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Part 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Comply with the Instructions to Bidders. Conform to the conditions stated in the Contract Agreement, General and Particular Conditions, specifications and drawings, which govern all Work of this contract.
- B. Wherever differences occur in the tender documents, the maximum condition governs and the bid shall be based on the greatest amount.

1.2 DESCRIPTION OF WORK

- A. The Ministry of Public Works (*hereinafter referred to as the "Ministry"*), proposes to install and set up a remote monitoring system for the Prospect Water Depot, 14 Headquarters, Hill, Devonshire, Bermuda
- B. The work is to be undertaken in two phases:
 - 1. Firstly install an electromagnetic flow measuring device and an Ultrasonic level indicator at locations shown on the drawings.
 - 2. The second phase of the contract comprises the provision of Scalable Remote monitoring system that will enable the client to connect to and manage Water and Sewage installations, machines and devices via the Internet. The solution shall be a web-based data acquisition, control, alarming, and management platform. Users shall have the ability to access, analyze, and export all monitoring data from various sources within the system

1.3 BUILDING DESCRIPTION

- A. The Prospect Water Depot is a Government owned and operated facility for the purpose of providing water treatment (reverse osmosis and ultra-filtration systems) to water coming from local wells and to supply potable water to the public from large capacity service reservoirs.
- B. The site has a single storey treatment building adjacent to three service reservoirs and there are a number of supplementary pumping facilities at the depot.

1.4 AUTHORITY HAVING JURISDICTION

- A. The entire installation shall be reviewed by the Government of Bermuda, Department of Planning Inspectors.

1.5 REVIEW AUTHORITY

- A. The system shall be reviewed by the Ministry's Project Manager (*hereinafter referred to as the "Project Manager"*). Any comments shall be directed to the Project Manager for review and action.



1.6 SCOPE

- A. The work includes the furnishing of all labour, materials, equipment and services necessary for, and reasonably incidental to, the completion of all the Work.
- 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. 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.

1.7 SERVICE MAINTENANCE AGREEMENT (SEPARATE ADDITIONAL PRICES)

- A. **Separate Additional Price #1:**
 - 1. Comprehensive Service Package including: Service, monitoring, testing, repair labour and materials, inspection and maintenance of Control & Monitoring System and Instrumentation Devices for **2 years after substantial completion.**
- B. **Separate Additional Price #2:**
 - 1. A Service Package that provides a six monthly health check visit to the plant. A survey of all equipment sensors control systems to be undertaken and a summary report to be produced no less than 7 days after the visit. This service to be provided for **2 years after substantial completion**

1.8 WORK INCLUDED

- A. This work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by Ministry.
- B. **Items obviously necessary, or reasonably implied, to complete the work, to be included as if shown on drawings and noted in the specifications.**
- C. All materials, tools, appliances, apparatus, and labour necessary for the execution, erection, and completion of the systems described herein shall be furnished. This includes providing lighting and power for own work.

1.9 CONTRACT DRAWINGS

- A. The drawings of this Package are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
- B. Based on the information, layout and specifications as shown on the contract documents.

1.10 EXTRA WORK

- A. Any extra work ordered to be done shall be governed by the specification of this contract unless specific instructions or clauses are contained in a Change Variation. In such cases, these instructions or clauses shall supersede those of the specification for that particular application only.



1.11 REGULATIONS

- A. All work associated with this project shall be in accordance with these code specifications and the following standards. Where there is a conflict between standards, the most restrictive will apply.
 - 1. Bermuda Building Code.
 - 2. Bermuda Health and Safety Work Act.
 - 3. International Mechanical Code.
 - 4. International Plumbing Code.

1.12 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.

1.13 PERMITS, LICENSES, FEES

- A. Contractor will apply and pay for all permits. Pay for any damage or security deposits required by jurisdictional authorities in connection with the completion of this project.
- B. Where permits, licenses and inspection fees are required by Authorities Having Jurisdiction for specific trade functions, they shall be obtained by particular trade responsible for that work.

1.14 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.

1.15 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.
- B. Immediately after letting of Contract, review material and equipment requirements. Determine supply and delivery dates of all items. Notify Project Manager of any potential delays in completion of this project, in order that remedial action may be taken.

1.16 JOB CONDITIONS

- A. It is recommended that a representative of the bidder visit the site during Tender period and examine all existing conditions which may affect work of this Division. Examine all drawings to ensure work may be satisfactorily completed. Notify the Project Manager 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.
- B. Submission of a Tender confirms that Contract Documents and site conditions are accepted without qualifications unless exceptions are specifically noted in the Tender.



1.17 INTERRUPTIONS

- A. Arrange execution of work to maintain present building operations and to minimize effect of work under this Division on existing operations.
- B. Prior to interrupting any existing service, notify Project Manager in writing at least 48 hours in advance and obtain his written authorization. Do not interrupt any existing service without Project Manager's specific authorization.
- C. Arrange time and duration of interruption through Project Manager. Include in Bid Price, for all overtime or premium time hours necessary to minimize duration of service interruption.

1.18 GUARANTEE

- A. Submit to Project Manager prior to date of Completion Performance, manufacturers' written warranties covering periods longer than one year or offering greater benefits than required in specifications and in the Ministry's name.
- B. Within a period of 1 year from the date of issue of a Certificate of Substantial Performance of the Work, replace or repair at own expense any defect in workmanship or material.

1.19 SECURITY

- A. Be responsible for security of all areas affected by work of this Contract until taken over by Ministry. Take steps to prevent entry to the work by unauthorized persons and guard against theft, fire and damage by any cause.
- B. Provide suitable surveillance equipment, fencing, and/or employ guard services, as required to adequately protect the work.

1.20 SAFETY AND HEALTH

- A. Legislation
 - 1. Comply with all current Health and Safety Legislation including Bermuda 1982: 26, Occupational Safety and Health Act 1982 and Bermuda Occupational Safety and Health Regulations 2009: BR 65/2009.
- B. Safety and Health Programme
 - 1. Prepare and submit a Safety and Health Programme to the Project Manager at the start of the project.
- C. Notification
 - 1. The Contractor shall, immediately on occurrence of any accident at or about the work area, or in connection with the execution of the Works, report such accident to the Employer. The Contractor shall also report such accident to the appropriate Authority whenever such report is required by Law.
 - 2. The Contractor shall post notices to inform the workers of their conditions of work in conspicuous places at the work places concerned.



Part 2 PRODUCTS

2.1 QUALITY OF PRODUCTS

- A. All products provided shall be UL, ULC, or ETL listed and new, unless otherwise specified.
- B. If products specified are not UL, ULC, ETL, or approved by some other nationally recognized testing or certifying body, the Contractor shall make all modifications and pay expenses 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. ONLY approved equals will be allowed to be installed. Any equipment found installed that is not approved will be removed and replaced at the Contractor's expense.

2.2 MANUFACTURERS

- A. All manufacturers must 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.

2.3 UNIFORMITY OF MANUFACTURE

- A. Unless otherwise specifically called for, uniformity of manufacture shall be maintained for similar products throughout the work.

2.4 FIRE STOPPING

- A. Small penetrations of cables, conduits or raceways, may be sealed by using a UL listed one part, elastomeric silicone RTV foam, to maintain the fire rating prior to penetration.

2.5 EQUIVALENTS AND ALTERNATIVES

- A. Unless otherwise noted on the plans or specifications, substitutions may be considered for approval by the Project Manager if requested by the contractor or by equipment suppliers, for items specified by the manufacturer's catalogue number.
- B. Requests for approval of such substitutions shall be submitted at least five (5) working days prior to the tender closing date. Requests received late may not be considered.
- C. Complete description and data sheets of proposed substitution shall accompany the application and supplier must be prepared to submit samples for approval on short notice.
- D. Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the specified item shall apply for comparison if no other clause of this specification applies. The decision of the Project Manager to accept or reject shall be final.
- E. Failure to obtain approval for proposed substitutions or submit a complete list of approved alternates shall mean that only specified products are to be used.



Part 3 EXECUTION

3.1 COORDINATION

- A. The Contractor is responsible for coordinating all Sub-Contractors and suppliers necessary for a complete installation.

3.2 INSTALLATION REQUIREMENTS

- A. Install equipment neatly to the satisfaction of the Project Manager. Unless noted otherwise install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom.
- B. Install all equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.
- C. Provide suitable shielding and physical protection for all devices.
- D. Install all products and services in accordance with the manufacturer's requirements and/or recommendations.
- E. Provide all bases, supports, hangers and fasteners. Secure all products and services so as not to impose undue stresses on the structure and systems.

3.3 CUTTING AND PATCHING

- A. Include cutting and patching as required in execution of work under respective sections of this Package.
- B. Cutting and patching of new and/or existing work is included within bid price. Do not cut, bore, or sleeve through any load-bearing member, new or existing without Project Manager's written authorization, unless specifically indicated on drawings.
- C. Include for x-ray or sonar scanning before coring through concrete floors and walls.
- D. No structural members shall be cut without consent of Project Manager and all such cutting, when authorized, shall be done in strict accordance with instructions of Project Manager.
- E. Make good surfaces affected by this work and repair finish to satisfaction of Project Manager. Finish painting, where required is not included in this Contract.
- F. Patch all holes where components/devices are removed.

3.4 FIRE STOPPING

- A. Provide fire stopping system at all new penetrations through existing fire rated ceiling and wall assemblies. Submit certified shop drawings for each fire stopping system.

3.5 PROTECTION

- A. Protect occupied workspaces from damage due to execution of work under this Division with tarpaulins or other covering. Repair damage to building resulting from failure to provide such protection to satisfaction of Project Manager at no expense to Ministry.



3.6 SUPPORT

- A. 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.

3.7 FINAL INSPECTION

- A. Submit to Project Manager, written request for final inspection of system. Include with this submission written certification that:
 - 1. Deficiencies noted during previous inspections have been completed.
 - 2. Systems have been tested and verified, and are ready for operation.
 - 3. Completed maintenance and operating data have been submitted and approved.
 - 4. Equipment identification and labelling has been completed.
 - 5. Cleaning up is complete.
 - 6. Spare parts and replacement parts specified have been provided and receipt acknowledged by Project Manager.
 - 7. As-built drawings have been completed and approved.
 - 8. Ministry's staff have instructed in operation and maintenance of systems.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
2. Project information.
 3. Work covered by Contract Documents.
 4. Access to site.
 5. Coordination with occupants.
 6. Work restrictions.
 7. Specification and drawing conventions.

1.2 PROJECT INFORMATION

- A. Project Identification: Prospect Water Depot, Remote Monitoring System, Project #12-038, File #50/201/75.
- B. Project Location: 14 Fort Hill Road, Devonshire DV 02, Bermuda.
- C. Ministry: Government of Bermuda, Ministry of Public Works (the *Ministry*)
- D. Ministry's Representative/Engineer:
Tarik Christopher, Principal Water and Sewage Engineer,
Department of Works and Engineering,
3rd Floor, 56 Church Street, Hamilton, HM 12, Bermuda.
Phone: 441-278-0571
Mobile: 441-501-3100
Email: tchristopher@gov.bm
- E. Project Manager: Consultant Project Engineer,
Department of Works and Engineering,
3rd Floor, 56 Church Street, Hamilton, HM 12, Bermuda.
Phone: 441-278-0565
Mobile: 441-704-1965
Email: kclaridge@gov.bm
- F. Construction Project Manager: shall be provided and appointed under the Contract.



1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Installation of two Monitoring devices
 - a. Provide and install an AquaMaster3 Electromagnetic 6 inch diameter flow meter as manufactured by ABB or equal.
 - .1 Meter to be solar powered
 - .2 Meter to have built in multi-sampling rate for both flow and pressure to transmit to an in-built high resolution data logger
 - .3 Meter to have the capability of transmitting wirelessly all flow data in real time.
 - b. Provide and install a guided radar level transmitter Model MT5000 as manufactured by ABB or equal
 - .1 Level sensor must have in built measurement to display levels in real time
 - .2 The sensor must be installed to be capable of transmitting wirelessly all level data in real time.

NOTE: In the absence of standard specifications, the use of manufacturers' brand or model designations has been used as a standard. Brand names are used to indicate general performance and quality levels. Unless otherwise noted, it is understood that other brands or models will be accepted on an "or equal" basis. A brand name has been used for the purpose of designating the standard of quality, performance, and characteristics desired and is not intended to restrict competition

2. Design and set up a wireless based system to transmit data from the installed monitoring Devices. This should be inclusive of but not limited to the following:
 - a. Site Interface or Control Panel (number as required to establish working system), to include.
 1. FRP Enclosure, Type 4X
 2. 120V Supply
 3. 24VDC Power Supply
 4. WEB based Controller with integrated WEB Server
 5. WEB based I/O, including 8 DI, 8 DO, 8 ANALOG, 1 TEMP.
 6. Power Strip, w/surge and breaker
 7. WIFI Access Point with Remote Antennae
 8. Power On Light
 9. ON/OFF switch
 10. Terminal Blocks for field wiring
 11. Drawings and Documentation
 - b. Software, to include the following.
 1. Mobile App to view and control I/O from any networked Tablet or Phone
 2. Email notifications assigned to I/O
 3. Trending of Analog I/O
 4. Remote viewing on any networked PC



- B. Type of Contract.
1. Project will be completed under a single contract
 2. The Contract includes the following which may be subcontracted or performed by the Contractor:
 - a. Project Coordination
 - b. Project Management
 - c. Supply and installation of equipment and instrumentation
 - d. Monitoring system design
 - e. Monitoring System Installation
 - f. Final Commissioning & Staff Training

1.4 ACCESS TO SITE

- A. Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Ministry's right to perform work or to retain other contractors on portions of Project.
1. Contractor may utilize designated "lay down area" on site for parking and storage of materials.
 2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Ministry, Ministry's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 3. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.
- B. Accept full responsibility for assigned work areas from the time of Contract award until Substantial Completion of the work.
- C. Where encroachment beyond property limits is necessary make arrangement with respective property owners.
- D. Repair and make good any damage caused at no extra cost to Ministry to the complete satisfaction of the respective property owners and Authorities having jurisdiction. Protect existing building interiors from damage by weather, when executing work which affects integrity of exterior walls and roof.
- E. Use of site: exclusive and complete for executing work. Coordinate all work with the Ministry.

1.5 COORDINATION WITH MINISTRY'S OPERATIONS

- A. Cooperate with Ministry during construction operations to minimize conflicts and facilitate Ministry usage. Perform the Work so as not to interfere with Ministry's day-to-day operations.
- B. The Water Treatment Plant can be shut down, during which time the contractor shall perform the mechanical, instrumentation, and process control system installations.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on parking on public streets and with other requirements of the authorities having jurisdiction.



- B. Existing System Power Interruptions: Do not interrupt power/control systems serving the Water plant unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Project Manager not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Project Manager's permission before proceeding with utility interruptions.
- C. Nonsmoking Building: Smoking is not permitted within the building or Depot area.
- D. Controlled Substances: Use of controlled substances on Project site is illegal.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

Part 2 PRODUCTS (Not Used)

Part 3 EXECUTION (Not Used)

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating installation operations on Project including, but not limited to, the following:
1. Coordination drawings.
 2. Requests for Information (RFIs).
 3. Project meetings.

1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking information or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate installation operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule installation 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other installation 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 installation schedule.
 2. Preparation of the schedule of values.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project closeout activities.
 6. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.



1.6 CONTRACT SCHEDULE

- A. Within fourteen days of contract award, submit in format acceptable to Project Manager, electronic copy of the Contractor's critical path installation schedule.
- B. Use suitable scheduling software (e.g. Microsoft Project) and set up format to permit plotting of actual installation progress against scheduled progress.
- C. Schedule shall show:
 - 1. Commencement and completion dates of contract
 - 2. Commencement and completion dates of installation stages/phases.
 - 3. Commencement and completion dates of each trade.
 - 4. Order and delivery dates for major of critical equipment.
 - 5. Critical dates for shop drawing/sample submissions.
 - 6. Any other information relating to orderly progress of contract, considered by contractor or Project Manager to be pertinent
- D. The Project Manager, together with Contractor, shall review installation progress during or immediately following the regular site meeting or more often as directed by the Project Manager.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Prospect Depot Control Room unless otherwise indicated.
 - 1. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 2. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, within 3 days of the meeting.
- B. Pre-installation Conference: Project Manager will schedule and conduct a pre-installation conference before starting installation, but no later than 15 days after execution of the Agreement.
- C. Progress Meetings: Construction Manager will conduct progress meetings at regular intervals.
 - 1. Attendees: In addition to representatives of the Ministry, Ministry Engineers, Construction Manager, Project Coordinator, and 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 meeting 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 Installation 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 installation schedule. Determine how installation 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.
- 1) Review schedule for next period.
- 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) Access.
 - 6) Site utilization.
 - 7) Quality and work standards.
 - 8) Status of correction of deficient items.
 - 9) Field observations.
 - 10) Status of RFIs.
 - 11) Status of proposal requests.
 - 12) Pending changes.
 - 13) Status of Change Orders.
 - 14) Pending claims and disputes.
 - 15) Documentation of information for payment requests.
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's installation schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

Part 2 PRODUCTS (Not Used)

Part 3 EXECUTION (Not Used)

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, and other submittals.
- B. Related Requirements:
 - 1. Section 01310 "Project Management and Coordination" for submitting RFI's, meeting minutes, and Contractor's construction schedule.
 - 2. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Section 01782 "Operation and Maintenance Data" for submitting operation and maintenance manuals.

1.2 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Project Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 5 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Project Manager will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 5 days for review of each resubmittal.
- B. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
- C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows: Name file with submittal number or other unique identifier, including revision identifier.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Project Manager's action stamp.
- E. Distribution: Furnish copies of final submittals from manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.



Part 2 PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements:
1. Submit electronic submittals via email as PDF electronic files.
 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Comply with Owner's requirements and office policy.
 - b. Identification of products.
 - c. Schedules.
 - d. Compliance with specified standards.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Relationship and attachment to adjoining construction clearly indicated.
 - h. Seal and signature of professional engineer if specified.
 - i. Revise "Sheet Size" Subparagraph below to establish a standard sheet size and format.
 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.



- D. Coordination Drawings Submittals: Comply with requirements specified in Section 01310 "Project Management and Coordination."
- E. Contractor's Construction Schedule: Comply with requirements specified in Section 01310 "Project Management and Coordination."
- F. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01770 "Closeout Procedures."
- G. Maintenance Data: Comply with requirements specified in Section 01782 "Operation and Maintenance Data."
- H. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Part 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Shop Drawings and Product Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to the Project Manager.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01770 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
- D. Shop Drawings and Product Submittals must be submitted to the Engineer for review prior to ordering and installation of equipment.

3.2 PROJECT MANAGER'S ACTION

- A. General: Project Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Shop Drawings and Product Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Project Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action as follows:

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

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

- C. It is understood that the following is to be read in conjunction with the wording on the



Engineer's shop drawing review stamp applied to each and every shop drawing submitted:

"THIS REVIEW BY THE ENGINEER IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH THE GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT THE ENGINEER 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 COORDINATION OF THE WORK OF ALL SUBTRADES".

- A. When shop drawings are returned and marked "REVIEWED AS NOTED" with revisions marked on the shop drawing copies, such shop drawings are to 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.
- B. 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.
- C. No drawings shall be used for the purpose of construction which do not have the Engineer's shop drawing review stamp.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 2. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 01810 "Commissioning" for requirements final testing and commissioning requirements.
 - 4. Section 01820 "Demonstration and Training" for requirements for instructing Ministry's personnel.

1.2 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Commissioning and Test Reports.
- C. Request for Substantial Completion.
- D. Warranty Certificates.
- E. Maintenance Contract Documentation.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.



1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction.
 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Project Manager. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Project Manager's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Complete startup and testing of systems and equipment.
 2. Instruct Ministry's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 3. Participate with Ministry in conducting inspection and walkthrough with local emergency responders.
 4. Terminate and remove temporary facilities from Project site, construction tools, and similar elements.
 5. Complete final cleaning and repair requirements.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Project Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Manager 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 Project Manager, 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.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Certified List of Incomplete Items: Submit certified copy of Project Manager's Substantial Completion inspection list of items to be completed or corrected (punch list). Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.



- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Project Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Manager 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.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Project Manager for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Ministry's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file.
 - 2. Provide additional copies of each warranty to include in operation and maintenance manuals.

Part 2 PRODUCTS (Not Used)

Part 3 EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances local environmental regulations.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - 1. 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.
 - 2. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - 3. Sweep concrete floors broom clean in unoccupied spaces.
 - 4. Remove labels that are not permanent.
 - 5. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication droppings and other foreign substances.
 - 6. Clean light fixtures.
 - 7. Leave Project clean and ready for hand over.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Product Data.
- B. Related Requirements:
 - 1. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. 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:
 - .1 Submit one paper-copy or PDF electronic files of scanned marked-up record prints.
 - .2 Project Manager will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - .1 Submit one paper-copy or PDF electronic files of scanned approved marked-up record prints.
 - .2 The Ministry will revise the construction AutoCAD files for own electronic record drawings.
- B. Record Product Data: Submit in PDF electronic file format of each submittal.

Part 2 PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings, incorporating revisions as soon as modifications are issued.
 - 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 provide information for preparation of corresponding marked-up record prints.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 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 Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Project Manager.



2.2 RECORD PRODUCT DATA

- A. This article contains minimum record Product Data submittal requirements adequate for most projects.
- B. 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.
- C. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Examples of miscellaneous record submittals in this article include documentation of tests and inspections and inspections by authorities having jurisdiction.
- B. 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.
- C. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up paper copy of marked-up miscellaneous record submittals.

Part 3 EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents: Store record documents on site 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 a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Project Manager's and Construction Manager's reference during normal working hours.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
1. Operation and maintenance documentation directory.
 2. Operation manuals for systems, subsystems, and equipment.
 3. Product maintenance manuals.
 4. Emergency manuals.
 5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Project Manager will comment on whether content of operations and maintenance submittals are acceptable.
 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Project Manager.
 2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Project Manager will return copy with comments.
1. Correct or revise each manual to comply with Project Manager's comments. Submit copies of each corrected manual within 15 days of receipt of Project Manager's comments and prior to commencing demonstration and training.

Part 2 PRODUCTS

2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- C. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Ministry.
 4. Date of submittal.



5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Project Coordinator.
 8. Name and contact information for Commissioning Authority.
 9. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. Avoid placing loose, oversize drawings in binder pockets. Use reduced drawings or place folded drawings in labeled envelopes bound in manual.
 - c. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.



2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Operating standards.
 3. Operating and emergency shutdown procedures.
 4. Operating logs.
 5. Wiring diagrams.
 6. Control diagrams.
 7. Piped system diagrams.
 8. Precautions against improper use.
 9. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.



- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Material and chemical composition.
 - 4. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation



and local sources of maintenance materials and related services.

- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

Part 3 EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- D. Comply with Section 01770 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.2 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CA: Commissioning Authority.
- C. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of the Contractor, including Project Construction Manager, Project Coordinator, and subcontractors, installers, suppliers, and specialists deemed appropriate by the CA.
- B. Members Appointed by Ministry:
 - 1. CA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Representatives of the facility user and operation and maintenance personnel.
 - 2. Engineering design professionals.

1.4 MINISTRY'S RESPONSIBILITIES

- A. Provide the OPR documentation to Contractor for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 - 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - 2. Provide commissioning plan.
 - 3. Organize and lead the commissioning team.



4. Convene commissioning team meetings.
5. Provide Project-specific construction checklists and commissioning process test procedures.
6. Integrate and coordinate commissioning process activities with construction schedule.
7. Complete construction checklists as Work is completed and provide to the Commissioning Authority.
8. Review and accept commissioning process test procedures provided by the Commissioning Authority.
9. Complete commissioning process test procedures.

1.6 CA'S RESPONSIBILITIES

- A. Include CA responsibilities in this article that have an impact on Contractor's activities and responsibilities.
- B. Attend commissioning team meetings.
- C. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CA will report the failure in the Issues Log.
- D. Prepare and maintain the Issues Log.
- E. Prepare and maintain completed construction checklist log.
- F. Witness systems, assemblies, equipment, and component startup.
- G. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

Part 2 PRODUCTS (Not Used)

Part 3 EXECUTION (Not Used)

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Ministry's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.3 CLOSEOUT SUBMITTALS

- A. At completion of training, submit complete training manual(s) for Ministry's use in hardcopy (3 sets) and in PDF electronic file format.

1.4 COORDINATION

- A. Coordinate instruction schedule with Ministry's operations. Adjust schedule as required to minimize disrupting Ministry's operations and to ensure availability of Ministry's personnel.
- B. Coordinate content of training modules with content of approved operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the Project Manager.

Part 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Individual Specification Sections include requirements for demonstration and training.
- B. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- C. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Operating standards.
 - c. Regulatory requirements.
 - d. Equipment function.
 - e. Operating characteristics.
 - f. Limiting conditions.
 - g. Performance curves.



2. Documentation: Review the following items in detail:
 - a. Operations manuals.
 - b. Maintenance manuals.
 - c. Project record documents.
 - d. Identification systems.
 - e. Warranties and bonds.
 - f. Maintenance service agreements and similar continuing commitments.
3. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
4. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Procedures for preventive maintenance.
 - c. Procedures for routine maintenance.
 - d. Instruction on use of special tools.
5. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

Part 3 EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01782 "Operation and Maintenance Data."

3.2 INSTRUCTION

- A. Facilitator: Engage an experienced facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Ministry for number of participants, instruction times, and location.
- B. Engage experienced instructors to instruct Ministry's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Coordinate first subparagraph below with Ministry/Architect Agreement. Delete
 2. Ministry will furnish an instructor to describe Ministry's operational philosophy.
 3. Ministry will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. Schedule training with Ministry with at least 7 days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. The work included in this contract comprises:
 - 1. Supply and installation of instrumentation devices.
- B. Instruments and components to be provided by the Contractor in accordance with the approved Design Equipment and Instrumentation Schedule submitted by the Contractor— Refer to Drawings and Specifications
- C. Electrical wiring, raceways, and connections to instrumentation. Refer to Division 16 and Division 17 Specification Sections.

Part 2 PRODUCTS

2.1 MECHANICAL EQUIPMENT AND INSTRUMENTATION

In the absence of standard specifications, the use of manufacturers' brand or model designations is used as a standard. Brand names are used to indicate general performance and quality levels. Unless otherwise noted, it is understood that other brands or models will be accepted on an "or equal" basis. A brand name has been used for the purpose of designating the standard of quality, performance, and characteristics desired and is not intended to restrict competition

- A. Provide the following Mechanical Equipment and Instrumentation at the designated locations shown on the drawings:
 - 1. Instrumentation, limited to:
 - a. Provide and install an AquaMaster3 Electromagnetic 6 inch diameter flow meter as manufactured by ABB or equal.
 - .1 Meter to be solar powered
 - .2 Meter to have built in multi-sampling rate for both flow and pressure to transmit to an in-built high resolution data logger
 - .3 Meter to have the capability of transmitting wirelessly all flow data in real time.
 - b. Provide and install a guided radar level transmitter Model MT5000 as manufactured by ABB or equal.
 - .1 Level sensor must have in built measurement to display levels in real time
 - .2 The sensor must be installed to be capable of transmitting wirelessly all level data in real time.
- B. Instrumentation shall include individual manufacturer's peripheral equipment, displays, mounting accessories, pipe wells etc. as required for a complete operating system.
- C. All items to complete installation such as, but not exclusively, pipe work, fixing bolts, screws, washers, gaskets, sealant, clamps, lifting equipment, P.P.E. and access equipment shall be provided by the Contractor.
- D. For the installation of the instruments the Client will have a suitable power supply provided to a designated point shown on the drawings. The contractor will be responsible for all installation beyond the designated point.



- E. Notwithstanding any omissions the bid shall comprise a fully functioning system with additional major items noted separately on Tender Price Breakdown form.
- F. Components shall be UL or ULC listed as suitable for such use. New screws, bolts, nuts and washers shall be used in all instances. Material shall be 316 stainless steel throughout.

Part 3 EXECUTION Not Required

END OF SECTION



Part 1 General

1.1 GENERAL REQUIREMENTS

- A. Provide the work indicated in the contract documents and as required to provide complete, tested and fully operational systems including all work not normally indicated but necessary for a complete and operational installation.
- B. The Contractor is expected to be experienced and competent and knowledgeable about the trades and applicable codes, ordinances and industry standards and shall perform the work accordingly, on schedule and fully coordinated with all other trades.
- C. The contract documents for this Division are an integral part of the complete contract documents for the project and will be interpreted in conjunction with all other Divisions.

1.2 DEFINITIONS

- A. Following are definitions of words found in the Electrical Specifications and on associated drawings of Division 16:
 - 1. "Construction Manager" means the Mechanical Contractor's Construction Project Manager.
 - 2. "Install" means (and all tenses of "install") - install, wire and connect complete products and services specified.
 - 3. "Supply" means supply only.
 - 4. "Project Manager" means the Ministry of Public Works' Project Manager/Electrical Engineer.
 - 5. "Provide" means (and all tenses of "provide") - supply, install, wire and connect complete products and services specified.
 - 6. "Work" means materials and labour.

1.3 RELATED SECTIONS

- 1. Section 01330 "Submittal Procedures" for submitting shop drawings and product data.
- 2. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
- 3. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.
- 4. Section 01810 "Commissioning" for requirements final testing and commissioning requirements.
- 5. Section 01820 "Demonstration and Training" for requirements for instructing Ministry's personnel.



1.4 AUTHORITY HAVING JURISDICTION

- A. The electrical installation shall be reviewed by the Government of Bermuda, Department of Planning Electrical Inspector.

1.5 REGULATIONS

- A. All work associated with this project shall be in accordance with these code specifications and the following standards. Where there is a conflict between standards, the most restrictive will apply.
 - 1. The Bermuda Building Code.
 - 2. The Bermuda Health and Safety Work Act.
 - 3. The BOCA National Building Code.

1.6 REVIEW AUTHORITY

- A. The system shall be reviewed by the Project Manager. Any comments shall be directed to the Project Manager for review and action.

1.7 SCOPE

- A. The work includes the furnishing of all labour, materials, equipment and services necessary for, and reasonably incidental to, the completion of all electrical work.
- 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 installation. Coordinate protective work during installation.
- D. Cutting and patching of new and/or existing work is included within bid price. Do not cut, bore, or sleeve through any load-bearing member, new or existing without Project Manager's written authorization, unless specifically indicated on drawings.
- E. 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.

1.8 SAFETY PROCEDURES

- A. Comply with lock-out, tag out procedures when working on or de-commissioning electrically operated equipment.

1.9 WORK INCLUDED

- A. This work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by owner.
- B. Items obviously necessary, or reasonably implied, to complete the work, to be included as if shown on drawings and noted in the specifications.



- C. All materials, tools, appliances, scaffolding, apparatus, and labour necessary for the execution, erection, and completion of the systems described herein shall be furnished. This includes providing lighting and power for own work.
- D. This contract shall include, but is not confined to, the following scope of work:
 - a. Panelboards and distribution systems.
 - b. Instrumentation equipment connections.

1.10 CONTRACT DRAWINGS

- A. The drawings of this Package are performance drawings and indicate general arrangement of the work. They are diagrammatic except where specific details are given.
- B. Obtain accurate or by site measurement. Location and elevation of services are approximate and must be verified before installation is undertaken.
- C. Make changes where required to accommodate structural conditions, (beams, columns, etc.). Obtain Engineer's approval before proceeding.
- D. 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. Devices and/or equipment may be relocated up to 10 feet in any direction without a change to the contract price.
- E. The electrical 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 electrical documents.

1.11 EXTRA WORK

- A. Any extra work ordered to be done shall be governed by the specification of this contract unless specific instructions or clauses are contained in a Change Variation. In such cases, these instructions or clauses shall supersede those of the specification for that particular application only.

1.12 DAILY WORK SCHEDULE

- A. Include in tender for any overtime or abnormal shift required to complete the project.

1.13 INSTALLATION SCHEDULE

- A. Coordinate installation schedule with the Construction Project Manager.

1.14 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, wire methods, etc. The Code is a minimum standard which the Contract Drawings may exceed.



1.15 PERMITS, LICENCES, FEES

- A. Contractor will apply and pay for all permits. Pay for any damage or security deposits required by jurisdictional authorities in connection with the installation of this project.

1.16 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.

1.17 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, panelboards 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 Project Manager of any potential delays in completion of this project, in order that remedial action may be taken.

1.18 JOB CONDITIONS

- A. Visit site during Tender period and examine all existing conditions which may affect work of this Division. Examine all drawings to ensure work may be satisfactorily completed. 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.
- B. Submission of a Tender confirms that Contract Documents and site conditions are accepted without qualifications unless exceptions are specifically noted in the Tender.

1.19 INTERRUPTIONS

- A. Arrange execution of work to maintain present building operations and to minimize effect of work under this Division on existing operations.
- B. Prior to interrupting any existing service, notify Project Manager in writing at least 48 hours in advance and obtain his written authorization. Do not interrupt any existing service without Engineer's specific authorization.

1.20 SHOP DRAWINGS

- A. No drawings shall be used for the purpose of installation which do not have the Project Manager's shop drawing review stamp.



1.21 RECORD DRAWINGS AND AS BUILT DRAWINGS

- A. Record all deviations as work progresses throughout the execution of this contract caused by site conditions or by changes ordered by the Project Manager. Maintain record drawings on site at all times in clean, dry, legible condition, making them available for periodic review by the Project Manager.
- B. Submit a “clean” white print set of As Built drawings prior to the final inspection with modifications copied from the installation set and printed neatly in red ink.
- C. The Project Manager will update the “Issued for Tender” CAD files and provide As Built white prints and CD’s to the Ministry.

1.22 GUARANTEE

- A. Submit to Engineer prior to date of Completion Performance, manufacturers’ written warranties covering periods longer than one year or offering greater benefits than required in specifications and in the Owner’s name.
- B. Within a period of 1 year from the date of issue of a Certificate of Substantial Performance of the Work, replace or repair at own expense any defect in workmanship or material.

1.23 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Section 01782 “Operation and Maintenance Data.”

Part 2 Products

2.1 QUALITY OF PRODUCTS

- A. All products provided shall be UL or ETL listed 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 and pay expenses 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. ONLY approved equals will be allowed to be installed. Any equipment found installed that is not approved will be removed and replaced at the Contractor’s expense.

2.2 MANUFACTURERS

- A. All manufacturers must be have been regularly engaged in the manufacturer of the products of types and sizes required that have been in satisfactory use in similar service for not less than 5 years.
- B. Where the Contractor purchases equipment from distributors that are licensed and certified to sell that equipment within Bermuda the equipment shall be capable of being maintained from licensed and certified technicians from either a local company or a licensed overseas technician brought in through a local company.

2.3 UNIFORMITY OF MANUFACTURE

- A. Unless otherwise specifically called for, uniformity of manufacture shall be maintained for similar products throughout the work.



2.4 FIRE STOPPING

- A. Small penetrations of cables, conduits or raceways, may be sealed by using a UL listed one part, elastomeric silicone RTV foam, to maintain the fire rating prior to penetration.

2.5 EQUIVALENTS AND ALTERNATIVES

- A. Unless otherwise noted on the plans or specifications, substitutions may be considered for approval by the Engineer if requested by the contractor or by equipment suppliers, for items specified by the manufacturer's catalogue number.
- B. Requests for approval of such substitutions shall be submitted at least five (5) working days prior to the tender closing date. Requests received late may not be considered.
- C. Complete description and data sheets of proposed substitution shall accompany the application and supplier must be prepared to submit samples for approval on short notice.
- D. Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the specified item shall apply for comparison if no other clause of this specification applies. The decision of the Engineer to accept or reject shall be final.
- E. Failure to obtain approval for proposed substitutions or submit a complete list of approved alternates shall mean that only specified products are to be used.

Part 3 Execution

3.1 COORDINATION

- A. The Contractor is responsible for coordinating all Sub-Contractors and suppliers necessary for a complete installation.

3.2 TEMPORARY LIGHTING AND POWER

- A. The Contractor shall provide grounded extension cords and temporary lights and power service required for the work.

3.3 SEPARATION OF SERVICES

- A. The Contractor shall maintain separation between electrical 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 aluminium, in damp or wet locations is not permitted.
- B. Wiring shall not be supported from pipes, ductwork, or ceiling hangers, etc.

3.4 INSPECTION

- A. Verify that all work of this Division may be executed in accordance with all pertinent codes and regulations, specifications, drawings, and referenced standards.
- B. Review all drawings and verify all dimensions at the site. Report all discrepancies immediately to the Engineer before proceeding with any installation work or shop drawings.



3.5 INSTALLATION REQUIREMENTS

- A. The Contractor shall lay out the work and equipment with due regard to structural and mechanical features.
- B. Install all equipment and apparatus to allow free access for maintenance, adjustment and eventual replacement.
- C. Install all products and services in accordance with the manufacturer's requirements and/or recommendations.
- D. Provide all bases, supports, hangers and fasteners. Secure all products and services so as not to impose undue stresses on the structure and systems.
- E. Remove and replace defective and non-conforming work.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed on masonry work without prior approval.

3.6 CUTTING AND PATCHING

- A. Include cutting and patching as required in execution of work under respective sections of this Package.

3.7 FIRE STOPPING

- A. Provide fire stopping system at all new penetrations through existing fire rated ceiling and wall assemblies. Submit certified shop drawings for each fire stopping system.

3.8 SUPPORT

- A. 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.

3.9 SPARE PARTS

- A. Identify spare parts as to contents and replacement parts number.
- B. Deliver spare parts in unopened containers to the site and store in the Ground Floor Electrical Room.
- C. Obtain a signed receipt from the Engineer for all spare parts or materials and include a copy in the maintenance manual. Without this receipt these items will be treated as a deficiency and the cost withheld at twice the estimated value by the Engineer.

3.10 TESTING AND COMMISSIONING

- A. The Contractor shall fully test and commission all equipment supplied and installed.

3.11 DEMONSTRATION OF SYSTEMS

- A. Instruct Engineer and operating personnel in the operation, care, and maintenance of equipment.
- B. Provide a 2 hour site tour to describe the new systems, routing of services, and identify locations of all new equipment.

END OF SECTION



Part 1 General

1.1 Scope

- A. Wiring for this project to be as outlined in basic wiring method.
- B. All wiring shall be surface mounted in Service Rooms.

1.2 Basic Wiring Method

- A. Ceiling cavities:
 - 1. All wiring shall be in rigid PVC, FT4 rated conduit except drops to individual emergency lighting units and exit signs may be armoured cable.
 - 2. shall be in rigid PVC conduit, complete with bonding conductor.
- B. Surface raceways:
 - 1. All surface raceways shall be rigid PVC conduit, complete with bonding conductor.
- C. Conduit hangers:
 - 1. **Replace ALL existing metal conduit hangers, unistrut, and supports with fiberglass equivalent. This applies to both line voltage and low voltage raceways.**
 - 2. All new conduit hangers and supports shall be of fiberglass construction.

1.3 Location

- A. Electrical drawings are diagrammatic and do not show all conduit, wire, cable, etc. Division 16 to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.
- B. Locate electrical devices on walls with main regard for convenience of operation and conserving wall space, in conjunction with the electrical drawings. Switches, receptacles, fire alarm pull stations, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.
- C. Review the exact location criteria of each electrical outlet and device with Engineer prior to rough-in. Relocate any item installed without confirmation at no cost to owner as long as the relocation is within 10 feet of the location originally shown on the electrical drawings.
- D. All raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.
- E. All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be surface mounted unless upgrading at existing flush mounted device.

1.4 Mounting Heights

- A. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- B. If mounting height of equipment is not specified or indicated, verify before proceeding with installation.



1.5 Conduit and Cable Identification

- A. Colour code conduits, boxes and armoured cables. Code with 25mm wide plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 50' intervals.
Line Voltage up to 250V: Yellow
- B. Colour coded paint finish for junction boxes to be as follows:
Line Voltage up to 250V: Non-painted (labelled as to voltage and source)

1.6 Wire Identification

- A. Line voltage conductors in conduit shall be colour coded as follows:

Phase A:	Red
Phase B:	Black
Phase C:	Blue
Neutral:	White
Ground:	Green or Bare

1.7 Spare Wire or Cable

- A. At all junction boxes and pull boxes leave a loop of wire or cable to allow for future flexibility.

1.8 Splices

- A. Wire or cables shall be continuous throughout their run. No splices of any kind will be allowed unless preapproved by the Engineer.

Part 2 Products

2.1 Conduit

- A. Rigid PVC tubing of sufficient quality and thickness to allow smooth field formed bends. Provide factory made bends where site bending is not possible. EMT couplings, connectors and fittings shall be of steel.
- B. Back boxes for all outdoor mounted devices shall be outdoor/weatherproof type, complete with weather-proof gaskets.

2.2 Outlet Boxes

- A. Each outlet box and back box must be suitable in all respects for the application, and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory. All outlet boxes and junction boxes shall be one piece formed or welded.
 - 1. "FS" or "FD" Series cast Ferloy and aluminum outlet boxes.
 - 2. Rigid plastic (PVC) outlet boxes.
- B. Back boxes for all outdoor mounted devices shall be weatherproof type, complete with weatherproof gaskets.
- C. Surface mounted boxes shall be solid construction.



2.3 Pullboxes and Junction Boxes

- A. The physical size of junction boxes and pullboxes shall be as required by the NEC to suit the number and size of conduits and conductors.
 - 1. Rigid plastic (PVC), junction boxes and access fittings with solvent weld type joints. All fittings with removable covers shall be complete with PVC gasket and brass securing screws and inserts. All metal components shall be brass or stainless steel.

2.4 Wire Connectors

- A. Connectors for conductors in conduit shall be 'twist-on' Marr or similar wire connectors, 600 volts rated, sized in compliance with manufacturer's recommendations.

2.5 Conductors

- A. Conductors shall be NEMA/ANSI approved, UL or ULC listed and labelled and in compliance with NEC and ASTM requirements.
- B. Conductor size shall be sized to NEC requirements for load and breaker current rating.
- C. All conductors shall be constructed of 98% conductive copper.
- D. Single solid conductor THHN/THWN 194°F (105°C), insulation rated to 600 volts.
- E. Process Control System
 - 1. Process control system multi-conductor cables with solid copper conductors 300V, 220°F (105°C). Refer to Process Control System drawings for wire and conduit specifications. Process Control System wiring and conduit shall be by Division 17.

Part 3 Execution

3.1 Rigid PVC Raceway

- A. Install PVC conduit and fittings using new PVC cement, approved by the conduit manufacturer.
- B. Clean terminations with solvent and bevel inside edge of field cut conduit.
- C. Protect conduit and fittings from water and keep dry while making connections.
- D. Secure PVC raceway using PVC clamp on surface runs.

3.2 Junction and Pull Boxes

- A. Generally, conduit runs exceeding 100' in length or with more than three 90 degree bends, shall be equipped with a pullbox installed at a convenient and suitable intermediate accessible location.
- B. Existing boxes without covers or that are improperly mounted shall have coverplates added and be securely fastened to the building structure.



3.3 Conductors

- A. All circuits must contain separate phase, neutral and ground conductors (i.e.: common neutral configuration is unacceptable).
- B. Conductors shall be minimum #12 AWG and #10 AWG for runs longer than 50'.

3.4 Mounting Locations

- A. Do not recess, paint, or conceal conduit or wiring, accessories, or work prior to observation by the Project Manager.

END OF SECTION



1. GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data.

1.2 IDENTIFICATION

- .1 Identify the circuit number and panel designation from which all power points are served.
- .2 Identify circuits on power point cover plates on reverse side using permanent marker pen, and on face of cover plates using P-Touch lettering tape.
- .3 Indicate circuit number on receptacle in centre between two receptacles with permanent marker pen.

2. PRODUCTS

2.1 SWITCHES

- .1 15A, 120V, single pole, double pole, or three-way switches as indicated.
- .2 Manually operated general purpose commercial specification grade ac switches and with following features:
 - .1 Terminal holes approved for No. 10 AWG 5mm² wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-20R, 125V, specification grade U ground, with following features:
 - .1 White urea moulded housing (except as noted).
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws or pigtail connections.
 - .5 Double wipe contacts and riveted grounding contacts.
- .2 Single receptacles CSA type 5-20R, 125V, 15A, U ground with following features:
 - .1 White urea moulded housing except as noted.
 - .2 Suitable for No. 10 AWG for back and side wiring or pigtailed connections.
- .3 Other receptacles with ampacity and voltage as indicated, white in all areas.
- .4 Receptacles of one manufacturer throughout project.
- .5 **Upgrade all existing 15A duplex receptacles to 20A Tslot type.**

2.3 GFCI RECEPTACLES

- .1 White urea moulded housing.
- .2 Complete with LED indicator light.
- .3 Silver alloy terminal contacts
- .4 Individual unit tested at 5mA threshold.
- .5 Complete with polycarbonate cover.

2.4 COVER PLATES

- .1 Cover plates for surface mounted devices shall be cast aluminum.
- .2 Cover plates for flush mounted devices shall be white nylon.
- .3 Galvanized sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.



- .4 Provide cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

3. EXECUTION

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed, three-way, if ganged must be in common position when on.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height specified in Section 16120 or as indicated.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height specified in Section 16120 or as indicated.
 - .3 All receptacles within 1.5m of a sink shall be GFCI type unless protected by GFCI breaker as per NEC.
- .3 Cover Plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface mounted boxes.
 - .3 Where devices are grouped, line up horizontally.
 - .4 Identify circuits on receptacle cover plates on reverse side using permanent marker pen, and on face of cover plates using P-Touch lettering tape.

END OF SECTION



Part 1 GENERAL

1.1 DESCRIPTION

- A. Provide disconnect switches for as indicated on the drawings, as manufactured by Cutler Hammer or Square D.

Part 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- A. Ratings: 240 volts for 120/208 volt distribution. Unless otherwise shown, 3 pole for 3 phase, 3 wire distribution, 3 pole and solid neutral for 3 phase 4 wire distribution. Ampere ratings as shown on the drawings or to suit load requirements. For motors, use disconnect switches with HP ratings at least equal to motor HP.
- B. Enclosures: CSA code gauge galvanized steel,
 - 1. Disconnect switches in dry locations shall be NEMA Type 12 galvanized steel.
 - 2. Disconnect switches shall be weatherproof, sealed, thermoplastic material and rated NEMA-3R where installed in "Wet Locations" (RO Plant Room, Pump Room, and Filter Room).
- C. Finish: One primer coat and one finish coat on all metal surfaces ANSI Gray.
- D. Switch mechanisms: Quick make and quick break action with self wiping contacts, solderless pressure lug connectors. For switches 100 amperes and over, provide non-tracking arc shrouds. All switch poles to operate together from a common operating bar.
- E. **Provide for padlocking all disconnect switches in "Off" position.** Doors to be interlocked and complete with defeat mechanism, to prevent opening when handle in ON position. Provide ON-OFF switch position indication on switch enclosure cover.
- F. Neutral Bars: Where distribution system has grounded neutral conductor, provide neutral bar where required with ampere rating equal to switch rating, in enclosure. Provide ground bar for terminating ground conductors.
- G. Fuse Holders: Provide fuse holders (relocateable and suitable without adapters) on load side of switches, ampere rating equal to switch ratings, suitable for fuses specified.

2.2 FUSES

- A. All fuses shall be 100,000 ampere (minimum) interrupting capacity of the current limited type. In addition, fuses feeding motors to be of the time delay type. Provide one full set of spare fuses, three for each different ampere rating used, stored in suitable enclosure.

Part 3 EXECUTION

3.1 DISCONNECT SWITCHES

- A. Mounting: Provide supports independent of conduits. Wall mount where possible, otherwise provide Unistrut frame support. Where switches are grouped mount in uniform arrangement.
- B. Wiring: Connect line and load cable to all switches.
- C. Fuse Rating: Install so that rating is visible.



- D. Identification: Provide lamacoid plate on each switch showing voltage, source of supply and load being fed.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes panelboards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush or surface mounted, refer to Panelboard Schedules on drawings.
- B. Rated for environmental conditions at installed location.
 - 1. Indoor Dry and Clean Locations: NEMA 250, Type 11
 - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 3R
- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Directory Card: Inside panelboard door, mounted in transparent card holder.
- E. Incoming Mains Location: Confirm on site.
- F. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- H. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.



2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with 10kAI to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).

Part 3 EXECUTION

3.1 INSTALLATION

- A. Ensure that, whatever height is selected for top of trim in first paragraph below, the operating handle of top-most switch or circuit breaker, in on position, is not higher than 79 inches above finished floor.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- G. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Create a directory to indicate installed circuit loads and incorporating room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- B. Panelboard Nameplates: Label each panelboard with a lamacoid nameplate.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

END OF SECTION



Part 1 GENERAL

1.1 DESCRIPTION

- A. The work included in this contract comprises providing, wiring, and installing an intergrated fieldbus/device network to provide a real time bridge from a range of devices such as flow sensors, level gauges, pressure sensors to a Ministry of Public Works web based data logging system. Any proposed system must be based on a recognized/supported protocol such as HART, ProfiBus, DeviceNet etc.
- B. The system to be installed is to use Wireless LAN(IEEE 802.11) to connect the devices to an internet portal for real time reporting to the Ministry's web based logging system. The wireless signals are to have security WEP,WPA,WPA2 etc. A 2.4GHz wifi network has already been established at the site to facilitate connection of the sensors. To minimize disturbance a Direct-Sequence Spread Spectrum(DSSS) should be used.

1.2 DEFINITIONS

- A. Following are definitions of words found in the Specifications and on associated drawings:
 - 1. "Construction Manager" means the Mechanical Contractor's Construction Project Manager.
 - 2. "Install" means (and all tenses of "install") - install, wire and connect complete products and services specified.
 - 3. "Supply" means supply only.
 - 4. "Project Manager" means the Ministry of Public Works' Project Manager/Electrical Engineer.
 - 5. "Provide" means (and all tenses of "provide") - supply, install, wire and connect complete products and services specified.
 - 6. "Work" means materials and labour.

1.3 RELATED SECTIONS

- 1. Section 01330 "Submittal Procedures" for submitting shop drawings and product data.
- 2. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
- 3. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.
- 4. Section 01810 "Commissioning" for requirements final testing and commissioning requirements.
- 5. Section 01820 "Demonstration and Training" for requirements for instructing Ministry's personnel.

1.4 SEPARATE ADDITIONAL PRICES

- A. Refer to Section 01000 "General Requirements".



1.5 QUALITY ASSURANCE

- A. Regulations, Standards and Publications
 - 1. UL Underwriters' Laboratories, Inc.
 - 2. NEC National Electrical Code.
 - 3. NEMA National Electrical Manufacturers Association.
 - 4. ANSI American National Standards Institute.
 - 5. IEEE Institute of Electrical and Electronic Engineers.
 - 6. ISA Instrument Society of America.
- B. Quality Control
 - 1. All components of the Monitoring transmission System shall be new and of the most current and proven design. All components shall be suitable for the intended application and shall be installed and wired in strict accordance with the manufacturer's requirements. The Contractor shall provide all necessary transformers, power supplies, surge protection, UPS system, fusing, and grounding as required to meet the manufacturer's requirements.
 - 2. The complete system must comply with all local laws, rules, and regulations and the authority having jurisdiction.
 - 3. All components and materials shall bear the label of the Underwriters' Laboratory.

1.6 SUBMITTALS

- A. Shop Drawings
 - 1. Submit required number of detailed shop drawings for all equipment being provided for the Monitoring transmission System as specified in Section 01330.
- B. Installation, Operation and Maintenance Manuals:
 - 1. Submit required number of copies of installation, operation and maintenance manuals for all equipment being provided for the Process Control System as specified in Section 01782.

1.7 RECORD DRAWINGS

- A. Section 01781 "Project Record Documents"
- B. Following start-up and commissioning of the system, the Process Control System Contractor shall make all necessary changes to the as-built drawings.



Part 2 PRODUCTS (Not Used)

Part 3 EXECUTION

3.1 COORDINATION

- A. The Monitoring transmission System Contractor shall attend all construction meetings.

3.2 TRAINING

- A. During the Final Acceptance Test, the Monitoring transmission System Contractor shall arrange for the instruction and training of Ministry's personnel at the plant site in the theory of operation and operational procedures of the system. At the end of this period, plant personnel shall have, as determined by the Project Manager, sufficient knowledge to operate the system. This training shall be for three sessions of 4 people for 6 hours. This training shall be in addition to the training specified in the other Sections.

END OF SECTION



Part 1 GENERAL

1.1 SUMMARY

- A. Section includes commissioning process requirements Monitoring Transmission System.
- B. Related Sections:
 - 1. Section 01810 "General Commissioning Requirements" for general commissioning process requirements.

Part 2 PRODUCTS (Not Used)

Part 3 EXECUTION

3.1 CALIBRATION

- A. General: All new instrumentation devices provided under Division 15 and existing devices to be re-used shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.
- B. Calibration Points: Each instrument shall be calibrated at 0, 25, 50, 75 and 100% of span using test instruments to simulate inputs. The test instruments shall have accuracy's traceable to National Institute of Testing Standards.
- C. Bench Calibration: Instruments, which have been bench-calibrated, shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the Ministry's Engineer.
- D. Field Calibration: Instruments which were not bench-calibrated shall be calibrated in the field to insure proper operation in accordance with the instrument loop diagrams or specification data sheets.
- E. Analyzer Calibration: Each analyzer system shall be calibrated and tested as a workable system after installation. Testing procedures shall be directed by the manufacturers' technical representatives. All samples and sample gases shall be furnished by the manufacturers.
- F. Calibration Sheets: Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit:
 - 1. Project name.
 - 2. Loop number.
 - 3. Tag number.
 - 4. Manufacturer.
 - 5. Model number.
 - 6. Serial number.



7. Calibration range.
 8. Calibration data: Input, output, and error at 10 percent, 50 percent and 90 percent of span.
 9. Switch setting, contact action, and deadband for discrete elements.
 10. Space for comments.
 11. Space for sign-off by Instrumentation Supplier and date.
 12. Test equipment used and associated serial numbers.
- G. Calibration Tags: Attach a calibration and testing tag to each piece of equipment or system. Sign the tag when calibration is complete. The Ministry's Engineer will sign the tag when the calibration and testing has been accepted.

3.2 SYSTEM START-UP AND COMMISSIONING

A. System Start-Up:

1. Start-up the monitoring transmission system by energizing the system equipment and testing the operation of all hardware, software, process control logic, and all customized software programs.
2. All start-up and testing shall be scheduled, performed in an orderly sequence, and conducted in the presence of and to the satisfaction of the Project Manager and Ministry's Engineer.

B. System Commissioning:

1. Calibrate all instrumentation, and place the complete Monitoring Transmission system into operation. The commissioning of the system shall include the overall calibration and tuning of all control loops and sequences to provide stable control of the process. The validity of all inputs and outputs for the system shall be checked and verified during the system commissioning.
2. The Monitoring Transmission System Contractor shall provide a technician on-site for the length of time necessary for system installation, start-up and commissioning.

C. Operational Testing:

1. Each component of the system operates correctly with the other components of the system.
2. Analog control loops operate in a stable manner.
3. Sequencing of pumps operates correctly.
4. Hard-wired and software equipment interlocks perform correctly.
5. Monitoring Transmission sequences perform correctly.
6. System trends and historical logging perform properly.



3.3 FINAL ACCEPTANCE TEST

- A. Following the commissioning of the Monitoring Transmission System, and the issuance of the Certificate of Substantial Completion to the Contractor by the Project Manager, a final acceptance test shall be conducted for a period of **10 consecutive days**. This test shall be scheduled with the Project Manager and shall not begin until the Monitoring Transmission System Contractor receives written approval to start. During that time period, the system shall operate satisfactorily and in compliance with the Specifications. The Monitoring Transmission System Contractor shall promptly correct any problems that occur during the acceptance test.
- B. The entire system shall operate for 10 days without failure.
- C. Provide all necessary support staff as required to operate the system and to satisfy the repair or replacement requirements.
- D. If any component fails during the performance test, it shall be repaired or replaced and the acceptance test shall be restarted on another 10-day period.
- E. Following the successful completion of the final acceptance test, a certificate of final acceptance will be issued to the Monitoring Transmission System Contractor.

END OF SECTION