and other manufacturer's representatives to instruct on specialized portions of the installation.

.3 Submit to the Consultant prior to application for a Certificate of Substantial Performance, a complete list of systems for which instructions were given, stating for each system:
- .1 date instructions were given to the Owner's staff;
- .2 duration of instructions;
- .3 names of persons instructed;
- .4 other parties present (manufacturer's representatives, etc.).

.4 Obtain the signatures of the Owner's staff to verify they properly understood the system installation, operation and maintenance requirements and have received operating and maintenance manuals and record drawings.

END OF SECTION 15050

SECTION 15400 – PLUMBING SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

.1 Section 15010 in this Division of the Specification applies to and is a part of this Section of the Specification.

.2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products, and methods of execution that apply to this Section as well as to other Sections of Division 15.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 The following work which is related to the plumbing work is specified in other Sections of the Specification:
.1 plumbing fixtures and fittings;

1.03 SUBMITTALS

.1 Submit shop drawings for all plumbing materials and equipment specified in PART 2 of this Section.

PART 2 PRODUCTS

2.01 VENT PIPING ROOF FLASHING ACCESSORY

.1 Lexsuco Canada Ltd., spun aluminum vandal-proof, vent stack covers each complete with a hooded sleeve and an insulation sleeve all sized to suit the vent stack.

.2 Acceptable manufacturers are Lexsuco Canada Ltd. and Thaler Specialties Roofing Products Inc.

2.02 DRAINAGE PIPING CLEANOUTS

.1 TY fittings, with extra heavy brass plugs screwed into the fittings.

.2 J.R. Smith 4500 Series enamelled cast iron cleanout tees, each complete with a large access opening and gasketed removable cover with stainless steel hardware.

.3 Acceptable manufacturers are J.R. Smith, Watts Industries, Wade Industries Ltd., and Zurn Industries Ltd.

.4 Bronze or copper cleanout tees each complete with a bronze ferrule.

2.03 CLEANOUT TERMINATIONS

.1 Unless otherwise specified, J.R. Smith, oven cured epoxy enamel coated cast iron, adjustable, gasketed cleanout terminations as specified on the drawing symbol list, each complete with captive stainless steel screws and a cover to suit the floor finish.

.2 Acceptable manufacturers are J.R.Smith, Watts Industries, Wade Industries Ltd., and Zurn Industries Ltd.

2.04 DRAINS

.1 Unless otherwise specified, J.R. Smith, oven cured, epoxy coated cast iron body drains as specified on the drawing symbol list, each meeting requirements of CAN3-B79-M79 and complete with all required accessories.

.2 Acceptable manufacturers are J.R. Smith, Watts Industries, Wade Industries Ltd., and Zurn Industries Ltd.

.3 All drains connected with sanitary drainage piping and equipped with traps shall be complete with a ½" (12 mm) diameter trap primer tapping.

2.5 WATER PRESSURE REDUCING VALVES

.1 Watts Industries Inc., Series U5B, adjustable, bronze body pressure reducing valve with a high temperature resisting diaphragm, removable stainless steel seat and built-in thermal expansion by-pass check valve.

.2 Singer Valve Co. Ltd., series 106-PR, pilot operated, adjustable, pressure reducing valve as specified on the drawing(s), complete with a bronze globe valve modulated by a diaphragm which in turn is operated by the pilot.

.3 Acceptable manufacturers are Singer Valve Co. Ltd., Braukmann Controls Co. Ltd., Watts Industries Inc., and Spirax Sarco Ltd.

2.6 WATER PIPING VACUUM BREAKER

.1 Watts Industries (Canada) Inc., No. NF8 vacuum breaker that meets or exceeds ASSE 1019.

.2 Acceptable manufacturers are Watts Industries Inc., Hersey Products Inc. and Zurn Industries "Wilkins Division".

2.7 FIRE EXTINGUISHERS

.1 National Fire Equipment Ltd., Model ABC-5, 2.3 Kg, ULC listed and 3A:10BC rated pressurized dry chemical extinguishers, each complete with a wall mounting bracket and securing hardware.

.2 Acceptable manufacturers are National Fire Equipment Ltd., C.F.H. Industries Ltd., Pyrene and Wilson & Cousins.

PART 3 EXECUTION

3.01 SUPPLY OF FLASHING ACCESSORIES FOR ROOF VENT STACKS

.1 Supply a vent stack cover accessory for each vent stack penetrating the roof.

.2 Hand the vent stack cover to the roofing trade at the site for installation and flashing into roof construction as part of the roofing work.

.3 Install vent stack piping up through and to a height as per vent stack cover manufacturer's instructions.

3.02 DRAINAGE AND VENT PIPING INSTALLATION REQUIREMENTS

.1 Provide all required drainage and vent piping. Pipe, unless otherwise specified, shall be as follows:
- .1 for underground pipe inside the building and to points 5’ (1.5 m) outside building lines - cast iron or rigid PVC sewer pipe as specified in Section 15050;
- .2 for pipe inside the building and above ground in sizes larger than 3" (75 mm) diameter - cast iron;
- .3 for pipe inside the building and above ground in sizes to and including 3" (75 mm) diameter - type DWV copper;
- .4 for drainage pump discharge pipe connections inside the building and above ground, from the pump to the gravity discharge main, including valve connections – Schedule 40

galvanized steel with grooved end galvanized couplings and fittings;

.2 At your option, drain, waste and vent piping, 2-1/2" (65 mm) diameter to and including 6" (150 mm) diameter inside the building and above ground may be type "DWV" grooved end copper pipe, fittings and joints in lieu of solder joined copper piping.

.3 Install and slope underground drainage piping to inverts or slopes indicated on the drawings to facilitate straight and true gradients between the points shown. Verify available slopes before installing the pipes.

.4 Slope horizontal branches of vent piping down towards the fixture or pipe to which they connect with a minimum pitch of 2%.

.5 Provide cleanouts in drainage piping in locations as follows:
- .1 in the building drain or drains as close as possible to the inner face of the outside wall, and, if and where a building trap is installed, locate the cleanout on the downstream side of the building trap;
- .2 at or as close as practicable to the foot of each drainage stack;
- .3 at maximum 50’ (15 m) intervals in horizontal pipe 4" (100 mm) diameter and smaller;
- .4 at maximum 100’ (30 m) intervals in horizontal pipe larger than 4" (100 mm) diameter;
- .5 wherever else shown on the drawings.

.6 Cleanouts shall be the same diameter as the pipe in piping to and including 4" (100 mm) diameter, and not less than 4" (100 mm) in piping larger than 4" (100 mm) diameter.

.7 Cleanouts in vertical piping shall be cleanout tees, cast iron in piping 3" (75 mm) diameter and larger, copper or bronze in piping smaller than 3" (75 mm).

.8 Cleanouts in horizontal piping shall consist of TY fittings.

.9 Cleanouts in horizontal inaccessible piping such so underground piping shall consist of TY fittings extended up to cleanout terminations set flush with the finished floor.

.10 In waterproof areas, equip each termination with a flashing clamp device.

.11 Where cleanout terminations occur in finished areas, locate the terminations to the Consultant's direction and arrange piping to suit.

.12 Where cleanouts are concealed behind walls or partitions, install the cleanouts such that the cover is within 1" (25 mm) of the finished face of the wall or partition.

3.03 DOMESTIC WATER PIPING INSTALLATION REQUIREMENTS

.1 Provide all required domestic water piping with the requirements of the Uniform Building Code. Pipe, unless otherwise noted shall be as follows:
- .1 for underground service piping to inside building - Canron "Blue Brute" rigid PVC;
- .2 for service pipe inside the building and above ground from termination of underground main to and including meter connection and bypass and similar service entrance connections – Schedule 80 PVC.

.2 Slope all piping so that it can be completely drained.

.3 Provide an accessible manually operated air vent above the high point of each water piping system unless the systems are suitably vented through frequently used plumbing fixtures or outlets.

.4 Provide a vacuum breaker in piping connecting a hose cock or any other fitting to which a hose can be attached, unless a vacuum breaker is provided integral with the hose cock or similar fitting. Install in accordance with local standards.

.5 Provide shut-off valves to isolate each piece of equipment and wherever else shown.

.6 Provide shut-off valves to isolate all equipment and wherever else shown.

3.4 INSTALLATION OF FIRE EXTINGUISHERS

.1 Provide fire extinguishers where shown. Unless otherwise noted, wall mount each extinguisher with a mounting bracket.

3.5 PLUMBING PIPING CONNECTIONS FOR EQUIPMENT AND SYSTEMS

.1 Rough-in all required plumbing piping connections to equipment and systems. Confirm exact locations of equipment prior to roughing-in.

When equipment or systems are installed, connect from the roughed-in work unless otherwise specified.

END OF SECTION

SECTION 15670 - HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.1 Requirements

A The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated on the Drawings and specified herein.

B This Section covers furnishing and installing High Density Polyethylene (HDPE) pipelines complete, in place, in accordance with the requirements of the Contract Documents.

1.2 Related Work

A Section 02300 Earthwork.

PART 2 – PRODUCTS

2.1 General

A Materials shall consist of a black high-density polyethylene copolymer resin designed for extrusion for potable water and industrial applications per ASTM D1248 Type III Class C. The resin shall have a PE 3408 rating. The Manufacturer shall be ISO 9001 certified.

B All pipe, fittings, and valve joints shall be joined using butt fusion or flanging. Flanged connections shall be made using a stub and backing ring arrangement, with the use of a suitable gasket material meeting the requirements of ASTM F477.

C High Density Polyethylene piping systems shall have design pressure limit of 100 psig at SDR = 11, unless otherwise noted.

D High Density Polyethylene piping systems shall have design temperature limit of 120 degree F, unless otherwise noted.

2.2 Pipe

A HDPE pipe shall have SDR = 11 per ASTM D1248 Type III Class.

B HDPE Tee fittings shall be EF FPT Red Tee – Main length shall be 2 feet OAL available from Isco Industries.

2.3 Pipe Line Vents

A All vent valves shall be D-040 Combination Air Valve “Barak” with a 2” NPT threaded connection available from A.R.I. Flow Control Accessories Ltd.

2.4 Tracer Wire

A Tracing wire shall be T.W.U., number eight gauge, stranded, and insulated copper wire with 60 mm of black, cross-linked polyethylene (XLPE) insulation specifically manufactured for direct burial applications.

1.5 Service Saddles

Saddles for HDPE pipe shall be full circumference wide band with stainless steel band, nuts, bolts and outlet. Band shall be type 304 Stainless steel of minimum 18” gauge thickness.

PART 3 – EXECUTION

3.1 General

A Not applicable

3.2 Handling and Storage

A Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

B Storage: Pipe should be stored, if possible, at the job site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe should be stored in such a way as to prevent sagging or bending and protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets should be stored in a cool, dark place out of the direct rays of the run, preferably in original cartons.

3.3 Trenching and Backfill

A Trench excavation and backfill shall conform to the requirements of Section 02300 "Earthwork," and as specified herein.

3.4 Pipe Installation

A Pipe shall be graded in straight lines, taking care to avoid the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with bulkheads.

B Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.

C Pipe shall be cut by means of saws, power driven abrasive wheels or pipe cutters, which will produce a square cut. No wedge-type roller cutters will be permitted. After cutting, the end of the pipe shall be beveled using a beveling tool, portable type sander or abrasive disc.

D Joints shall be butt fused or flanged in accordance with the manufacturer's instructions.

E Pipe installed by the Contractor shall at the end of the completion of Works each day be capped with a temporary protection cap to keep the pipe free of debris and vermin.

F Welding of Pipe: Pipe may be welded to a maximum of 40-foot lengths. The Ministry has a welding machine available to the contractor for use. Prior to the use of the Ministry machine the Contractor shall provide a demonstration by their staff that they have a full understanding of the use and operation of the machine. Each weld shall have a unique identifying number stamped into the molten weld bead:

G Each weld shall have the following logged by the welder:Weld number.

1. Temperature of heater.
2. Pressure applied during the weld.
3. Time pressure was held for.
4. Date of weld.

H Where the pipe is buried tracer wire shall be laid flat and securely affixed to the pipe at three metre intervals. The wire shall be protected from damage during the execution of the works. No breaks or cuts in the tracer wire or tracer wire insulation shall be permitted. At water service saddles, the tracer wire shall not be allowed to be placed between the saddle and the water main. Except for approved spliced in connections, tracer wire shall be continuous and without splices from test box to test box.

3.6 Field Testing and Disinfection

A The Contractor shall include in the Schedule the points in time at which it intends to perform hydrostatic testing ("Hydrostatic Test) of the installed pipe

B The Contractor shall include in his project Method Statement a detailed description of how it intends to conduct the hydrostatic tests.

C Upon completion of the install pipes shall be pressurized to 150 psi gauge pressure, after which time the hydrostatic test pump shall be shut off and the pipe sealed. The allowable test pressure shall be verified and confirmed with the Employer's Representative prior to performing any tests.

D The pipe shall maintain the pressure for 8 hours without the need for restarting of the pump, except for the addition of makeup water as defined in the Hydrostatic Test procedure.

E Gauge readings shall be taken at hourly intervals during the hydrostatic test and the readings shall be logged by the Contractor.

F The Employer's Representative shall be notified at least 48 hours in advance of the intent to perform a hydrostatic test and may elect to be present for the duration of the test.

G All joints in the tested section shall be inspected at least twice during the test period.

H In the event that the tested section fails the hydrostatic test, the test pressure shall be maintained by operating the pump until the leak is found.

I On completion of the repair of any leaks, the pipe shall be retested, until it has passed the test.

J All HDPE pipes in the Scope of Works noted above shall be subjected to Hydrostatic Testing.

K After Hydrostatic Testing the pipe shall be drained sufficiently to resume the Works.

3.7 Pipe Line Vents and Sample Points

A At all high points in the pipework, the Contractor shall install a venting valve and sampling valve.

B All vent valves and sampling valves shall be fully accessible and at the discretion of the Employer's Representative shall require vaults suitable for full access to the pipeline.

3.8 Thrust Blocks

A All thrust blocks shall be installed at the direction of the Employer's Representative. No concrete supports or thrust blocks shall be buried without the Employer's Representatives approval.

B In all cases, thrust blocks shall be completely buried and not be visible once the Works are complete.

***** END OF SECTION 015670 *****

SECTION 15850 – AIR FILTERS

PART 1 GENERAL

1.01 REFERENCES

.1 Section 15010 in Division 15 applies to and is a part of this Section of the Specification.

.2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products, and methods of execution that apply to this Section as well as to other Sections of Division 15.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 The following work which is related to the air handling work is specified in other Sections of the Specification:
- .1 all required starter interlock wiring and 115 volt control wiring;
- .2 supply of control components and control connections to all components.

1.03 SHOP DRAWINGS

.1 Submit shop drawings for all equipment specified in this Section. Include certified performance curves and noise evaluations with the fan shop drawings.

PART 2 PRODUCTS

2.01 AIR FILTERS

.1 Air filters shall have two-stage panel filter; First Stage, pre-filter made of polyester fibers; Second Stage, polyurethane foam. Minimum 1" thick.

.2 The frame shall be constructed of high wet-strength, moisture resistant beverage board. Two mating die-cut boxes shall be bonded together, forming a double wall around the entire filter. The pleated media pack shall be bonded to the inside of the frame on all four edges to prevent leakage and increase rigidity. The media pack support retainers, which are an integral part of the frame, shall be bonded to the pleats on both the air entering and air leaving sides, to allow proper spacing between pleats for a maximum dust holding capacity while between pleats for a maximum dust holding capacity while minimizing resistance. A welded wire pleat support grid shall be bonded to the air leaving side of the media to maintain uniform pleat shape and stability for proper

airflow and resistance. Provide access door for removal and replacement of filter.

PART 3 EXECUTION

3.01 INSTALLATION OF AIR FILTERS

.1 Provide all required air filters, located and arranged as shown and scheduled.

.2 Provide all required filter assembly frames and install to prevent air by-pass and to permit easy filter removal. Construct frames from the same material as the plenum, casing or duct the filters are associated.

.3 When air handling systems are complete and ready for start-up and testing, but building finishes are not complete and cleaning is not complete, provide minimum 20% average dust spot efficient (atmospheric) temporary glass fibre media in place of permanent filters prior to fan start-up, and provide temporary media over all return air openings in dirty, dusty, incomplete areas.

.4 Prior to application for a Certificate of Substantial Performance, and when the systems are ready for air balancing, remove temporary media and install permanent filters.

.5 For each filter bank, supply a spare set of replacement media and turn the filters over to the Owner prior to application for a Certificate of Substantial Performance of the Work.

END OF SECTION 1580

Division 16 Electrical Specification

SECTION 16010 – GENERAL PROVISION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Comply with the Instructions to Bidders. Conform to the conditions stated in the Contract Form, Supplementary Conditions, and Division 1 of the Specifications, which govern all Work of this contract.
B. Section 16010 applies to and governs all work of Division 16.
C. Wherever differences occur in the tender documents, the maximum condition governs and the bid shall be based on the greatest amount.

1.2 SCOPE

A. The work includes the design of the complete electrical installation, furnishing of all labour, materials, equipment and services necessary for, and reasonably incidental to, the completion of all electrical work. Co-ordination will be required with work described in other Packages if applicable.
B. The work shall be fully tested and left in perfect working order. Any incidental accessories necessary to make the work complete even if not particularly specified shall be furnished.
C. Take such measures and include in Bid Price for proper protection of building and its finishes at all times during construction. Coordinate protective work with all Sub-Contractors.
D. Cutting & patching of new and/or existing work.
E. Arrange, pay for, and carry out the following work in accordance with stipulations of respective Specification Divisions noted.
   1. Removal of obsolete materials and equipment for work of this Package.
F. The specifications are integral with the drawings which accompany them. Neither is to be used alone. Any item or subject omitted from one but implied in the other is properly required.

1.3 QUALITY ASSURANCE

A. The Contractor shall comply with all laws, rules, regulations, codes, orders and requests of all authorities having jurisdiction relating to this work.
B. The Contractor shall comply with the National Electrical Code and supplements. It is not the intention of the drawings and specification to reiterate the Code. It is expected that the Contractor will be responsible for access panels, ground fault receptacles, wire methods, etc. The Code is a minimum standard which the Contract Drawings may exceed.

C. The Contractor shall give all required notices, obtain all permits, licenses and certificates and pay all fees required and shall furnish a Certificate of Final Inspection and approvals from the Department of Planning to the Engineer/Engineer.

1.4 STANDARDS OF WORKMANSHIP

A. The Contractor shall execute all work in a competent manner which will present an acceptable appearance when completed, employing a competent supervisor and all necessary competent tradesmen.
B. Unless otherwise specified, the Contractor shall handle, install, operate and test products, and where necessary shall design and construct, all in accordance with the instructions and recommendations of the manufacturers.

1.5 SHOP DRAWINGS

A. The Contractor shall provide the Engineer for review, two copies of layout drawings, shop drawings, wiring schedules, equipment drawings and parts lists.
B. The Contractor shall allow the Engineer a minimum of seven days for review, and make any changes which may be required after which the Contractor shall re-submit a minimum of five copies of revised drawings for review.
C. Corrections or comments made on the shop drawings during review do not relieve the Contractor from compliance with the Contract Documents. This check is for the review only and general conformance with the design concept of the project and general compliance.
D. The Contractor shall confirm and correlate all quantities and dimensions.
E. Of drawings etc. submitted for approval, the Engineer shall retain one copy for his records and two copies for the Owner and return the remainder. The Contractor shall keep one complete set of shop drawings on site during construction.
F. No drawings etc. shall be used for the purpose of construction which do not have the Engineers shop drawings review stamp.
G. Shop drawings shall show details, dimensions, construction, size, arrangement, operating clearances, performance characteristics and capacities of products and parts of the work.
H. Only drawings bearing the Engineers and Contractor's stamps of certification will be reviewed.

1.6 MAINTENANCE/OPERATING MANUALS AND AS-BUILT DRAWINGS

A. Before acceptance two complete sets of maintenance/operating manuals, and one digital copy of "As-Built" drawings shall be submitted to and accepted by the Engineer.

B. The Contractor shall incorporate maintenance/operating instructions, shop drawings, etc., into indexed binders with the project title, date and subject typed on labels. Contents shall be arranged in the order of Sections of this specification, with material in sections arranged with similar information together. Instructions, information sheets, shop drawings, etc., shall be free from unnecessary markings (i.e., Engineer's review stamp, Contractor's Certification stamp, etc.,) and shall be originals from the manufacturer or supplier, with inapplicable information deleted.
C. Service instructions of all electrical equipment shall include lists of spare and replacement parts, assembly drawings, and names and addresses of all suppliers of equipment.
D. The Contractor shall include all technical information and data including design calculations, performance characteristics and capacities (i.e. manufacturer's ratings, test data, equipment operating data, etc.), reproducible wiring diagrams of all panels and control circuits, etc.
E. The Contractor shall provide maintenance and operating instructions of all equipment including a description of the sequence of operation.
F. The Contractor shall provide all equipment registration and inspection certificates, letters or certificates of approval, and of bonds or warranty, which shall show:
    1. Name/number of project.
    2. Guarantee commencement date (date of substantial Completion) unless equipment has been identified as deficient. Guarantee on deficient equipment shall commence on the date of acceptance of this equipment by the Engineer.
    3. Duration of guarantee.
    4. Clear indication of what is being guaranteed and what remedial action shall be taken under guarantee.

G. The Contractor shall provide complete copies of all panel board and distribution center load cards.
H. The Contractor shall identify the exact locations, elevations, and dimensions of all buried or concealed equipment, giving drawing/detail no. for reference.

1.7 PRODUCT DELIVERY, HANDLING, AND STORAGE

A. The Contractor shall use all means necessary to protect products during and after installation. Store neatly, out of way, and protect from damage materials and equipment supplied under this Division that are received at site by this Division.
B. The Contractor shall remove labels from fixtures, conduit, control panels etc. and remove dirt, rubbish, grease, etc., from all surfaces.
C. Immediately after letting of Contract, review material and equipment requirements. Determine supply and delivery dates of all items. Notify Engineer of any potential delays in completion of this project, in order that remedial action may be taken.

1.8 MANUFACTURERS

A. All manufacturers must be have been regularly engaged in the manufacture of the products of types and sizes required that have been in satisfactory use in similar service for not less than 5 years.

1.9 JOB CONDITIONS

A. Visit site during Tender period and examine all existing conditions which may affect work of this Division.
B. Examine Architectural, Engineering, Structural, Mechanical and Electrical drawings to ensure work may be satisfactorily completed.
C. Notify the Engineer upon discovery of conditions which adversely affect work. No allowance will be made after letting of Contract for any expenses incurred through failure to do so.
D. Submission of a Tender confirms that Contract Documents and site conditions are accepted without qualifications unless exceptions are specifically noted in the Tender.

1.10 WARRANTY

A. Submit to Engineer prior to date of Completion Performance, manufacturer's written warranties covering periods longer than one year or offering greater benefits than required in specifications and in the Owner's name.

1.11 INTERRUPTIONS

A. Arrange execution of work to maintain present water production operations and to minimize effect of work under this Division on existing site systems.
B. Prior to interrupting any existing service, notify the Engineer in writing at least 48 hours in advance and obtain his written authorization. Do not interrupt any existing service without Engineer's specific authorization.
C. Arrange time and duration of interruption through Engineer. Include in Bid Price, for all overtime or premium time hours necessary to minimize duration of service interruption.

PART 2- PRODUCTS

2.1 QUALITY OF PRODUCTS

A. All products provided shall be UL approved and new, unless otherwise specified.
B. If products specified are not UL, ETL or approved by some other nationally

recognized testing or certifying body, the Contractor shall make all modifications required for approval.

C. Products are generally indicated on the drawings, and shall be of the type, colours, sizes, depths, capacities, ratings and characteristics suitable for each installation.

2.2 UNIFORMITY OF MANUFACTURE

A. Unless otherwise specifically called for uniformity of manufacture shall be maintained for similar products throughout the work.

2.3 FIRE SEPARATION

A. Where fire separations are penetrated, the Contractor shall maintain the rating of the separation by using approved fire rated cable clamps such as Electrovert "Multi-Cable Transits". Transits shall not be sized less than 8" x 2" (200 x 50mm).

B. Small penetrations of cables, conduits or raceways, may be sealed by using a Dow Corning type 3-6548 silicone RTV foam, to maintain the fire rating prior to penetration.

PART 3- EXECUTION

3.1 CO-ORDINATION

A. The Contractor is responsible for coordinating with the Engineer, all other Contractors, and suppliers necessary for a complete installation, together with agreeing demarcation of builder's work such as trenching, cutting chases, installing anchors, bolts, pipe sleeves, hanger inserts, etc.

3.2 GENERALLY

A. The Contractor shall lay out the work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural drawings take precedence over all other drawings regarding locations of walls, doors and equipment.

B. The Contractor shall not cut structural members without the approval of the Engineer.

3.3 TEMPORARY LIGHTING AND POWER

A. The Contractor shall provide grounded extension cords and temporary lights and power service required for the work.

3.4 SEPARATION OF SERVICES

A. The Contractor shall maintain separation between wiring system and building piping,

duct work, etc., so that the wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

B. Wiring shall not be supported from pipes, ductwork, or ceiling hangers, etc.

3.5 EQUIPMENT STARTED DURING THE CONTRACT

A. The Contractor shall clean, lubricate, and adjust and/or overhaul (if necessary), equipment as required to return it to first-class condition, immediately prior to acceptance.
B. The Contractor shall ensure that all products, materials or component parts are UL, ETL approved, or approved by other nationally recognized body.

3.6 INSPECTION

A. Inspect installed work of other Sub-Contractors and verify that all such work is complete to point where work under this Division may properly commence.
B. Verify that all work of this Division may be executed in accordance with all pertinent codes and regulations, specifications, drawings, and referenced standards.
C. Review all drawings and verify all dimensions at the site. Report all discrepancies immediately to the Engineer before proceeding with any construction work or shop drawings.

3.7 INSTALLATION, APPLICATION AND PERFORMANCE

A. Relationship with Other Sub-Contractors: cooperate with other Sub-Contractors whose work affects or is affected by work of this Package to ensure satisfactory installation and to avoid delays. Provide all materials to be built in such as sleeves, anchors, and inserts, together with templates and/or measurements, promptly when required by other Sub-Contractors. Provide structural supports for all equipment to be mounted on or in walls. Provide 3/4" G1S painted plywood backboards for all equipment to be surface mounted to wall by this Contractor.
B. Installation Requirements
    1. The Engineer's drawings and instructions govern the location of all items. The Contractor shall prepare his own fully coordinated installation drawings prior to installation.
    2. Install equipment neatly to the satisfaction of the Engineer. Unless noted otherwise install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom.
    3. Confirm the exact location of devices, fixtures and connections. Confirm location of outlets for equipment supplied under other divisions
    4. Install all equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.
    5. Install metering and/or sensing devices to provide proper and reliable sampling of

quantities being measured. Install instruments to permit easy observation.

6. Provide suitable shielding and physical protection for all devices.
7. Install all products and services in accordance with the manufacturer's requirements and/or recommendations.
8. Provide all bases, supports, hangers and fasteners. Secure all products and services so as not to impose undue stresses on the structure and systems.
9. Use powder activated tools only with written permission of the Consultant and in accordance with the Owner's health & safety policies.
10. Ensure that the load onto structures does not exceed the maximum loading per square foot indicated on the structural drawings or as directed by the Engineer.

C. Contract Drawings
   1. The drawings of this Package are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
   2. Obtain accurate dimensions from the drawings, or by site measurement. Location and elevation of services are approximate and must be verified before construction is undertaken.
   3. Make changes where required to accommodate structural conditions, (beams, columns, etc.). Obtain Engineer's approval before proceeding.

   4. Adjust the location of materials and/or equipment as directed without adjustment to contract price, provided that the changes are requested before installation and do not affect material quantity. Outlets and/or equipment may be relocated up to 10 feet in any direction without a change to the contract price.
   5. The drawings are intended for tender pricing. The quantities and quality to be included in the bid price shall be based on the layout and specifications as shown on the documents.

D. Record Drawings:
   1. Maintain project "as-built" record drawings as per Section 01700 (See Spec).
   2. Record all deviations from contract documents caused by site conditions or by changes ordered by the Engineer. All deviations shall be recorded in red ink clearly and accurately, using industry standard drafting procedures consistent with quality and standards of Engineer's documents.
   3. Record all deviations as work progresses throughout the execution of this contract. Maintain record drawings on site at all times in clean, dry, legible condition, making them available for periodic review by the Engineer.
   4. Record location of concealed services, particularly underground services. Before commencing any backfilling, obtain accurate measurements and information concerning correct location and depth of services.

E. Cutting and Patching:
   1. Include cutting and patching as required in execution of work under respective sections of this Package.
   2. Cutting and patching of roofs, reinforced concrete structures, and of all openings greater in size than 50 sq. in. or 8" dia. shall be executed by specialists familiar with the

materials affected, and shall be performed in a manner to neither damage nor endanger the work. Coordinate, supervise and pay for all such cutting and patching.

3. No structural members shall be cut without consent of Engineer and all such cutting, when authorized, shall be done in strict accordance with instructions of Engineer. Where raceways and cabling must pass through structural members, and Engineer has approved burning of holes in such members, Contractor shall provide approved welded steel reinforcements of suitable dimensions adjacent to hole to effectively offset weakening effect of the hole upon member.
4. Maintain the integrity of fire rated assemblies where they are pierced by raceways and cabling.
5. Make good surfaces affected by this work and repair finish to satisfaction of Engineer. Finish painting, where required, will be provided under Division 9.

F. Painting:
   1. Repair minor damage to finish of equipment with standard factory applied baked enamel finish under the appropriate Sections of this Division. Replace entirely, items suffering major damage to finish if too extensive to be repaired in the opinion of the Engineer.
   2. Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.
   3. Paint both sides of plywood backboards prior to installation with fire retardant (intumescent type) paint, light grey. Paint to be as manufactured by Pittsburgh Paints "Speedhide" #42-7 or equivalent as manufactured by P.P.G., Glidden or Olympic.
   4. Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish primer.
      a) Paint indoor enclosures light grey.
   5. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting. Paint all galvanized materials that have been field cut, with cold galvanizing paint immediately after cutting.

G. Protection: protect finished and unfinished work by tarpaulins, or other covering, from damage due to execution of work under this Division. Repair damage to building resulting from failure to provide such protection to satisfaction of Engineer at no expense to Owner.

H. Support: support raceways, cabling and equipment from load bearing structures such as beams, joists, reinforced concrete slabs and concrete block walls, and do not support from steel roof deck, or wall or ceiling finishes.

3.8 PREPARATION

A. Existing services and equipment shall be relocated or removed to suit new construction and renovation work.

B. Services that are no longer required shall be removed or cut back and capped as indicated to the satisfaction of the Engineer.

C. Obtain written authorization from Engineer for renovation work that is not specifically indicated.

D. All existing raceways and wiring found in existing ceiling spaces of renovated areas, which are not supported as per this specification shall be re-supported to conform herewith.
   1. Existing boxes without covers or improperly mounted shall have cover plates added and be securely fastened to the building structure.

3.9 SPECIAL TOOLS AND SPARE PARTS

A. Identify spare parts containers as to contents and replacement parts number.
B. Provide one set of special tools required to service equipment as recommended by manufacturers.

3.10 SITE QUALITY CONTROL

A. Temporary and Trial Usage
   1. Owner shall have privilege of temporary and trial usage of installed equipment, as soon as Contractor claims that work is complete, for a period of time required to conduct a thorough test.
   2. Such usage shall not be construed as evidence of acceptance of work by Owner.
   3. Repair damage to work tested, resulting from such trial usage, by this Contractor.

3.11 ADJUST AND CLEAN

A. Clean all equipment and fixtures, lubricate all equipment installed under this Package and leave all items in perfect order ready for operation.
B. Test and adjust control devices, instrumentation, etc., installed in this Package after cleaning of systems and leave in perfect order ready for operation.
C. Remove from the premises upon completion of work of this Package, all debris, surplus and waste materials resulting from operations of this Package.
D. Cover wiring devices, fittings and covers to protect them from paint and other damage.

END OF SECTION 16010

SECTION 16120 - WIRES AND CABLES

PART 1 GENERAL

1.1 SCOPE

A. Electrical wiring, cable work and connectors.

1.2 QUALITY ASSURANCE

A. The Contractor shall comply with UL Stds 83,44 and 486A, and shall provide wiring/cabling and connector products which are UL-listed and labelled.
B. The Contractor shall comply with NEMA/IPCEA Stds Pub. #WC-5, and WC-30.

1.3 SUBMITTALS

A. The Contractor shall submit the manufacturer's current data on electrical wires, cables and connectors to the Engineer prior to installation.

1.4 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall deliver wire and cable properly packaged in factory fabricated containers, or wound on NEMA type wire and cable reels.
B. Wire and cable shall be stored in a clean dry space in original containers or on reels. Products shall be protected from the weather, damaging fumes, debris and traffic.
C. The Contractor shall handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing, and ensuring that dielectric resistance integrity of wires and cables is maintained.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wire/cable manufacturers are:
   1. American Insulated Wire Corp.
   2. American Wire and Cable Co.
   3. General Cable Corporation.
   4. Pirelli Cable Corp.
   5. Triangle PWC, Inc.
   6. Nexans
   7. Belden Div: Cooper Industries
B. Connector manufacturers are:
   1. AMP, Inc.
   2. O/Z - Gedney Co.
   3. Bumdy Corp.
   4. Appleton Electric.
   5. Square D Company.
   6. Thomas and Betts Co.

2.2 WIRES, CABLES AND CONNECTORS

A. The Contractor shall provide standard electrical wires/cables and connectors as indicated by current published product information.
B. Except as otherwise indicated, the Contractor shall provide copper conductors with a conductivity of not less than 98% at 20 deg C (68 deg F).

2.3 BUILDING WIRES

A. The Contractor shall select, from the following UL types, the wires with construction features which fulfill the application requirements:
   1. Type THW-2
      For dry and wet locations; max operating temperature 90 deg C (194 deg F). Insulation, flame-retardant, moisture-and heat-resistant, thermoplastic; conductor, annealed copper.
   2. Type THWN-2:
      For dry and wet locations; max operating temperature 90 deg C (194 deg F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
   3. Type XHHW:
      For dry locations; max operating temperature 90 deg C (194 deg F). Insulation, flame-retardant, cross-linked synthetic polymer; conductor, annealed copper.

2.4 GROUND (EARTH) WIRING

A. Ground (EARTH) wiring shall be stranded, soft-drawn bare copper conductors.

2.5 CONNECTORS

A. The Contractor shall ensure that connector materials mate and are compatible with conductor materials and cables
B. Where connectors are not indicated, the selection shall be determined to comply with requirements, and NEC and NEMA standards.
C. The Contractor shall select from the following, the types, classes and styles of connectors that fulfill the project requirements:
   1. Type: Pressure, crimp or compression as appropriate.
   2. Class: Uninsulated.
   3. Kind: Copper (for Cu to Cu connection).
   4. Style: Pigtail connection.
   5. Style: Wire-nut connections.

2.5 COLOUR CODING

A. Multi-conductor power cables shall have solid-colour conductor insulation.
B. Where the Architect approves numbered conductors, coloured PVC tapes shall be used at each end of the conductor to identify the phasing, as follows.

Three Phase/Single phase	Number	Colour
A/A	1	RED
B/B	2	BLACK
C/*	3	BLUE
Neutral	4/3	WHITE
Ground (Earth)	5/4	GREEN

PART 3 EXECUTION

3.1 CABLES/WIRES AND WIRING CONNECTORS

A. The Sub-Contractor shall comply with applicable portions of NEC, UL, and NEMA standards, and with NECA's "Standard of Installation".
B. The Sub-Contractor shall install UL Type THW wiring in conduit, for feeders and branch circuits.
C. Electrical connectors and terminals, including screws and bolts, shall be tightened in accordance with the manufacturer's published torque tightening requirements, or if none, to comply with UL Stds 486A and B.
D. Neutral conductors to be full capacity with white covering, and be continuous throughout system without fuses switches or breakers of any kind, unless otherwise indicated.
E. Wiring to be continuous within raceways. Spices only permitted at outlets or junction boxes.
F. Do not pull wiring into raceway until work that may cause injury is completed and conduits cleaned inside. Use approved lubricants that will not shorten life of insulations when pulling wires.

3.2 SITE QUALITY CONTROL AND TESTING

A. Prior to energising, the Sub-Contractor shall test wires and cables for continuity of circuitry, insulation resistance, and for short-circuits, and shall correct malfunctions when detected.
B. Subsequent to wire/cable hook-up, the Sub-Contractor shall energise circuitry and demonstrate functioning in accordance with requirements, and shall correct malfunctions, if any, and re-test.

C. The Sub-Contractor shall provide the Architect with a typed results of site quality control and testing, with a confirming signature, no later than one week after testing.

END OF SECTION 16120

SECTION 16135 – ELECTRICAL BOXES AND FITTINGS

PART 1 GENERAL

1.1 SCOPE

A. Electrical outlet, device, and junction boxes and fittings.

1.2 QUALITY ASSURANCE

A. The Contractor shall comply with applicable requirements of the current version of the NEC Article 370 as applicable to construction and installation of electrical wiring boxes and fittings.
B. The Contractor shall comply with UL Std No.'s 50, 514-series and 886, and shall provide electrical boxes and fittings which are UL-listed and labelled.
C. The Contractor shall comply with applicable requirements of NEMA Stds/Pub #OS 1, OS2, and Pub 250.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Box and fitting manufacturers are:
   1. Adalet-PLM Div, Scott Fetzer Co.
   2. Bell Electric; Square D Company
   3. Midland-Ross Corp.
   4. Pass and Seymour, Inc.
   5. RACO Div; Harvey Hubbell, Inc.
   6. Thomas & Betts Co.
   7. Crouse-Hinds Co.

2.2 OUTLET BOXES AND ACCESSORIES

A. Outlet wiring boxes shall have mounting holes, and cable and conduit-size knockout openings in bottom and sides. Boxes shall have corrosion-resistant covers and grounding screws for fastening surface and device type box covers, and for equipment type grounding.
B. Outlet box accessories shall be as required for each location including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, all to be compatible with outlet boxes.

2.3 DEVICE BOXES AND ACCESSORIES

A. Device boxes shall be non-gangable constructed for flush mounting with mounting holes, and with cable-size knockout openings in the bottom and ends, and with threaded screw holes in end plates for fastening devices. The Contractor shall provide cable clamps and corrosion-resistant screws for fastening, and for equipment type grounding.
B. Device box accessories shall be as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, all to be compatible with device boxes.

2.4 RAINTIGHT OUTLET BOXES

A. Raintight outlet wiring boxes shall be corrosion-resistant with conduit holes for fastening electrical conduit, face plates with spring-hinged water-tight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

2.5 JUNCTION AND PULL BOXES

A. The Contractor shall provide junction and pull boxes, with screw-on covers.

2.6 BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS

A. The Contractor shall provide corrosion-resistant box knockout closures, conduit locknuts and bushings, and offset connectors.

PART 3 EXECUTION

3.1 GENERALLY

A. Electrical boxes and fittings shall be installed in accordance applicable requirements of NEC and NECA's "Standard of Installation".
B. Electrical boxes shall be fastened rigidly to substrates, or structural surfaces, or solidly embedded in concrete or masonry. Outlets exposed to weather or moisture shall be weathertight.
C. Electrical boxes shall be accessible to enclosed electrical wiring.
D. Recessed outlet boxes shall be positioned accurately to allow for the surface finish thickness.
E. The Contractor shall provide electrical connections for installed boxes.
F. Electrical boxes shall be grounded properly upon completion of installation work and the Contractor shall demonstrate compliance with requirements.
G. Subsequent to their installation, the Contractor shall protect boxes from construction debris and damage.
H. All electrical boxes shall have screw-on covers, including those concealed, e.g. in ceiling spaces.

END OF SECTION 16135

SECTION 16180 – OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SCOPE

A. Moulded case circuit breakers.

1.2 QUALITY ASSURANCE

A. The Contractor shall comply with the requirements of UL 489, "Molded-Case Circuit Breakers and Circuit-Breaker Enclosures", and shall provide overcurrent protective devices which are UL-listed and labelled.
B. The Contractor shall comply with the requirements of NEMA Std Pub #AB 1, AB 2 and SG 3 pertaining to moulded-case power type circuit breakers.
C. The Contractor shall comply with the US Federal Specification W-C-375B/GEN pertaining to moulded-case circuit breakers.

PART 2PRODUCTS

2.1 MOULDED CASE CIRCUIT BREAKERS

A. The Contractor shall provide circuit breakers and ancillary components which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.
B. Circuit breaker manufacturers are:
   1. Federal Pacific Electric Co.
   2. General Switch Co.
   3. GTE Sylvania Inc.
   4. Cutler-Hammer Inc..
   5. Square D Co.
   6. Westinghouse Electric Corp.

2.2 MOULDED-CASE CIRCUIT BREAKERS

A. Moulded-case circuit breakers shall be factory-assembled, rated up to 1600 amperes, 600-volts, 60 Hz, 3-pole with 10,000 RMS symmetrical amperes interrupting ratings or 14,000 or 22,000 amperes where specifically stated.
B. Breakers shall have permanent thermal and instantaneous magnetic trips in each pole, and with fault-current limiting protection, ampere ratings as indicated, constructed with over-centre, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication.
C. Push-to-trip button cover for mechanical tripping circuit breakers, shall be constructed for mounting in any position and operating in an ambient temperature of 40 deg C.
D. The Contractor shall provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

E. The Contractor shall paint the front face of Fire Alarm System circuit breakers "Red". The Contractor shall provide lock-on devices on all circuit breakers, supplying Fire Alarm System Devices.

PART 3EXECUTION

3.1 GENERALLY

A. The Contractor shall test devices for continuity of circuitry and for short-circuits, prior to energisation of overcurrent protective devices.
B. The Contractor shall correct malfunctioning units on site, and re-test to demonstrate compliance, or replace with new units and proceed with re-testing.

3.2 CIRCUIT BREAKERS

A. Circuit breakers shall be fastened without causing mechanical stresses, twisting and with no misalignment being exerted by clamps, supports, or cabling.
B. The Contractor shall set site-adjustable circuit breakers for trip settings as indicated, subsequent to installation of units.
C. The Contractor shall inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.
D. The Contractor shall install lock-on devices on all Fire Alarm System circuit breakers.

END OF SECTION 16180

SECTION 16195 – SYSTEM IDENTIFICATION

PART 1GENERAL

1.1 SCOPE

A. Electrical identification tape, bands, signs and lettering etc.

1.2 QUALITY ASSURANCE

A. The Contractor shall comply with requirements of the current version of the NEMA Stds #WC-1 and WC-2, UL 969 and ANSI A13.1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The Contractor shall provide standard products of categories and types required for each application, with a single type for each application.
B. The Contractor shall provide electrical identification products of one of the following (for each type of marker):
   1. Brady, W. H. Co..
   2. Panduit Corp.
   3. LEM Products, Inc.
   4. Markal Company.
   5. National Band and Tag Co.
   6. Seton Name Plate Co.

2.2 COLOUR-CODED CONDUIT MARKERS

A. Conduit markers shall be standard printed, flexible or semi-rigid, permanent, plastic-sheet adhesive extending 360 degrees around conduits.
B. Joints of markers shall be adhesive lapped, with matching adhesive plastic tape at each end of marker, or a pre-tensioned snap-on.
C. Lettering generally shall indicate the voltage of conductor(s) in the conduit; 8" minimum length for 2" (50mm) and smaller conduit, 12" (300mm) length for larger conduit, and be orange markers with black letters.

2.3 COLOUR-CODED PLASTIC TAPE

A. Plastic tape shall be standard self-adhesive orange vinyl tape not less than 3 mils thick by 1-1/2" (38mm) wide.

2.4 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. Underground-type plastic line marker shall be standard permanent, bright-coloured,

continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide (150mm) x 4 mils thick. The tape shall be with printing which most accurately indicates the type of service of buried cable.

2.5 CABLE/CONDUCTOR IDENTIFICATION BANDS

A. Cable/conductor markers shall be standard aluminium wrap-around type of the size required for proper application, and numbered to show circuit identification.

2.6 PLASTICISED TAGS

A. Plasticised tags shall be standard printed or partially-printed accident-prevention and operational tags, of plasticised card stock with matt finish suitable for writing with brass grommets and wire fasteners, and with appropriate printed wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE. Flash Hazard warnings shall be affixed to all service entrance and distribution equipment operating at 480/277 Volts.

2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Engraved plastic-laminate signs shall be engraving stock melamine with red field and white core plies (letter colour), complying with FSL-P-387. The laminate shall be engraved with standard letter style and punched for mechanical fastening except where adhesive mounting is necessary because of the substrate.

2.8 LETTERING AND GRAPHICS GENERALLY

A. The Contractor shall co-ordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled.
B. The Contractor shall provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment, complying with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 EXECUTION

3.1 GENERALLY

A. For painted surfaces, identification shall be installed after the completion of painting.
B. Colour-coded identification for exposed electrical conduit shall match that of exposed mechanical piping in the same area.

3.2 UNDERGROUND CABLE IDENTIFICATION

A. The Contractor shall install line marker for every buried cable, whether direct buried or protected in conduit.

B. During back-filling/top-soiling of exterior underground electrical, signal or communication cables, the Contractor shall install continuous underground-type plastic line markers, located directly over buried lines 6" to 8" (150 to 200mm) below the finished grade.
C. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16" (400mm) the Contractor shall install a single line marker.

3.3 CONDUIT IDENTIFICATION

A. Color -coded identification for exposed electrical conduit shall match that of exposed mechanical piping in the same area.
B. Except as otherwise indicated, the Contractor shall use orange as the coded color for conduit

3.4 CABLE/CONDUCTOR IDENTIFICATION

A. The Contractor shall apply cable/conductor identification, including voltage, phase, and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided.
B. Identification shall match the marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for fire alarm system work.

END OF SECTION 16195

SECTION 16400 – ELECTRIC SERVICE AND DISTRIBUTIOIN

PART 1 GENERAL

1.01 REFERENCES

.1 Section 16010 applies to and is a part of this Section.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 The following work which is related to the electric service and distribution work is specified in other Sections of the Specification:

1.03 SHOP DRAWINGS

.1 Submit shop drawings for the following:
- .1 Main distribution panelboard.
- .2 Distribution transformers.
- .3 Secondary distribution panelboard.
- .4 Branch circuit panelboards.

1.04 ENVIRONMENTAL AND CORROSION PROTECTION

.1 Electrical distribution equipment, luminaries, conduits and raceways where exposed and of metal construction, shall be hot dipped galvanized steel and provide “coastal protection” level of corrosion protection. Enclosures and luminaire lensed frames respectively, shall be gasketted. The finish shall comply with latest ANSI C57.12.20 and C57.12.25 requirements regarding corrosion resistance to salt spray.

.2 Electrical distribution equipment located in the electrical service room, shall be weatherproof NEMA 3R rated in addition to above “coastal protection” level of corrosion protection.

PART 2 PRODUCTS

2.01 DUCT AND FISHCORD FOR CONCRETE ENCASED DUCTBANK

.1 NEMA/ANSI/UL approved, Canron Inc., PVC Type II plastic or FRE Composites Inc., "FRE" fibreglass reinforced epoxy conduit suitable for concrete encasement and in accordance with local Utility requirements.

.2 Brantford No. 450 plastic twine cord, or 3/4" (20 mm) diameter polyethylene rope approved by the Utility.

2.02 DISTRIBUTION PANELBOARDS

.1 Cutler-Hammer, “Pow-R-Line”, factory assembled dead front panelboards as per the schedule, manufactured to UL 67/50 NEMA, NEC and local Utility requirements.

.2 Panelboards shall be provided in the electrical room, as shown on drawings.

.3 Panelboards shall be single or double as required and complete with molded case, bolt-on circuit breakers calibrated for 104 degrees F. (40 degrees C.) ambient temperature. Both main lugs and neutral bar shall be located at the same end. Main lugs shall be shielded by a removable cover. Each circuit breaker shall be identified adjacent to the breaker handle. Breakers sized 225A or greater shall be provided with solid state adjustable trip units.

.4 Panelboard boxes shall be constructed of code gauge galvanized steel and shall be complete with removable ends and wiring gutter space on all sides.

.5 Floor mounted enclosures shall be free-standing type, reinforced as required to provide adequate strength.

.6 Enclosures shall be in accordance with NEMA 2 (drip-proof) requirements. The top of each shall be complete with a "drip-shield" consisting of a roof designed to shed water. Ventilation louvres shall be protected from penetration of water and doors shall be gasketed.

.7 The central plant switchboard shall be NEMA 3R (weatherproof and corrosion resistant)

.8 Panelboards shall be factory painted in ASA No. 61 grey enemel.

.9 Bus Bars:

.1 Main bus bars shall be constructed of top quality, 98% pure, rectangular copper bars, silver flashed or silver plated at all joints. Bus and connections shall be designed so that the maximum temperature rise in any part of the switchboard will not exceed 65 degrees C. over an ambient temperature of 40 degrees C. The bus shall be properly isolated and designed to carry the currents as noted.

.2 A continuous ground bus not less than 1/4" (6 mm) x 2" (50 mm) cross section area shall be provided for the length of the switchboard and solidly bolted to the steel framework. The ground bus shall be constructed of the same material as the main bus and shall be complete with suitable lugs for grounding connections outlined on the drawings. The ground bus shall have momentary current rating equal to or greater than that of the apparatus in the switchboard.

.10 Control Wiring:

.1 Each cell shall be complete with all required control wiring and terminal blocks. Control wiring shall be type "S1S", size No. 12, extra flexible wire with thermoplastic insulation. Control wiring shall be neatly harnessed, suitably secured and provided with markers at each end.

.2 Terminal blocks shall be of the pressure type and complete with removable marking strips.

.11 Switchboard Arrangement & Components:

.1 The panel-board components shall be as detailed on the drawings.

.12 Voltmeter, Ammeter & Accessories:

.1 Microprocessor based digital metering with system voltage protection and non-volatile memory.

.2 Current and potential transformers as required.

.13 Breakers:

.1 Cutler- Hammer, moulded case front operated. Non-automatic circuit breaker as scheduled and as required for application.
.2 Acceptable manufacturers are Cutler-Hammer, Siemens Electric Ltd.Schneider Electric(Federal Pioneer and Square D)

.14 Nameplates:

.1 Engraved Lamacoid nameplates, approximately 1/8" (3.2 mm) thick, indicating loads shall be rivetted to the front of the switchboard and shall extend to the handles of the respective breakers

.15 Accessories:

.1 The switchboard shall be complete with Manufacturer's standard accessories, spare parts and maintenance tool kit.

.16 Acceptable Manufacturers:

.1 Cutler-Hammer, Schneider Electric (Federal Pioneer) and Siemens Electric (with ITE breakers).

2.03 DISTRIBUTION TRANSFORMERS

.1 Hammond Manufacturing Co. Ltd., dry type transformers as per the drawing schedule, constructed and factory tested in accordance with the latest requirements of UL 1561/1562, ANSI C57.12.51, NEMA TR1/ST-1, IEC 76 and ASTM D635. Maximum losses shall be in compliance with local governing code requirements.

.2 The transformers shall be complete with:
- .1 a NEMA 2 sprinkler-proof ventilated enclosure with a rigid end frame, removable front and rear plates, a terminal compartment located at the bottom of the enclosure and drip shield;
- .2 class "H" silicone type coil insulation, such that the winding temperature rise will not exceed 220°C under full load in a 104 degrees F. (40 degrees C.) ambient temperature.

.3 Each transformer shall also be complete with:
- .1 K factory 13 rating as per ANSI/IEEE C57.110-1986;
- .2 copper windings;
- .3 core construction consisting of stacked laminations of high permeability silicone steel;
- .4 lugs or pressure type terminals to suit primary and secondary conductors;
- .5 four (4) 2-1/2% full capacity taps, two (2) above normal and two (2) below normal;
- .6 an integral vibration dampening system;
- .7 an ANSI No. 61 light grey enamel finish;
- .8 an aluminum nameplate indicating impedance rating, weight, connection diagram, style and serial number, riveted to the front of the enclosure.

.4 Transformers shall be enclosed in NEMA 3R corrosion resistant and weatherproof enclosure.

.5 Acceptable manufacturers are Hammond Manufacturing Co. Ltd., Schneider Electric (Federal Pioneer) and Polygon Transformers Inc.

2.04 BRANCH CIRCUIT PANELBOARDS

.1 Cutler-Hammer, factory assembled dead front panelboards as per the drawing schedule, manufactured to UL 67/50, NEMA PB1, NEC requirements and designed for sequence phase connection of branch circuit breakers.

.2 Panelboards as scheduled, shall generally be of the following types:
- .1 “DP1”, 277/480 volt, 3 phase, 4 wire panelboard , WITH bolt-on moulded case circuit breakers and an interrupting capacity of 65,000 amperes symmetrical at 480 volts.
- .2 "DP2", 120/208 volt, 3 phase, 4 wire panelboards with, bolt-on moulded case circuit breakers with an interrupting capacity of 25,000 amperes symmetrical at 208 volts;

.3 Circuit breakers connected to fire controls shall be complete with handle lock devices.

.4 Acceptable manufacturers are Cutler-Hammer, Schneider Electric (Federal Pioneer) and Siemens Electric.

2.05 DISTRIBUTION CONDUCTORS

.1 Conductors as specified in Section 16050, and type “RA90” conductors as specified below.

.2 Type “RA90” (X-LINK) conductors shall be Nexans., “CORFLEX II” cable suitable for 600 volt service and consisting of cross-linked polyethylene insulated single copper conductors, 194 degrees F. (90 degrees C.) rated, enclosed by a continuous extruded corrugated aluminium sheath with an overall PVC jacket. Provide non-ferrous mounting plate. Acceptable manufacturers are Nexans Wire Inc., BICC Cables and Aetna.

2.06 DISCONNECT SWITCHES

.1 Cutler-Hammer, heavy duty, NEMA/ANSI/UL approved, front operated with a handle suitable for padlocking in the "OFF" position and arranged so that the enclosure cover cannot be opened while the handle is in the "ON" position. Operating mechanisms shall be quick-break, positive acting with visible blades and a line terminal shield. Fusible units shall be complete with fuse clips suitable for HRC fuses, unless otherwise noted. The ampere rating, number of poles and fuse requirements shall be as indicated on the drawings.

.2 Acceptable manufacturers are Cutler-Hammer, Schneider Electric (Federal Pioneer), and Siemens Electric.

2.7 FUSES

.1 Unless otherwise indicated, fuses shall be English Electric Ltd., Form I, Class "J" HRC fuses for constantly running equipment, and Form II, Class "C" fuses for motor equipment that cycles "ON" and "OFF".

.2 Acceptable manufacturers are English Electric Ltd., Gould Shawmut Co., Noram and Bussmann.

PART 3 EXECUTION

3.01 INSTALLATION OF SECONDARY PANELBOARD

.1 Provide secondary panelboard where shown.

.2 Assemble the individual sections of the panelboardboard in accordance with the manufacturer's recommendations and instructions, and secure the assembly to the concrete base. Ensure that all bus joint bolts are torqued to the manufacturer's prescriptions.

.3 Arrange for the switchboard manufacturer to provide all necessary drawings for erection and installation of the switchboard. In addition, if required, obtain from the manufacturer all necessary copies of detail, erection, etc., drawings required for approval of the installation from the Utility and any other authority having jurisdiction. Obtain all required approvals.

.4 Install controls and displays at height of between a minimum 4' (1200 mm) to a maximum of 6' (1800 mm) above finished floor level.

.5 The switchboard shall be arranged as indicated on the drawings.

.6 Make all necessary incoming and outgoing power cable connections to the equipment in strict accordance with the equipment and cable manufacturer's recommendations. Ensure all connections, stress cones and terminations are suitable for specific incoming and outgoing cables.

.7 Arrange for and include costs for the switchgear manufacturer's personnel to provide inspection and testing of the switchgear prior to energizing the system.

3.02 INSTALLATION OF DISTRIBUTION TRANSFORMERS

.1 Provide distribution transformers where shown and connect complete.

.2 Secure transformers 75 KVA and larger to a concrete housekeeping pad on Vibro-Acoustics Ltd. type "RSR" vibration isolation pads.

.3 Ensure that the transformers are equipped with lugs or connections suitable for the primary and secondary connections indicated. Isolate primary and secondary connections from the transformer enclosures by means of 12" (300 mm) to 18" (450 mm) of liquid-tight flexible conduit.

.4 When installation is complete, test and check the secondary voltages. Make all required adjustments and furnish to the engineer a written report indicating the secondary voltage readings and any adjustments made to achieve the proper voltages. Furthermore, when the building is in normal use, re-check the voltages and make any required adjustments.

3.03 INSTALLATION OF DISTRIBUTION PANELBOARDS

.1 Provide distribution panelboards where shown on the drawings and connect complete.

.2 Install floor mounted panelboards on concrete housekeeping pads. Surface wall mount other panelboards, unless otherwise noted, independent of connecting conduit.

.3 Equip each panelboard with suitable lugs to accommodate main and branch conductors scheduled.

3.04 INSTALLATION OF BRANCH CIRCUIT PANELBOARDS

.1 Provide factory assembled branch circuit panelboards as indicated on the schedules found on the drawings.

.2 Support cabinets and enclosures independent of connecting conduit, and accurately install with reference to wall finishes.

.3 Equip panelboards with suitable lugs or provisions to accommodate the main and branch conductors scheduled.

.4 Turn over to the Architect, prior to application for a Certificate of Substantial Performance of the Work, a quantity of a three (3) keys for each panelboard cabinet or enclosure. All branch circuit panelboards shall be keyed alike.

.5 Identify all panelboard breakers in a permanent manner, and complete panelboard circuit directories to the Consultant's approval. Use Owner's actual room names/numbers. Provide copies of directories in maintenance manuals.

.6 Upon completion of the installation of the ground fault breakers, demonstrate in the presence of the Engineer that all protected circuits will "trip" when a simulated ground fault is applied to the "load" side of each circuit breaker/ ground fault interrupter combination. Megger the load side neutral on all GFI protected branch circuits to ensure that the neutral is not grounded on the load side on the GFI. Verify the GFI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads). Provide a written report confirming that all tests have been performed and that the system is functioning properly.

.7 Inspect, test and verify TVSS units after installation.

3.05 INSTALLATION OF DISTRIBUTION CONDUCTORS

.1 Provide all required distribution conductors. Install corflex II conductors in accordance with manufacturer’s instructions.

.2 Provide a Unistrut Corporation channel support system for overhead suspended "CORFLEX II" cable. The support system shall consist of channels on 3' (1 m) centres, supported by suitable threaded steel rods secured to the structure. Secure the cable on the channel at one (1) diameter spacing with suitable non-ferrous aluminum clips.

.3 Support surface mounted and vertical "CORFLEX II" cables at one (1) diameter spacing at 3' (1 m) centres by means of proper insulated non-ferrous two (2) hole clips secured to the building construction in an approved manner.

.4 Provide non-ferrous plate in pull box for corflex cable installation.

.5 Provide all required cable support system accessories which are not specified herein or shown on the drawings but are required for proper installation.

.6 Ground and bond single conductor "CORFLEX II" cables at both ends where the sheath currents do not affect the cable ampacity. For certain areas, where sheath currents will reduce the cable ampacity, ground and bond the cable at the supply end and isolate the cable at the load end as recommended by the cable manufacturer, and provide a No. 3/0 green TW ground conductor for each cable run.

.7 Do not use tie wraps for support of cables.

.8 Note that drawings are diagrammatic and do not accurately identify exact routing of any cables. Contractors to be responsible for determining exact routing to suit.

3.06 INSTALLATION OF DISCONNECT SWITCHES

.1 Provide safety switches (disconnects) as follows:
- .1 wherever shown on the drawings and/or specified herein;
- .2 wherever required by starter schedule drawings;
- .3 for motorized equipment which cannot be seen from the motor starter location or is more than 30' (9 m) from the starter location;
- .4 for all "packaged" equipment fed from a motor starter panel.

.2 Ensure that enclosures for safety switches located outside the building, in pool area or in pool mechanical room are NEMA 3R. All other enclosures shall be NEMA 2, sprinkler proof, unless otherwise noted.

3.7 INSTALLATION OF FUSES

.1 Provide a complete set of fuses for each fusible disconnect, motor starter, and similar fusible equipment provided or supplied by you.

.2 Supply three (3) spare fuses of each size and type used on the project, mount the fuses on a painted and identified plywood rack, and secure the rack in a location where later directed.

3.8 INSTALLATION OF ENCLOSED CIRCUIT BREAKERS

.1 Provide surface wall mounted, enclosed, circuit breakers for equipment where shown on the drawings. Connect complete as indicated.

.2 Confirm exact locations prior to roughing-in.

.3 Provide a Lamacoid identification nameplate for each enclosure.

3.9 GROUNDING

.1 Do all required grounding work in accordance with the drawings and in accordance with requirements of governing authorities, including the NEC. Provide Utility's grounding requirements for the high voltage transformers, Electrical Room and all equipment under their governing jurisdiction.

.2 Provide in the Electrical Room, a ground electrode grid consisting of a minimum of four (4) ground rods driven into the grade in a square arrangement, at spacing as shown on the drawing and interconnected with minimum No. 3/0 bare copper conductor. Ground rods shall be a minimum 3/4" (20 mm) diameter copper rods of minimum 10' (3 m) length.

.3 Provide 1/4" x 2" x 24" (6 mm x 50 mm x 600 mm) electrical grade copper ground bus in the Electrical Room, 12" (300 mm) above finished floor level.

Secure the ground bus on 3/4" (20 mm) standoff insulators. Provide ground electrode for pad mounted transformer and bond into main grounding system.

.4 Connect each room mesh grid with ground bus with minimum 3/0 copper ground conductor in conduit. Extend ground conductor to the incoming water service and connect ground conductor to any water meters.

.5 When the busses are in place and all bolts have been tightened and all lugs have been installed, coat the entire installation with two (2) 100% covering coats of suitable shellac to prevent the busses from oxidizing.

.6 Provide minimum No. 3/0 insulated ground wire from the ground bus to the switchboard, structure, floor, etc.,

.7 Throughout the complex, solidly ground the system and make all required grounding connections to all electrical devices and apparatus. Ground conductors shall be insulated copper wire connected with approved fittings in accordance with the NEC. Provide separate insulated ground wire for each isolated ground circuit.

.8 Provide FT-4 rated, minimum No. 3/0 AWG copper grounding conductors and 24” x 2" x 3/8" (600 mm x 50 mm x 9 mm) copper ground bus mounted on wall with standoff insulators and eight (8) drilled taped holes, in the main communications room. Connect ground bus to building ground system.

.9 Do not permit concrete to be poured until all grounding conductors and grounding connections to be embedded in the concrete are inspected and approved by engineer and/or local electrical utility.

.10 All ground connections in slab or buried underground shall be made using welded copper connections, "Cadweld" as supplied by Erico Products or "Thermoweld" as supplied by Burndy Ltd.

.11 Provide ground conductors as sized on drawings and in accordance with Codes and Standards requirements, but which shall be of size no smaller than the requirements specified herein this article.

3.10 ELECTRICAL CONNECTIONS FOR MECHANICAL, OWNER'S, ETC., EQUIPMENT

.1 In addition to providing electrical feeders and connections to equipment provided by Division 16, provide all required electrical connections to apparatus provided and/or supplied by Division 15/17, the Owner and as part of other Divisions of the Specification.

.2 Provide as detailed on the drawings, all required electrical connections including power and control wiring for equipment supplied by the Owner or other Divisions. Where shown on the drawings provide complete empty conduit systems with fish cord, with minimum diameters as sized on the drawings and all required junction boxes, pull boxes, outlet boxes, faceplates, sleeves, etc., as required. Provide disconnect switches, receptacles and all other required wiring and connection accessories. Co-ordinate all work with the

suppliers of the equipment to be provided with electrical connections.

.1 Division 15 will supply will provide Lamacoid identification throughout.

.3 Motor control centres will be supplied and set in position by Division 15.

.4 Be responsible for:

.1 mounting loose starters and providing "line" and "load" power connections;

.2 providing motor starter panels - conduit work at motor starter panels must be horizontally and vertically plumb and the installation shall be planned to avoid crossovers;

.3 making "line" side power connections to starters on "packaged" equipment;

.4 making "line side power connections to motor control centres and "load" side connections to motors or other apparatus supplied power from motor control centres;

.5 coordinating feeder entries to starters and starter assemblies with Division 15/17;

.6 providing additional disconnect switches complete with identification detailed on the drawings, or required by Code, or for apparatus which cannot be seen from its starter or is in excess of 30' (9 m) from its starter;

.7 connections to thermistors and provision of relays for required connections to starters;

.8 performing all required motor starter interlocking in accordance with requirements specified and as outlined on the starter schedule;

.9 providing an identification nameplate on each motor starter or disconnect;

.10 providing an identification nameplate on each motor control centre - the nameplate shall give the name, for example, MCC No. 1, and the voltage, for example, 600 volts;

.11 providing and attaching with stainless steel screws to each separately mounted 3-phase motor starter or group of 3-phase motor starters a suitably sized black-white-black Lamacoid nameplate engraved to read:

.12 providing "line" side power connections to Division 15/17 control system equipment.

.5 Note that you will be liable for replacing motors due to abuse of the above prior to acceptance of the work. If additional starts are required, it is recommended that none be made until all conditions affecting motor operation have been thoroughly investigated and the apparatus examined for evidence of excessive heating. Note that the number of motor starts should be kept to the absolute minimum since the life of the motor is affected by the number of starts.

.6 Repair all deficiencies found.

****END OF SECTION 16400****

SECTION 16515 – INTERIOR LIGHTING FIXTURES

PART 1 GENERAL

1.1 SCOPE

A. Lighting fixtures, lamps, ballasts, housings, lampholders, reflectors, starters and wiring.

1.2 QUALITY ASSURANCE

A. The Contractor shall comply with applicable requirements of NEMA Stds Pub #LE 1 and LE 2 pertaining to lighting equipment.

B. The Contractor shall comply with IES RP-1 pertaining to interior lighting fixtures.

C. The Contractor shall comply with UL standards, including Stds 486A and B, pertaining to interior lighting fixtures and components which shall be UL-listed and labelled.

D. The Contractor shall provide lamp ballasts that comply with Certified Ballast Manufacturers Association standards and which carry a CBM label.

1.3 SUBMITTALS

A. The Contractor shall submit the manufacturer's technical product data on interior lighting fixtures.

B. The Contractor shall submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical or numerical order, with the proposed fixtures and accessories clearly indicated on each sheet.

1.4 LAMPS USED FOR TEMPORARY LIGHTING

A. Lamps used for temporary light shall be replaced with new if they are burned out or faulty prior to acceptance.

PART 2 PRODUCTS

2.1 GENERAL

A. The Contractor shall provide lighting fixtures which are structurally well designed and constructed and which use new parts and materials of highest commercial grade available, and as stated in the manufacturer's catalogues and data sheets.

B. The Contractor shall review the drawings and specifications to verify ceiling types, modules, suspension systems appropriate to installation and provide required plaster rings, frames etc., necessary for mounting fixtures.

C. The Contractor shall use cadmium plated chains for suspended fixtures in unfinished areas.

2.2 MANUFACTURERS

A. Acceptable Manufacturers:

1. Emerson Electric Co.
2. Columbia Lighting Inc.
3. GTE Sylvania,Inc.
4. Holophane Div., Johns-Manville Corp.
5. McGraw-Edison Co.
6. Omega Lighting Div, Emerson Electric Co.
7. Lithonia Lighting.
8. Wide-Light Corp.

2.3 INTERIOR LIGHTING FIXTURES

A. The Sub-Contractor shall provide lighting fixtures of sizes, types, and ratings indicated; complete with, but not limited to, housings, energy efficient lamps, lampholders, reflectors, energy efficient ballasts, starters and wiring.

B. Fixtures shall be shipped factory-assembled, with parts and components required for a complete installation.

C. Fixtures shall be designed with concealed hinges and catches, with metal parts grounded as common unit, and constructed appropriately to dampen ballast-generated sounds.

D. Refer to Fixture Schedule for other requirements.

2.4 WIRING

A. Electrical wiring within fixtures shall be suitable for connecting to branch circuit wiring as follows: NEC Type AF for 120 volts, minimum #12 AWG.

2.5 FLUORESCENT LAMP BALLASTS

A. Low-energy fluorescent lamp ballasts shall be capable of operating lamp types indicated; with high power-factor, rapid-start, and low-noise features; Type 1; Class P; sound-rated A. As per ASHRAE/IES 90.1-1989 "Energy efficient design of new buildings" Section 6.4.4.

2.6 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. HID lamp ballasts shall be capable of operating lamp types with ratings indicated; reactor type, high power-factor, core and coil assembly encapsulated in non-melt resin; with the capacitor installed outside the ballast encapsulation for easy site replacement.

2.7 LAMPS

A. Lamp types are as follows:

1. Fluorescent lamps energy saving type.
3. Clear/phosphor coated metal halide.
4. High-pressure sodium lamps.

B. Refer to Fixture Schedule.

PART 3 EXECUTION

3.1 GENERALLY

A. Fixtures and/or fixture outlet boxes shall be provided with hangers to support properly the fixture weight. The design of hangers, method of fastening, other than those indicated or specified herein, shall be submitted to the Engineer for review.

B. Flush mounted fixtures shall be installed so as to eliminate light leakage between fixture frames and finished surfaces.

C. For recessed fixtures in ceilings other than the suspended grid type, the Contractor shall provide plaster frames, which shall be braced temporarily to prevent distortion during handling.

D. Electrical connectors and terminals, including screws and bolts, shall be tightened to comply with the tightening torques specified in UL Stds 486A and B.

E. Fixtures shall be fastened securely to indicated structural supports.

F. Solid pendant fixtures shall be checked to ensure they are plumb and level. Individually mounted pendant fixtures longer than 2' (600 mm) shall be provided with twin stem hangers, with ball aligners and provisions for minimum 1"(25mm) vertical adjustment.

G. Continuous rows of fixtures shall be mounted with one stem hanger more than the number of fixtures in the row.

H. Surface mounted fixtures longer than 2' (600mm) shall be supported at a point additional to the outlet box fixture stud.

3.2 CLEANING

A. The Contractor shall clean interior lighting fixtures of dirt and debris upon completion of installation, and protect installed fixtures from damage during the contract period.

3.3 TESTING

A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energised, the Contractor shall apply electrical energy to demonstrate capability and compliance with requirements.

B. The Contractor shall correct malfunctioning units on site, and re-test to demonstrate compliance; or shall replace with new units, and proceed with re-testing.

3.4 REMEDIAL WORK

A. The Contractor shall replace lamps in interior lighting fixtures which are noticeably dimmed after Contractor's use and testing, as judged by the Architect on Substantial Completion.

****END OF SECTION 16515****