Project ID : PCHRD – PB – 2025 – 01
Project Name : Procurement of Labor, Supplies, and Materials for the Construction of Saliksik Extension Building - Phase 1

Project Location : DOST-PCHRD Office, PCHRD Saliksik Building, Sikap Street, DOST Main Compound, Gen. Santos Ave., Bicutan, Taguig City

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SUPPLEMENTAL / BID BULLETIN NO. 1
August 11, 2025

Subject : <u>Modification / Amendment of Some Provisions in the Bidding Documents</u>

In connection with the project stated above advertised at the PhilGEPS and PCHRD Website on July 26, 2025; this Supplemental / Bid Bulletin No. 1 is issued to modify and amend some provisions in the Bidding Documents. Attached is the updated ***Annex "A" – Technical Specifications*** and ***Annex "B" – Drawings and Plans***.

I. Modification / Amendment of Some Provisions in the Bidding Documents

ORIGINAL PROVISION	AMENDMENT / CHANGE / CLARIFICATION
From: ***Section VI. Specifications***	***To:*** ***Section VI. Specifications*** . . . . . . ➢ ***Please refer to the attached updated Annex "A" – Technical Specifications***
From: ***Section VII. Drawings***	***To:*** ***Section VII. Drawings*** . . . . . . ➢ ***Please refer to the attached updated Annex "B" – Drawings and Plans***

This Supplemental / Bid Bulletin shall form an integral part of the said Bidding Documents.

For guidance and information of all concerned.

(sgd.)
MARIA VIOLETA G. INTIA
Chairperson, Bids and Awards Committee

ANNEX "A"

TECHNICAL SPECIFICATIONS

PROPOSED PHILIPPINE COUNCIL FOR HEALTH RESEARCH AND DEVELOPMENT (PCHRD) SALIKSIK BUILDING EXTENSION PROJECT

(PHASE 1)

Bicutan Science Community, DOST Comp., General Santos Avenue, Bicutan, Taguig City

TECHNICAL SPECIFICATIONS

ARCHITECTURAL WORKS

CONTRACT DOCUMENTS

June 2025

OWNER

PHILIPPINE COUNCIL FOR HEALTH RESEARCH AND DEVELOPMENT, DOST-TAGUIG

ENRIQUE O. OLONAN & ASSOCIATES
ARCHITECTS ENGINEERS CONSULTANTS

IN JOINT VENTURE WITH

ENRIQUE O. OLONAN AND ASSOCIATES, CO.
ARCHITECTS ENGINEERS CONSULTANTS

ARCH. HENRY STEVE R. OLONAN
PRC: 17726
REG VALID: 04-27-2027
PTR: 7120518
DATE ISSUED: 01-14-25
ISSUED: QUEZON CITY
TIN NO: 106-186-110
IAPOA: 11494 424318 070424

TABLE OF CONTENTS

SECTION 011000

SUMMARY

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Phased construction.
   4. Future work.
   5. Access to site.
   6. Coordination with occupants.
   7. Work restrictions.

B. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3. PROJECT INFORMATION

A. Project Identifications: PROPOSED PHILIPPINE COUNCIL FOR HEALTH RESEARCH AND DEVELOPMENT (PCHRD) SALIKSIK BUILDING EXTENSION PROJECT. The proposed "extension" Building is to be built at the Department of Science and Technology compound. The Project consists of a 4 storey w/ roof deck and basement building. Construction of the building shall include incidental related works to complete the building, ready for occupancy and use.

1. Project Location: Department of Science and Technology, Taguig

B. Owner: Philippine Council for Health Research and Development

C. Architect-of-Record: Detailed Architectural Drawings and Documents dated December 2022 were prepared for the Project by Arch. Henry Steve R. Olonan of Enrique O. Olonan and Associates (EOOA).

D. Architect's Consultants: As part of EOOA's design group, the following design professionals where part of the preparation of the Detailed Engineering Drawings and Documents as part of the Contract Documents dated December 2022;

1. Structural:	Engr. Elias Rivamonte Rey
2. Sanitary/Plumbing:	Engr. Cesar Madriaga
3. Electrical:	Engr. Manuel Panis
4. Mechanical & Fire Protection:	Engr. Meliton Nague
5. Electronics and Communications:	Engr. Efren Pineda

1.4. WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The Work includes complete Architectural, Structural, Electrical, Mechanical, Fire Protection, Plumbing/Sanitary, Landscape Works, and other site related construction or as defined in the Contract Documents and Specification Documents.

2. Workmanship: Only personnel skilled in the operations of each trade required under any and all part of these Specifications shall undertake the works called for in the manner specified herewith.

1.5. ACCESS TO SITE

A. General: Contractor shall have full use of the Project Site for construction operations during the construction period. Contractor's use of the Project site is limited only by the Owner's/ Client's right to perform work or to retain other contractors on portions of the Project.

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the site premises
2. Driveways, Walkways and Entrances: Keep driveways, parking, garage, loading areas, and entrances serving premises clear and available to Owner/Client, its employees and representatives and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6. SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.7. MISCELLANEOUS PROVISIONS

A. The Contractor shall comply with all laws, City Ordinances, and all Government Regulation and with the following regulatory requirements, in so far as they are binding upon or affect the portion of the work thereto. The Contractor of those engaged shall obtain all necessary licenses and permits and shall be responsible for all damages to persons or property, which may occur in connection with the execution of the work.

1. National Building Code of the Philippines
2. Architectural Code of the Philippines
3. National Structural Code of the Philippines (Latest Ed.)
4. Handicapped Law to Enhance Mobility of Disabled Persons /Accessibility Law
5. Philippine Electrical Code (National Electrical Code)
6. Philippine Electronics and Communications Code
7. Philippine Plumbing Code (Uniform Plumbing Code)
8. Philippine Society of Mechanical Engineers Code (Uniform Mechanical Code)
9. NFPA, Fire Protection Code

B. RA 9266: All drawings and specifications acting as an instrument of service is the property of Enrique Olonan & Associates, and cannot be reproduced without their written consent.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100

ALLOWANCES

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes administrative and procedural requirements governing allowances:
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Quantity allowances.
   2. Contingency allowances.
   3. Testing and inspecting allowances.

C. Related Requirements:
   1. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3. SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advice Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
C. Purchase products and systems selected by Architect from the designated supplier.

1.4. ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5. INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6. COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation

1.7. QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.8. CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9. TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1. EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2. PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 012100

SECTION 012300

ALTERNATES

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3. DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.

2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4. PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

END OF SECTION 012300

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
2. "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3. DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4. ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.5. SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect'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 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect 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 15 days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
   3. Include the following information for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Name of subcontractor.
      g. Name of supplier.
      h. Name of manufacturer.
      i. Submittal number or other unique identifier, including revision identifier.
         1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
      j. Number and title of appropriate Specification Section.
      k. Drawing number and detail references, as appropriate.
      l. Location(s) where product is to be installed, as appropriate.
      m. Other necessary identification.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.
   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
   a. Project name.
   b. Date.
   c. Name of Contractor.
   d. Name of firm or entity that prepared submittal.
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Specification paragraph number or drawing designation and generic name for each of multiple items.
   j. Drawing number and detail references, as appropriate.
   k. Location(s) where product is to be installed, as appropriate.
   l. Related physical samples submitted directly.
   m. Indication of full or partial submittal.
   n. Transmittal number.
   o. Other necessary identification.
   p. Remarks.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. 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 Architect's and Construction Manager's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 – PRODUCTS

2.1. SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals via email as PDF electronic files.
   2. Action Submittals: Submit (3) paper copies of each submittal unless otherwise indicated. Architect will return (2) copies.
   3. Informational Submittals: Submit (2) paper copies of each submittal unless otherwise indicated. Architect will not return copies.
   4. 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.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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.
      i. PDF electronic file.
      j. (5) Paper copies of Product Data unless otherwise indicated. Architect will return (4) copies.

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 unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Submit Shop Drawings in the following format:
      a. PDF electronic file.

b. (3) Opaque copies of each submittal. Architect will retain (2) copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
      a. Number of Samples: Submit (3) sets of Samples. Architect will retain (1) Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
         1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least (3) sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. Three (3) paper copies of product schedule or list unless otherwise indicated. Architect will return (2) copies.

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests

performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

U. Field Test Reports: Submit written reports indicating and interpreting results of field tests either performed during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

V. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions, other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 – EXECUTION

3.1. CONTRACTOR'S REVIEW

A. Action and Informational 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 Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and 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.

3.2. ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals, not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000

QUALITY REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality- assurance and control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:
1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3. DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

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

   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4. CONFLICTING REQUIREMENTS

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

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

1.5. INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.6. REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and re-inspecting.

B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7. QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

I. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.8. QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and - control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9. SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and in Statement of Special Inspections attached to this Section, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1. SPECIAL TESTS AND INSPECTIONS

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 13300 "Submittal Procedures"

1.3. DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4. ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one (1) week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven (17) days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
b. b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5. QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from spilling.

1.7. PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 – PRODUCTS

2.1. PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items

2.2. COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300

EXECUTION

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

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

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

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting surveys.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3. INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
B. Certified Surveys: Submit two (2) copies signed by land surveyor.
C. Final Property Survey: Submit two (2) copies showing the Work performed and record

1.4. QUALITY ASSURANCE

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

1.5. WARRANTY

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

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION (Not Used)

3.1. WARRANTY

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

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2. PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions

outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3. CONSTRUCTION LAYOUT

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

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

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

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

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

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

3.4. FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

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

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.

C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

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

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

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5. INSTALLATION

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

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

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

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

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

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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

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

3.6. PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 27 degrees C.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

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

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

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not

recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

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

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

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

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

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

3.7. STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.8. STARTING AND ADJUSTING

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

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

END OF SECTION 017300

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. 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.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3. 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 permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, 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 Architect. 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 Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

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. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Advise Owner of changeover in heat and other utilities.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect 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 Architect, 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.

1.4. FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect 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.

1.5. LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

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

1.6. SUBMITTAL OF PROJECT WARRANTY

A. Time of Submittal: Submit written warranties on request of Architect 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 Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215 mm x 280 mm paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 – PRODUCTS (Not used)

2.1. MATERIALS

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

1. Use cleaning products that comply with the relevant code for regulations in maximum allowable VOC levels.

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 and Federal and local environmental and antipollution regulations.

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

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.

l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

3.2. REPIR OF THE WORK

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

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

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

B. Related Requirements:

   1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Section 017700 “Closeout Procedures”.

1.3. CLOSEOUT SUBMITTALS

A. 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 Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

   2. Three (3) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two (2) copies.

B. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

C. Final 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. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 – PRODUCTS

2.1. OPERATION AND MAINTENANCE DOCUMENTARY DIRECTORY

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. Include a section in the directory for each of the following:
   1. Use List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2. REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. 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.

B. Title Page: Include the following information:

   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.

C. 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.

D. 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.
E. 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 binders, in thickness necessary to accommodate contents, sized to hold 215 mm x 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, cross-referenced to Specification Section number 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. a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. 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.

2.3. EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating

personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4. 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 procedures.
4. Operating logs.
5. Wiring diagrams.
6. Control diagrams.
7. 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.

2.5. 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 and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. 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.

1. Include procedures to follow and required notifications for warranty claims.

2.6. 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 and drawing or schedule designation or identifier where applicable.

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.
6. Demonstration and training video recording, if available.

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.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1. MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. 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.

   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. 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.

   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Requirements:

   1. Section 017300 "Execution" for final property survey.
   2. Section 017700 "Closeout Procedures" for general closeout procedures.
   3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3. CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit 1 set(s) of marked-up record prints.

B. Record Specifications: Submit one paper copy annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy annotated PDF electronic files and directories 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 and Shop Drawings, incorporating new and revised drawings 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.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Record data as soon as possible after obtaining it.

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. Mark Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.

2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

3. Refer instances of uncertainty to Architect for resolution.

4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

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

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor

2.2. RECORD SPECIFICATIONS

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

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

2.3. RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, record Specifications, and record Drawings where applicable.

2.4. MISCELLANEOUS RECORD SUBMITTALS

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

PART 3 - EXECUTION

3.1. RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during 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 and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner'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.
3. Demonstration and training video recordings.

1.3. INFORMATION 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. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4. CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.

1.5. QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6. COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 – PRODUCTS

2.1. INSTRUCTION PROGRAM

A. 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.

B. 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. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.

e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning

e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. 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. INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven (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.

3.2. DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum format type acceptable to Owner.

C. Narration: Describe scenes on video recording by audio narration off-site after video recording is recorded. Include description of items being viewed.

D. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

END OF SECTION 017900

SECTION 022113

SITE SURVEYS

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section specifies the gathering of research documents, performance of a topographic survey and preparation of a topographic survey map.

1.2. MATERIALS (not used)

PART 2 – EXECUTION

A. The surveyor shall research available public records for all mapping, plats, governmental surveys etc. that may pertain to the subject property. Research all applicable public utilities for substructure data such as sewers, storm drains, water lines, electrical conduits etc.

B. The surveyor, when applicable, shall consult with the Project Architect / Engineer to determine the scale of plat or map and sizes of drawings.

C. The surveyor shall furnish two sets of prints of the plat or map of survey and an electronic CADD file. If the plat or map of survey consists of more than one sheet, the sheets shall be numbered, the total number of sheets indicated and the match lines shown on each sheet.

D. On the plat or map, the survey boundary shall be drawn to a convenient scale, or the scale designated by the Architect, with the scale clearly indicated. A graphic scale, shown in meters shall be included. A north arrow shall be shown and when applicable, the plat or map of survey shall be oriented so that north is at the top of the drawing. Symbols or abbreviations used shall be identified on the face of the plat or map of survey by use of a legend or other means. Supplementary or exaggerated diagrams shall be presented accurately on the plat or map where dimensional data is too small to be shown clearly at full scale. The plat or map shall be 30 by 42 inches.

E. The survey shall contain the following applicable information:

1. The name, address, telephone number, and signature of the Professional Land Surveyor who made the survey, his or her official seal and registration number, the date the survey was completed and the dates of all revisions.

2. The survey drawing(s) submitted shall bear the following certification adjacent to the Engineer's official seal: "I hereby certify that all information indicated on this drawing was obtained and verified by actual measurements in the field and that every effort has been made to furnish complete and accurate information."

3. Vicinity map showing the property surveyed in reference to nearby highways or major street intersections.

4. Land area as defined by the boundaries of the legal description of the surveyed premises.

5. All data necessary to indicate the mathematical dimensions and relationships of the boundary represented by bearings and distances, and the length and radius of each curve, together with elements necessary to mathematically define each curve. The point of beginning of the surveyor's description and the basis of bearings shall also be shown.

6. When record bearings or angles or distances differ from measured bearings, angles or distances, both record and measured bearings, angles, and distances shall be clearly indicated. If the record description fails to form a mathematically closed figure, the surveyor shall so indicate.

7. Measured and record distances from corners of parcels surveyed to the nearest right-of-way lines of streets in urban or suburban areas, together with recovered lot corners and evidence of lot corners, shall be noted. The distances to the nearest intersecting street shall be indicated and verified. Names and widths of the streets and highways abutting the property surveyed and widths of right-of-way shall be given. Observable evidence of access (or lack thereof) to such abutting streets or highways shall be indicated. Observable evidence of private roads shall be so indicated. Streets abutting the premises, which have been described in record Documents, but not physically opened, shall be shown and so noted.

8. The identifying titles of all recorded plats, filed maps, right-of-way maps, or similar documents which the survey represents, wholly or in part, with their appropriate recording data. The survey shall indicate platted setback or building restriction lines which have been recorded in subdivision plats or which appear in a Record Document which have been delivered to the surveyor. Contiguity, gores, and overlaps along the exterior boundaries of the survey premises, where ascertainable from field evidence or Record Documents, or interior to those exterior boundaries, shall be clearly indicated or noted. Where only a part of a recorded lot or parcel is included in the survey, the balance of the lot or parcel shall be indicated.

9. The location of all buildings upon the plot or parcel shall be shown and their locations defined by measurements perpendicular to the boundaries. State if there is no building. Proper street numbers shall be shown where available.

10. All easements evidenced by a Record Document which have been delivered to the surveyor shall be shown, both those burdening and those benefiting the property surveyed, indicating recording information. If such an easement cannot be located, a note to this affect shall be included. Observable evidence of easements and/or servitudes of all kinds, such as those created by roads, right-of-ways, water courses, drains, telephone, or electric lines, water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed property, shall be located and noted. Surface indications, if any, or of underground easements and/or servitudes shall also be shown.

11. The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted. Without expressing a legal opinion, physical evidence of encroaching structural appurtenances and projections by or on adjoining property or on abutting streets,

on any easement or over setback lines shown by Record Documents shall be indicated with the extent of such encroachment or projection.

12. Location, alignment and dimensions of all roads, curbs, walks, parking and paved areas abutting the subject land. Indicate road centerlines with true bearings and lengths by 50 foot stationing. Describe curves by designating the points of curvature and tangency by station. Include all curve data as well as a location of radius and vertex points.

13. Location of utilities existing on or serving the surveyed property as determined by observing evidence together with plans and markings provided by utility companies, and other appropriate resources (with reference as to the source of information). Locate and show all fire hydrants located within 500 feet of the project property.

14. Indicate location of manholes, catch basins, valve vaults or other surface indications of subterranean uses.

15. Wires and cables (including their function) crossing the survey premises, all poles on or within ten feet of the surveyed premises, and the dimensions of all cross-wires or overhangs affecting the surveyed premises.

16. Utility company installations on the surveyed premises.

17. Names of adjoining owners of platted lands.

18. Observable evidence of earth moving work, building construction or building additions within recent months.

19. Any changes in street right-of-way lines either completed or proposed, and available from the controlling jurisdiction. Any observable evidence of recent street or sidewalk construction or repairs shall be indicated.

END OF SECTION 022113

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes: cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building walls.

1.3. ACTION SUBMITTALS

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

B. Shop Drawings: For steel reinforcement.

C. Material test reports and certificates.

D. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

F. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

G. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

   1. Location of construction joints is subject to approval of the Architect.

1.4. INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Steel reinforcement and accessories.
3. Water stops.
4. Vapor retarders.
5. Repair materials.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 – PRODUCTS

2.1. FORM-FACING MATERIALS

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

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

2.2. STEEL REINFORCEMENTS

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

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3. CONCRETE MATERIALS

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

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

B. Normal-Weight Aggregates: ASTM C 33, Use well-graded, clean hard particles of gravel or crushed rock conforming to the "STANDARD SPECIFICATIONS FOR CONCRETE AGGREGATES".

1. Maximum Coarse-Aggregate Size: shall not be larger than 1/5 of the narrowest dimension between sides of the forms nor larger than 3/4 of the maximum clear spacing between reinforcing bars, and in no case larger than 38 mm (1 ½") in diameter.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

2.4. ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

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

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

2.5. WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

2.6. VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 0.25 mm thick.

2.7. CURING MATERIALS

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

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

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

D. Water: Potable.

2.8. RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.9. METHOD OF DETERMINING OF CONCRETE STRENGTH AND PROPORTIONS

A. Submit mix designs obtained from samples made in accordance with "Standard METHOD OF MAKING AND CURING CONCRETE COMPRESSION AND FLEXURE SPECIMENS" (ASTM Designation A192) and "STANDARD METHOD OF TEST COMPRESSIVE STRENGTH OF MOLDED CONCRETE CYLINDERS" (ASTM Designation C-39) for each strength required stating the proposed slump and the proportional weights of cement, saturated dry aggregates, and water.

B. These mixes shall be proved by preliminary tests of 30 days before concreting and shall show a 28- day strength of 15% higher than the ultimate required.

C. No substitution shall be made in the materials or mix without additional tests to show that the quality of concrete is satisfactory.

D. As to the actual pouring to verify whether the established strength mix design is followed, specimen shall be taken on actual mixing trucks prior to pouring and will be tested for 28-day compressive strength using the same testing method.

PART 3 – STEEL REINFORCEMENTS

3.1. FABRICATING REINFORCEMENTS

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

3.2. CONCRETE MIXING

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

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

PART 4 – EXECUTION

4.1. FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

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

4.2. EMBEDDED ITEMS

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

4.3. VAPOR RETARDERS

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

1. Lap joints 150 mm and seal with manufacturer's recommended tape.

4.4. STEEL REINFORCEMENTS

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

4.5. JOINTS

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

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

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

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

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

4.6. WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

4.7. CONCRETE PLACEMENT

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

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

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

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI

D. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 32 deg C at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

4.8. FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

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

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

4.9. FINISHING FLOORS AND SLABS

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

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

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

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

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thinfilm-finish coating system.
2. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system
3. For slabs to receive porcelain floor tile, finish floor slab surfaces to tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface: Specified overall values of flatness, F(F) 40; with minimum local values of flatness, F(F) 30; and of overall levelness, F(L) 30; and of local levelness, F(L) 20.

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

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

4.10. CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 300mm lap over adjacent absorptive covers.

4.11. CONCRETE SURFACE REPAIRS

A. Non-Structural Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Limited to only non-structural defects.

B. Structural Defective Concrete: Notify the Architect and the Structural Engineer-of-Record of such defects. The Contractor should not continue work on areas affected by the said defect. Contractor to consult its own Structural Engineer (ASEP Member) to assess the defect and submit a report indicating the root cause/Root Cause Analysis Report and propose a rectification methodology to the designer for its review and approval prior to any repair and/or retrofitting of defective areas.

4.12. FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed.

END OF SECTION 033000

SECTION 071300

SHEET WATERPROOFING MEMBRANE (BLIND SIDE SYSTEM)

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes:

1. Sheet Waterproofing Membrane (Blindside System)
   a. Accessories of the products
   b. Surface Preparation
   c. Installation of sheet membrane system and accessories.

1.3. ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal- supported concrete pavers.

1.4. INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For waterproofing, based on evaluation of comprehensive tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.5. QUALITY ASSURANCE

A. Supplier Qualifications: A Manufacturer and/or Supplier engaged in waterproofing with at least **10 years'** experience to include pre-formed membrane, whose publish literature clearly indicates general compliance of products with requirements of this section. The Manufacturer of the specified product shall be ISO 9001: 2015 certified and have in existence a recognized ongoing quality assurance program, independently audited on a regular basis.

B. Installer Qualifications: A highly specialize Applicator that is approved or accredited by the waterproofing manufacturer for installation of waterproofing required for this Project. Qualified in the field of waterproofing application with a successful track record of **3 years** or more. The Applicator shall maintain qualified personnel who have received product training by the Manufacturer and/or suppliers technical team.

C. Source Limitations: Obtain waterproofing materials from single source from single manufacturer.

D. Mockups: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.

1. If Architect determines mockups do not comply with requirements, reapply waterproofing until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Pre-installation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
C. Store rolled membrane on pallets.

D. Do not store at temperatures above 36-38 degrees C for extended periods.

E. Keep away from sparks and flames.

F. Completely cover when stored outside. Protect from rain.

G. Protect materials during handling and application to prevent damage or contamination.

H. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.7. PROJECT CONDITIONS

A. Maintain ambient conditions recommended by manufacturer for best working environment. Do not install products under outside manufacturer's declaration.

B. SHEET WATERPROOFING MEMBRANE

1. Perform work when existing and forecasted weather conditions are within the limits established by the membrane manufacturer.
2. Ensure subsoil is approved by the Architect or geotechnical firm. Manufacturer to also inspect actual substrate condition prior to installation.
3. Wear appropriates PPE and protective clothing as directed by the Safety Officer onsite.
4. Keep flammable products away from spark or flame. Post "No Smoking" signs. Do not allow use of spark-producing equipment during application.
5. Maintain work area in a neat and workmanlike condition. Remove empty packaging materials and rubbish from the site daily. Follow housekeeping rules

1.8. WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which waterproofing manufacturer and Installer agree to repair or replace waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements.

2. Warranty Period: **10 years** from date of Substantial Completion.

PART 2 – PRODUCTS

2.1. FULLY BONDED HDPE WATERPROOFING MEMBRANE (SANDED)

A. A multilayer compound waterproof material with excellent performance. It includes one layer of high-density PE film, one layer pressure sensitive polymer adhesive and one insulation layer. It is Highly recommended to be used as a vapor barrier and a waterproof layer specifically for below grade structures.

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

a. **BLOCK X750 HDPE** and corresponding accessories by BOSTIK PHILIPPINES INC.
b. Or approved equal.

2.1. AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended by manufacturer to be compatible with one another and with waterproofing, as demonstrated by waterproofing manufacturer, based on testing and field experience.

2.3. PERFORMANCE REQUIREMENTS

A. BLOCK X750 HDPE is widely used on flat concrete surface as well as waterproof layer of vertical surface of temporary and adjacent structures to form continuous and permanent combination. It is designed for waterproofing protection to basement with accessible and non-accessible basement rafts and confined retaining walls with high water table and cut & cover structures area as tunnels, subway and etc.

a. Colour: White

b. Puncture Resistance: ≥600 N

c. Tensile Strength: 22 +/-5 MPa

d. Elongation at break: ≥550%

e. Low Temperature Flexibility : <-25 degrees C (no visual cracks)

f. Tensile Strength: 22 +/-5 MPa

g. Peel Adhesion to Concrete: ≥880 N/mm

h. Performance of anti-water breakthrough: 0.6 MPa, no water breakthrough

i. Peeling strength with post-cast concrete after immersed in water: ≥1.5 N/mm

PART 3 – EXECUTION

3.1. PREPARATION

A. Complete the retention system per project specifications.
B. Remove objects that could penetrate the membrane, such as nails and concrete fins.
C. Never place the membrane in standing water.
D. Remove surplus water from excavation to be concreted.
E. Surface must be dry prior to application.

3.2. GENERAL SITE CONDITION

A. For Horizontal Area/below raft area - Blinding concrete is suitable as a base layer to receive BLOCK X750 HDPE. Alternatively, a well compacted soil, drainage board or a 19 mm ply can be used as a substrate. The base layer should be rigid and should not move under load of concrete.
B. For Vertical Area: For Blind side (If required) waterproofing a smooth finish shotcrete/block work or 19 mm sacrificial plywood would serve as substrate. The plywood/drainage board should be rigid and should not move under the load of concrete. Single side formwork is recommended for blind side waterproofing.
C. The area should be relatively dry with no standing water (appropriate drainage system should be adopted if water stagnant is expected)

D. At site where water table is high and or water logging is anticipated, sump pits/dewatering system should be installed. No water should be allowed to stagnate below BLOCK X750 HDPE till concrete for the raft/slab is completed.
E. The rebar chair used should not be sharp, it may damage BLOCK X750 HDPE. Concrete blocks or PVC rebar chair which has a larger base to distribute the load is recommended for use.

3.3. SURFACE PREPARATION

A. The substrate shall be PCC concrete of sufficient thickness to ensure a firm substrate that will not crack or deform under normal trafficable conditions during waterproofing installation, and structural concreting operations. It should be free from debris and other irregularities, which may puncture and damage the waterproof liner.
B. Any standing water on the substrate should be removed.
C. The substrate needs to be uniform. Any undulations or voids greater than 13mm should be filled with a repair mortar or material to provide sufficient support to the membrane after it is placed. (This activity will be in client's scope).

3.4. MEMBRANE LAYOUT

A. The HDPE side should always face the substrate, whereas the sanded side will receive the fresh concrete. The membrane layout should be such that the joints are staggered. Horizontal membrane should be laid first.

B. For selvedge side - Overlap the adjacent membrane to minimum 75 mm. Remove the release liner partially from the selvedge area and place the adjacent membrane. Firmly press the membrane with hand followed by rolling. Ensure no fish-mouth occurs, if fish-mouth occurs, apply BLOCK X751 HDPE ONE SIDE TAPE over the fish-mouth area.

1. Provide sealant cants around penetrations and at inside corners of deck-to-wall butt joints when recommended by waterproofing manufacturer.

3.5. DETAIL ON END LAPS (without selvedge)

A. OPTION 1
a. Place the membrane in sequence as shown 1,2,3, and 4 and roll.
b. Apply BLOCK X752 HDPE TWO SIDE TAPE & BLOCK X751 HDPE ONE SIDE TAPE centrally at the lap area as shown - 5 and roll
c. Apply BLOCK X751 HDPE ONE SIDE TAPE as shown 6 and 7 and roll.
d. Note: Due to thickness of BLOCK X750 HDPE there is a step-down formation at the overlap area. When BLOCK X751 HDPE ONE SIDE TAPE is applied over the area, a small air channel is formed. This area should be carefully rolled using a Vee Roller or a pointed roller.

B. Option 2
a. Place membrane 1, 2 and 3. Bond the membrane 1 and 2 at the selvedge.
b. Remove the sand at the end lap of membrane 2 by heating using hot air gun (Leister Triac SA) approx. 180°C - 200°C heat temperature then removes the sand with scraper at 80mm for overlap.
c. Apply BLOCK X752 HDPE TWO SIDE TAPE at the end lap of membrane 2. Remove the release liner of BLOCK X752 HDPE TWO SIDE TAPE, bond membrane 3 onto BLOCK X752 HDPE TWO SIDE TAPE and selvedge of membrane 1.

d. Place membrane 4 and bond to membrane 2 and 3.
e. Apply BLOCK X751 HDPE ONE SIDE TAPE as shown 6 and 7 and roll.
f. Note: Due to thickness of BLOCK X750 HDPE there is a step-down formation at the overlap area. When BLOCK X751 HDPE ONE SIDE TAPE is applied over the area, a small air channel is formed. This area should be carefully rolled using a Vee Roller or a pointed roller.

3.6. SYSTEM APPROACH

A. This system is generally used where there is no space between the boundary line of the building and the excavation line. This system is also referred as blind side waterproofing. In this system waterproofing of the Horizontal (raft) as well as the Vertical (retaining wall) section of the structure is done with BLOCK X750 HDPE membrane.
B. Composite - This system is generally used where there is sufficient gap between the boundary line of the building and the excavation line so as to apply waterproofing membrane from the positive side. In this system the horizontal area waterproofing is done with BLOCK X750 HDPE membrane whereas the vertical area is done with BLOCK B550 BOSCOSEAL 16 / BLOCK B750 DOUBLE-SIDED SAM / BLOCK X970 2K SPRAY APPLY POLYUREA / BLOCK P550 BOSCOSEAL PUW (BY BOSTIK).

3.7. LAYING OF WATERPROOFING MEMBRANE ON PCC FOR RAFT WATERPROOFING

A. BLOCK X750 HDPE is supplied in 1.0-meter-wide rolls of 40 meters length. The membrane needs to be laid with the HDPE film side facing down (towards the PCC) and the side with the sand finished to be on top, facing the concrete pour.
B. Lay a second roll of the membrane alongside the first one ensuring an overlap of 75mm between both. Make sure the membranes are laid in a staggered manner next to each other.
C. The overlap of the second membrane should be in line with the marked selvedge.
D. Ensure the underside of the succeeding sheet and top of release liner are clean, dry and free form contamination before attempting to bond overlap. Peel back and completely removes the plastic release liner progressively between the overlap as the two layers are bonded together.
E. Roll firmly over the edges to ensure proper bonding.
F. Use double sided HDPE sticky tape - BLOCK X752 HDPE TWO SIDE TAPE for securing end laps. Use scraper and hot air gun to remove the sand with 80mm overlap. Tape must be adhered onto a clean and dry membrane substrate to ensure bond strength. Before applying BLOCK X752 HDPE TWO SIDE TAPE, any water / moisture on the application area MUST first be removed.
G. During damp conditions (e.g. water spillage), the selvedge and tape adhesive can be gently warmed using a hot air gun or similar to remove moisture or condensation and improve initial adhesion.
H. Ensure that the BLOCK X750 HDPE is applied at least 500mm longer than the installed rebar so that there is accessibility on lapping with subsequent membrane.
I. Placing of temporary formwork -- Timber and steel shuttering should be positioned with care onto membrane and measures taken to minimize concrete spillage.
J. Commence the process of laying the raft. It is recommended to pour the concrete within 5 weeks of installing the membrane at site. While doing the compaction of the concrete, care must be taken not to damage the membrane. Consolidation with sharp objects should be avoided.

3.8. WATERPROOFING OF CONFINED/BLIND SIDE STANDALONE SYSTEM

A. Lay the horizontal membrane on the blinding screed/substrate with a minimum overlap of 75mm.
B. Lay the membrane on the vertical rigid support.
C. The minimum height of vertically installed membrane should either be 500mm more than the finished level of raft or 500mm more than the height of reinforcement, whichever is greater. Subsequent height of the membrane should at least be kept 500mm more than the height of reinforcement.
D. Anchors to hold the membrane in position should be provided in the overlap area. If anchors are not within the overlap area, provide a small patch of BLOCK X750 HDPE adhered by BLOCK X752 HDPE TWO SIDE TAPE over the anchor and overlapping all around with minimum 75mm. (150mm diameter patch to be used).
E. If the membrane gets dirty with concrete splashes at the overlap area, tug the top membrane behind the bottom membrane and use BLOCK X752 HDPE TWO SIDE TAPE (Adhesive side of top membrane will bond to HDPE side of bottom membrane).

3.9. FORMWORKS REMOVAL

A. Removal of formworks having BLOCK X750 HDPE membrane should be done at least 7 days after pouring to ensure adequate curing of concrete that is essential to the adhesion of membrane. If cannot be avoided due to time constraint, the formworks should be carefully removed, ensuring all temporary mechanical fixation or adhesive used for the membrane, that may cause the membrane to peel away from concrete, are initially removed.

3.10. DAMAGE REPAIR PROCEDURE

A. Work shall be visually inspected for damages before and after installation of steel reinforcements.
B. If overlaps and BLOCK X751 HDPE ONE SIDE TAPE/BLOCK X752 HDPE TWO SIDE TAPE have not fully bonded it will be necessary to clean the affected areas with damp cloths, allow to dry, then apply new tape as appropriate.
C. Check membrane after finishing bottom bar laying & rectify any damage & puncture. Damaged areas to be repaired with an oversize patch of BLOCK X750 HDPE applied to a clean, dry surface fixed with tape. Maintain 75 – 80mm overlap periphery of damaged and remove the sand with hot air gun prior fixing with BLOCK X752 HDPE TWO SIDE TAPE.
D. Minor damages like scratches can be directly repaired by removing the sand and placing BLOCK X751 HDPE ONE SIDE TAPE centrally on the surface prepared.
E. Recheck the membrane after finishing reinforcement cage for the raft & rectified for any puncture or damage.
F. BLOCK X750 HDPE extended beyond concrete pour area for further overlapping should be covered with tarpaulin to avoid direct UV Exposure till subsequent pour.
G. If the concrete pour between tower and non-tower is anticipated to come after UV Exposure limit of membrane than it is advisable to cover the membrane with release liner or loose HDPE sheet (200 microns) to avoid direct UV exposure and prevent membrane damage during prolonged exposure.
H. All nails penetrating BLOCK X750 HDPE where fresh concrete will be in contact must not be left exposed. BLOCK X751 HDPE ONE SIDE TAPE must be applied on top of all penetrations.

3.11. DETAILING

A. PVC, Pressure Release Pipe Treatment:

a. Fixing the pressure release pipe/Rock anchor sleeve minimum 150 mm below the PCC level. The pressure release pipe base shall be surrounded with metal and geotextile as a separation layer and grouted with cement sand mortar. (Providing & Fixing Pressure release pipe/rock anchor sleeve in civil contractor's scope)

b. Once all the pressure release pipes are fixed in position, BLOCK X750 HDPE to be laid as per manufacturer's specification on PCC / blinding concrete surface.

c. BLOCK X750 HDPE need to be cut close to penetration & ensures the membrane surface is clean dry and free of contaminants.

d. The junction of BLOCK X750 HDPE and the pipe periphery shall be sealed with the help of a single-sided HDPE tape (BLOCK X751 HDPE ONE SIDE TAPE), wrapped all around the periphery of the sleeves at the bottom.

e. Apply BLOCK P550 BOSCOSEAL PUW with a brush or roller with a minimum overlap of 75 mm onto BLOCK X750 HDPE laid horizontally & 200mm onto the vertical surface of pipe followed by wrapping BLOCK X751 HDPE ONE SIDE TAPE with an overlap of 50mm over BLOCK P550 BOSCOSEAL PUW as shown in below drawing.

f. BLOCK P550 BOSCOSEAL PUW shall be allowed to cure for 24 hours before pouring of concrete, to achieve watertight continuity.

g. BLOCK X910 JOINT BARS (Hydrophilic water stop) to be wrapped around pipe and fixed with adhesive binding wire prior to concreting.

3.12. G.I. PIPE TREATMENT

A. Fixing the pressure release pipe/Rock anchor sleeve minimum 150 mm below the PCC level. The pressure release pipe base shall be surrounded with metal and geotextile as a separation layer and grouted with cement sand mortar. (Providing & Fixing Pressure release pipe/rock anchor sleeve in civil contractor's scope)

B. Once all the pressure release pipes are fixed in position, BLOCK X750 HDPE to be laid as per manufacturer's specification on PCC / blinding concrete surface BLOCK X750 HDPE need to be cut close to penetration ensures the membrane surface is clean dry and free of contaminants.

C. Remove dust, debris, and any other contaminants from the surface of GI pipe. Clean surfaces to near white metal finish ie SA 2.5

D. Apply BLOCK P550 BOSCOSEAL PUW with a brush or roller with a minimum overlap of 75 mm onto BLOCK X750 HDPE laid horizontally & 200mm onto the vertical surface followed by wrapping of BLOCK X751 HDPE ONE SIDE TAPE with an overlap of 50mm over BLOCK P550 BOSCOSEAL PUW as shown in the diagram.

E. BLOCK P550 BOSCOSEAL PUW shall be allowed to cure for 24 hours before pouring of concrete to achieve watertight continuity.

F. BLOCK X910 JOINT BARS (Hydrophilic gasket) to be wrapped around GI pipe prior to concreting.

3.13. PASSIVE ANCHOR TREATMENT

A. Passive rock anchor shall be treated by applying BLOCK P550 BOSCOSEAL PUW. Minimum 75 mm

3.14. PILE TREATMENT

A. Re-profiling of Pile Head: Using non-shrink cementitious grout.
B. Sealing of Side faces of Pile Cap: Using bitumen modified Polyurethane waterproofing membrane BLOCK P550 BOSCOSEAL PUW.
   a. Surface Preparation: Concrete substrates should be free from weak laitance, surface contaminants and curing compounds. Remove any friable material and laitance by mechanical means. Remove rust from any reinforcement that will be encapsulated by the cementitious grout. Continuously pre-soak the substrate with clean water for at least an hour before grout application, this ensures substrate saturation. Remove any ponded water immediately before grout application, manually or with an air lance.
   b. Placing: Formwork must be constructed to be leak-proof. All formwork should be coated with a release agent, before the grout is placed. The compression pile surface will be re-profiled in minimum 20mm.
   c. Sealing of Side faces of Pile Head Once grout was appropriate cured, apply BLOCK P550 BOSCOSEAL PUW - 75 mm onto BLOCK X750 HDPE & onto pile side surface as far as reinforcement will allow. BLOCK P550 BOSCOSEAL PUW should be applied by trowel or spatula maintaining minimum thickness of 2.5 mm.

3.15. ALONG CORNERS DETAILING

A. Internal and external corners should be formed as shown in the diagrams returning the membrane a minimum of 100mm and sealing with BLOCK X751 HDPE ONE SIDE TAPE. Ensure that the apex of the corner is covered and sealed with tape and roll firmly. Crease and fold the membrane to ensure a close fit to the substrate profile and avoid hollows.

3.16. ROCK ANCHOR BOLT TREATMENT IN CONFINED RETAINING WALLS

A. The first step consists of fabricating a box (Metal/Wooden/PVC) size dependent on size of
a. rock anchor bolt and mounting it securely around rock anchor bolt as per waterproofing agency proposed drawing - In Civil Contractor's OR Waterproofing Applicator’s Scope.

3.17. FIELD CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.
B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.18. CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer’s recommendations.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 071300

SECTION 071614

INTEGRAL / ADMIXTURE-TYPE WATERPROOFING

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes the following:

1. Surface preparation and substrate treatment.
2. Integral / admixture-type waterproofing.

1.3. PERFORMANCE REQUIREMENTS

A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with physical requirements of ASTM C 836 as demonstrated by testing performed by an independent testing agency of manufacturer’s current waterproofing formulations

1.4. SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections
B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing
C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
F. Sample Warranty: Copy of waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing

1.5. QUALITY ASSURANCE

A. Supplier Qualifications: Shall be atleast (10) years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section. The Manufacturer of the specified product shall be ISO 9001: 2015

certified and have in existence a recognized ongoing quality assurance program, independently audited on a regular basis.

B. Installer Qualifications: A Specialist Applicator that is approved or licensed by waterproofing manufacturer for installation of waterproofing required for this Project. Qualified in the field of waterproofing coating application with a successful track record of 3 years or more. The contractor shall maintain qualified personnel who have received product training by a Manufacturer/Supplier representative.
C. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.
D. Field Samples: Apply waterproofing field sample to concrete slab to demonstrate surface preparation and standard of workmanship

1. Notify Architect one week in advance of the dates and times when field sample will be prepared.
2. Retain and maintain approved field sample during construction in an undisturbed condition as a standard for judging the completed waterproofing. An undamaged field sample may become part of the completed Work.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
B. Store materials in their original undamaged container in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.
C. Remove and replace material that cannot be applied within its stated shelf life.

1.7. PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during preparation, application, and through complete curing of waterproofing materials.

1.8. WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with

requirements or that does not remain watertight within specified warranty period. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/16-inch (1.6-mm.) in width.

1. Warranty Period: **10 years** from date of Substantial Completion.

PART 2 – PRODUCTS

2.1. MANUFACTURERS

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

1. Integral / Admixture-type waterproofing

a. **CWS ADMIX** by CWS WATERPROOFING
b. **FOSROC CONPLAST W400** by **PRIME STAR GLOBAL**
c. **SEALPROOF ICW-119 BY SEALBOND CHEMICAL INDUSTRIES INC.**
d. Or approved equal.

2.1.1 MATERIALS

1. 3CC C System: Superplastet, the first of the System ingredients, is a highly effective superplasticiser used to reduce water requirements and improve wokability for complete compaction. The second and vital ingredient, 3CC reacts with alkalis in the concrete forming a highly water-repelling compound along the capillaries and throughout the concrete or mortar. In this way, the surface tension forces which would normally draw water into the capillaries and microcracks.

2.2. MANUFACTURERS

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Tank Lining

a. **BOSTIK ETL-FG60** by BOSTIK
b. **FOSROC NITOCOTE EP405** by **PRIME STAR GLOBAL**
c. Or approved equal.

2.2.1 MATERIALS

1. Is The nontoxic epoxy (Food grade) resin coating, solvent free, protective coating. The coating shall be moisture tolerant and, when cured, shall be suitable for use in contact with potable water. It shall further possess excellent bond and chemical resistance properties.

PART 3 – EXECUTION

3.1. EXAMINATION

A. 3CC System:

1. Concrete shall be waterproofed by the addition of 3CC Integral Waterproofer at a rate of 15 liters per cubic meter. Superplasticer or other approved water reducing admixture shall be added at a rate of 1 – 1.5% by weight of cement per cubic meter to preserve the desired slump. The cement content of waterproofed concrete shall not be less than 350 kg. per cubic meter. Cement content shall be stated on premix concrete dockets.

3.2. FIELD QUALITY CONTROL

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.

E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.3. PREPARATION AT TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to ASTM C 898 and manufacturer's written instructions.

B. Prime substrate unless otherwise instructed by waterproofing manufacturer.

C. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

1. Provide sealant cants around penetrations and at inside corners of deck-to-wall butt joints when recommended by waterproofing manufacturer.

3.4. JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 ASTM C 1471and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks, complying with ASTM D 4258, before coating surfaces.

1. Comply with ASTM C 1193 for joint-sealant installation.
2. Apply bond breaker between sealant and preparation strip.
3. Prime substrate and apply a single thickness of preparation strip extending a minimum of 75 mm along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

B. Install sheet flashing and bond to deck and wall substrates where indicated or required according to waterproofing manufacturer's written instructions.
1. Extend sheet flashings onto perpendicular surfaces and other work penetrating substrate according to ASTM C 898.

3.5. WATERPROOFING APPLICATION

A. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 071614

SECTION 311000

SITE CLEARING

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section includes

1. Protecting existing vegetation to remain.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.

1.3. MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4. INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5. QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site.

1.6. PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premise.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

H. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on- site.

PART 3 – EXECUTION

3.1. PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2. TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3. EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

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

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.4. EXISTING UTILITIES

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 450 mm below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 200 mm, and compact each layer to a density equal to adjacent original ground.

3.5. TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated on Drawings in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 50 mm in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6. DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 313116

TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditionsand Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Soil treatment with termiticide.
2. Anti-termite reticulation system.

1.3 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA/FDA-Registered Label for termiticide products.
2. Technical Brochure including Safety data sheets

B. Qualification Data: For qualified Installer and management services.

C. Product Certificates: For termite control products, from manufacturer.

D. Pre-treatment Report: Before application of termiticide, submit the following:

1. Lay-out plans and shop drawings.
2. Installation program.

E. Soil Treatment Application Report: After application of termiticide is completed, submit report forOwner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application, As-built plan.
7. Water source for application.
8. Systems operating instructions.

F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA/FDA-Registered Label.

B. Source Limitations: Obtain termite control products from single source from single manufacturer.

C. Pre-installation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treatsoil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Three years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide a comprehensive and continuing service to be undertaken every six (6) months including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

1. Warranty Period: Three (3) years from date of Substantial Completion signed by the Pest Management Operator.

2. In the event of any discovery of termite activity during the three (2\3) years warranty period, alltermite abatement work including soil re-treatment work necessary and appropriate shall be undertaken at no

additional cost to the Owner.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

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

a. Bayer Environmental Science; Premise SC200 (Imidacloprid) (Non-repellant).
b. Bayer Environmental Science; Agenda 2.5 EC, formerly Termidor 2.5 EC (Fipronil)

B. Anti-Termite Reticulation System: Provide an FPA-registered anti-termite reticulation system complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

1. Polyethylene perforated pipes
2. Protective filter fabric
3. 50mm dia., brass, filler point covers (Verify approval of Architect)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as

wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 DELIVERY AND STORAGE

A. General: Termiticides shall be delivered to project site in sealed & labeled containers as supplied by manufacturer. The label shall be complete with application and safety instructions and bear the EPA/FDA registration number. Temporary storage of insecticides utilized at the project site shall be allowed subject to standard environmental safety requirement.

3.4 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.5 APPLYING SOIL TREATMENT

Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be

penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.6 INSTALLATION OF ANTI-TERMITE RETICULATION SYSTEM

A. Use the approved lay-out plan and installation program. Any deviation there from must have prior approval of the Architects.

B. Conduct operation ability test on all reticulation pipes installed before they are finally covered. The Construction Manager must certify that test has been successfully undertaken.

C. Upon completion, submit an as-built plan and operating instruction of the system.

D. Ensure that filler point covers are properly installed and that they conform with designer's specification.

END OF SECTION 313116

PROPOSED PHILIPPINE COUNCIL FOR HEALTH RESEARCH AND DEVELOPMENT (PCHRD) SALIKSIK BUILDING EXTENSION PROJECT

(PHASE 1)

Bicutan Science Community, DOST Comp., General Santos Avenue,

Bicutan, Taguig City

TECHNICAL SPECIFICATIONS

STRUCTURAL WORKS

CONTRACT DOCUMENTS

June 2025

OWNER

PHILIPPINE COUNCIL FOR HEALTH RESEARCH AND DEVELOPMENT, DOST-TAGUIG

ENRIQUE O. OLONAN & ASSOCIATES
ARCHITECTS ENGINEERS CONSULTANTS

IN JOINT
VENTURE WITH

ENRIQUE O. OLONAN AND ASSOCIATES, CO.
ARCHITECTS ENGINEERS CONSULTANTS

ENGR. ELIAS R. REY
PRC: 91876
REG VALID: 07-20-2026
PTR: 2721980
DATE ISSUED: 01-02-25
ISSUED: PASIG CITY
TIN NO: 230-121-725

CONSTRUCTION SPECIFICATIONS

EARTHWORK

TABLE OF CONTENTS

The specification covers general requirements for the building works of excavation and backfilling for this project.

1.1.1 Scope

Excavating, filling, and sub-grade preparation in connection with the construction of foundations and underground facilities for building.

The work includes but is not necessarily limited to:

(1) Surveying
(2) Site clearing
(3) Protecting existing facilities
(4) Excavating for footings and foundations
(5) Filling and backfilling to formation levels
(6) Preparation of sub-grade in building areas
(7) Earthworks generally
(8) Quality control

1.1.2 Surveying

All surveying required for the works shall be performed by the contractor. The elevations and distances shall be measured from the Owner's approved existing benchmarks.

All the surveying methods and records shall be submitted to the Project Manager for approval

1.1.3 Site Clearing

The entire site as indicated on the drawings shall be cleared and the Contractor shall take all necessary precautions in its execution.

1.1.4 Protection of Existing Facilities

All the existing facilities in the vicinity of the works shall be protected from damage. Existing lighting poles, foundations of adjacent buildings, street paving, curbs and gutter, sidewalk and drainage, etc., shall be protected as required in a manner as approved by the Project manager.

Existing facilities such as paving, lighting poles, etc., if temporarily relocated, damaged or removed shall be re-installed by the Contractor.

1.2 QUALITY ASSURANCE

1.2.1 Codes and Standards

(1) Applicable Standards

Comply with standards as specified in this specification.

(2) Particular Standards

Unless otherwise specified or shown the following codes and standard of the latest issue shall apply:

ASTM D 1196	Standard Test Method for Non - repetitive Static Plate Load Test of Soils and Flexible Pavement Components.
ASTM D1556	Standard Test for Density of Soil in Place by the "Standard Cone Method".
ASTM D1557	Standard Test for Moisture Density Relation of Soil and Aggregate Mixtures using 10lbs Rammer and 18" Drop.
ASTM D422	Method of Particle - Size Analysis of Soils.

2.0 PRODUCTS

2.1 FILL MATERIAL - GENERAL

2.1.1. Approval

All fill material shall be subject for approval by the Project Manager.

2.1.2 Notification

For approval of fill material, notify the Project Manager at least two weeks in advance of the intention to import fill material. Take samples and test as necessary for the purpose of verifying the quality of the material for the acceptance of the Project Manager.

2.2 IMPORTED FILL MATERIAL

Imported excavated for use as fill shall be obtained from borrow pits to be located and secure by the Contractor. All borrow material shall be free from stumps, tree roots and deleterious substances.

2.3 TRENCH AND STRUCTURAL BACKFILL

2.3.1 Imported Cohesion less Fill Material

Imported cohesion less material used for trench and structural backfill shall be free from organic substance, debris, rocks or lumps and other deleterious matter, shall be subject for approval by the Project Manager, and shall be particle size grading within the following limits.

(1) Passing the number four sieve: 100 %

(2) Passing the number 200 sieve: 8 % max.

2.3.2 Excavated Material

(1) Material excavated from the site, except for deleterious material, shall be used for back filling subject to the Project Manager's inspection and approval.

(2) Excavated material, which is approved by the Project Manager for backfill, shall be stockpiled at a location adjacent to the construction site as directed.

2.4 OTHER MATERIALS

The Contractor subject for approval by the Project Manager shall select all other materials not specifically described but required for a complete and proper installation.

3.0 EXECUTION

3.1 GENERAL

3.1.1 Familiarization

Prior to all work of this Specification the Contractor should become familiar with the site, site conditions, the sub - soil conditions, and all portions of the work falling within this specification.

3.1.2 Temporary access and drainage

If the work site is inaccessible due to soft soil or obstructions, the Contractor should provide the necessary means of access at his own expense. Effective temporary drainage should be designated to keep the work area from flooding.

3.1.3 Prior to backfilling

(1) Do not allow or cause any of the work performed or installed to be covered up or enclosed by works of this specification prior to all required inspection and approvals.

(2) Should any of the works be so enclosed or covered up before it has been approved, uncover all the work at no additional cost to the Owner.

(3) Prior to backfilling, all backfill material shall be inspected by the Project Manager.

3.2 EXCAVATING

3.2.1 Excavation to Levels

(1) All excavation shall be made to lines and elevation as shown on the design drawings. Where excavated levels are not shown on the drawings, excavate as required to accommodate the installation. Do not disturb adjacent foundation bottoms.

(2) Tolerance for excavation shall be kept to a minimum of 50 mm over excavation and zero mm under excavation.

(3) When unsuitable soil is encountered at the specified excavation level, the Contractor must report the condition to the Project Manager and obtain directions for corrective action before proceeding.

3.2.2 Excavated Faces

The Contractor shall assume full responsibility for maintaining the stability of all excavated faces until final acceptance of the foundation works.

3.2.3 Over Excavation

(1) Backfill and compact all over excavated areas as specified for ill below at no additional cost to the Owner.

(2) Over excavation adjacent to existing foundation shall be avoided. If over excavation is necessary, proper support and the Contractor as approved by the Project Manager shall provide protection to existing structures and facilities.

3.2.4 Removal of Surplus Soil

Surplus soil and rejected or disapproved excavated material such as clay or boulders shall be removed from the jobsite as directed by the Project Manager in such a manner that other work may not be interrupted Furthermore, excavated materials to be re-used shall be immediately transported and stockpiled at a location adjacent to the construction site as directed by the Project Manager. No surplus excavated material shall be removed off site without the permission of the Project Manager.

3.2.5 Soft Spots

Where unexpected soft deposits are encountered during the course of excavation for foundations, they shall be removed to the extent as directed by the Project Manager and shall be filled to the design lines with approved materials.

3.3 PREPARATION OF SUBGRADE

3.3.1 Scarifying

Cut or fill existing subgade in under floor areas of building to required formation levels, scarify the exposed surface to a minimum depth of 150 mm, thoroughly moisture - condition, and re-compact to the requirement of fill below.

3.3.2 Leveling

Remove all hummocks and other uneven surfaces of subgade prior to placement of fill.

3.4 EXCESS WATER CONTROL

3.4.1 Unfavorable Weather

Do not place, spread or roll and fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the Project Manager.

3.4.2 Flooding

Provide temporary drainage to prevent flooding of sub grade. Promptly remove all water collected in depressions.

3.4.3 Softened Sub grade

Where the soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and re-compact as specified for fill and compaction below.

3.4.4 De - Watering

(1) Provide and maintain at all times during construction ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the work.

(2) Flooded excavation shall be de - watered including forming temporary sumps, all residual silt and muck is to be removed before proceeding with the work.

(3) De-water by means, which will ensure dry excavations and the preservation of the final lines, faces, and grades of bottom of excavations.

(4) If ground water or spring is encountered, the Contractor shall pump excavations free of water prior, during, and for a sufficient period after placing foundations.

3.5 FILLING AND COMPACTION

3.5.1 Filling

After sub grade and bottoms of foundations and trenches have been prepared and approved by the Project Manager, spread approved fill material in layers not exceeding 300 mm in un-compacted thickness.

3.5.2 Moisture - Conditioning

Water the fill material as necessary and thoroughly mix to obtain as near as possible optimum water content which will permit proper handling.

3.5.3 Compaction: General

(1) Compact each layer of fill to at least the specified minimum degree around the foundations. Repeat compaction process until the required level is obtained.

(2) The bottom of all excavations shall be finished as the required level.

3.5.4 Degree of Compaction Requirements.

Under Floor Slab

Sub grade under floor slabs shall be compacted to a dry density equivalent to 95% (min).

3.5.5 Quality Control

(1) Backfilling shall be carried out at a time as agreed with the Project Manager

(2) The type of compaction equipment to be used by the Contractor shall require prior approval by the Project Manager.

(3) Compaction shall comply with the following:

(a) Soil compaction test frequency as required by the Project Manager.

(b) Loose fill thickness - 300mm max.

(c) Plate compaction test:

(i) Frequency of plate load test for backfilling shall be one test every 50m x 50m (m2) on the finished surace.

(ii)	Loose Fill Thickness	30cm max.
(iii) min	'K' value of 30 cm dia bearing plate	5kg/cm3 general fill. 7kg. /cm3 min. for structural fill.

Priority of the quality control method for compaction is the plate load test. If it is better to use Field density test instead of the plate load test after making comparison table of the plate load test and field density test with the Project Manager's approval, the Contractor can proceed the quality control with the field density test.

(1) The work procedure for excavation and backfilling works must be submitted to the Project Manager for approval.

CONSTRUCTION SPECIFICATION

FOR

CAST-IN-PLACE CONCRETE

TABLE OF CONTENTS

1.0 GENERAL

In accordance with the provisions of this section and the drawings, provide:

(1) Cast-in-place concrete, complete, in place, and properly installed.

(2) All steel, complete, and in place, required for reinforcement of cast-in-place concrete.

(3) Formwork for all cast-in-place concrete.

1.2 QUALITY ASSURANCE

1.2.1 Codes and Standards

(1) Applicable Standards

Comply with standards specified in this specification.

(2) Particular Standards

ASTM	American Society of Testing and Materials
ACI	American Concrete Institute

1.2.2 Reinforcement

Reinforcement shall be free from defect, corrosion, or other deleterious coatings.

1.2.3 Design of Formwork

Design of formwork is the contractor's full responsibility.

1.2.4 Qualification of Installers

(1) Throughout the progress of installation of the work of this section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this section.

(2) In actual installation of the work of this section, use adequate numbers of skilled workmen to ensure installation in strict accordance with the approved design.

(3) In acceptance or rejection of work performed under this section, the Owner will make no allowance for lack of skill on the part of workmen.

(i) Verification of Site Condition

The contractor, before commencing any work, shall verify the grade conditions of all ground surfaces and any other conditions at the site and other areas which may affect his work and shall notify the Project Manager in writing of any discrepancies between conditions as actually existing and as shown on the design drawings.

(ii) Quality Control

(1) Testing Arrangements

Prior to all work under this section, make all necessary arrangements with the testing laboratory regarding timely implementation of testing procedures and quality control for concrete and concrete related materials.

(2) Trial Mixes and Strength Tests

(a) At least four weeks prior to commencement of concrete placing, trial mixes shall be made for each class of concrete.

(b) The contractor shall submit a detailed execution plan for the trial mixes for approval by the Project Manager before commencing the work.

(c) Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day nor less than once for each volume stated below.

Total Concrete Volume (cubic meters) per day	No. of Samples to be taken
0 - 50	One sample
51 - 200	One for each 75 CM
201 - 400	One for each 100 CM
401 or over	One for each 150 CM

(1) Changes in Materials and Mix Proportions

Neither the mix proportions nor the source of material supply to the jobsite shall be altered. However, adjustments can be made in the proportions of the mix as required to take account of permitted variations in the materials. In this case, trial mixes and strength tests shall be carried out.

(2) Failure to Meet Requirements

If the 28-day test results are found to be below the specified strength, cylindrical core specimens shall be cut from the hardened concrete at appropriate locations. Where the strength of the specimens is less than the specified strength at 28 days, the concrete structure or part of it shall be removed and replaced.

(3) Records

Records shall be kept of the positions in the works of all batches of concrete, of their grade and of all tests or other specimens taken from them.

1.3 SUBMITTALS

1.3.1 Product Data

Submit the following within 30 days after award of the contract.

(1) Complete material list of all items proposed to be furnished and installed under this section.

(2) Sufficient data to demonstrate compliance with the specified requirements.

(3) Complete information on cement source of supply, physical and chemical characteristics, transportation, and intermediate terminating procedures for mill-to-site handling, and site storage procedures.

(4) Complete information on aggregate procurement, processing and storage.

(5) Complete information on proposed batching and mixing equipment and procedures, including water chilling or other devices or systems to reduce mix temperatures.

(6) Complete information on concrete handling equipment proposed to be used, including capacities for chutes, pumps, buckets, and all other equipment.

(7) Complete information on proposed consolidation equipment.

(8) Complete description of proposed curing methods.

(9) Steel producers certificates of mill analysis, plus tensile and bend tests for reinforcing steel.

(10) Manufacturers data and installation instructions for proprietary formwork materials including form coatings, ties and accessories, and manufactured form systems if used.

1.3.2 Samples

Submit to the Project Manager samples of the following:

(1) Concrete constituents, including admixtures.

(2) Formwork ties and spreaders.

(3) Formwork release agent

(4) Remolded joint filler

(5) Vapor barriers

(6) Waterstops

(7) Wedge inserts, and;

(8) Expansion bolts

1.4 PRODUCT HANDLING

1.4.1 Protection

Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Delivery

Deliver reinforcement to the jobsite bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

1.4.3 Storage

(1) Cement

All cement shall be delivered in sound and properly secured bags and shall be stored in a dry weatherproof shed with a raised wooden floor, or other facilities approved by the Project manager.

Each consignment shall be kept separate and distinct, and shall be used in the sequence in which it is delivered to the site. Any cement that has become seriously affected by damp or other causes shall be removed from the site immediately.

(2) Aggregates

Aggregates shall be stored so that intermixing of different grading shall not occur. Stockpile aggregates in a manner that will prevent contamination from the ground with undesirable material.

(3) Reinforcement

Store reinforcement at the job site in a manner as to prevent damage and accumulation of dirt and rust.

1.4.4 Replacements

In the event of damage to materials of this section, immediately make all repairs and replacements necessary to the approval of the Project manager.

1.4.5 Rejection

Any consignment or part of a consignment that does not comply with the specification shall not be used in the work and shall be removed from the site.

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 Cement

(1) Portland Cement

Portland Cement shall conform to Type 1 or equivalent and shall be applied to all concrete grades. Different brands of

cement shall not be mixed. Preferably, use only one brand of cement for the entire work.

(2) Certificate

The manufacturer's complying with the above specification shall certify cement and a copy of the manufacturers test certificates shall accompany each consignment.

2.1.2 Aggregates

(1) General

For the concrete of this section, all fine and coarse aggregate shall preferably come from only one source.

(2) Testing

Certified copies of satisfactory tests by a testing laboratory approved by the Project Manager shall be accepted for aggregate quality requirements.

2.1.3 Water

Water for mixing concrete shall be fresh and clean, and free from injurious amounts of oil, acid, alkali, salt, or organic materials

2.1.4 Admixtures

Admixtures shall be subject to prior approval of the Project Manager, if they are to be used.

2.1.5 Curing Materials

(1) Liquid Curing
Liquid curing and sealing compound shall be clear or translucent without dye.

(2) Sheet Materials
Sheet materials in sheet form used for covering the surfaces of concrete to inhibit moisture loss during the curing period like curing paper, polyethylene film, and white burlap polyethylene sheet.

(3) Burlap cloth
For moist curing burlap cloth made from jute or kenaf and weighing approximately 305 grams per sq. m. and shall be used in two layers.

2.1.6 Other Concreting Materials

(1) Pre-formed Expansion Joint

Expansion joint filler material shall be bituminous fiber type.

(2) Waterstops

Water stops shall be extruded from new stock polyvinyl chloride, ribbed, expandable center bulb, or other approved type. The minimum width shall be 150 mm and minimum thickness shall be 6.4 mm.

(3) Vapor Barriers

Vapor barriers shall be polyethylene sheets having a thickness of 0.2 mm minimum.

2.1.7 Batching, Mixing, and Delivery of Concrete

Use transit-mixed concrete from the approved batching and mixing plant.

2.1.8 Reinforcement

(1) **Reinforcing Bars**
Reinforcing bars shall be deformed bars
Grade 60 (10mm dia.,12mm dia.)
Grade 60 16mm dia.,20mm dia, 25mm dia.,28mm dia, 32mm dia.,36mm dia)

(2) Steel Wire

Double strands Ga. 16 tie wires for fixing and tying reinforcements. For big diameter bars, use Ga. 14.

(3) Supports for Reinforcements

Bolsters, chairs, spacers, and other devices of or spacing, supporting, and fastening reinforcement in place.

(a) Use wire bar type supports, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

(b) For slabs on grade, use supports with sand plates or horizontal runners where abase material will not support chair leg.

(c) For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

(1) Compliance

All bars, wires, and mesh reinforcement shall be certified by the manufacturer as complying with the above specification and a copy of the manufacturers test certificate shall accompany each consignment.

(2) Bending and Cutting

(a) Reinforcing bars shall conform to required shapes and dimensions, with bending and cutting tolerances. In case of errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material. Reinforcing bars shall be sized and shaped at ambient temperature.

(b) Reinforcement with any of the following defects will not be permitted in the work:

(i) Bar lengths, depths, and bends exceeding specified fabrication tolerances.

(ii) Bends or kinks not indicated on the final shop drawings.

(iii) Bars with reduced cross-section due to rusting or other cause.

(c) Bars shall be cropped to length and flame cutting will not be permitted unless with the approval of the Project Manager.

2.1.9 Formwork

(1) Exposed Surfaces

Formwork material for faces of exposed concrete surfaces shall be smooth faced undamaged plywood, metal or other panel type materials acceptable to the Project Manager, to provide straight, smooth, as-cast surfaces that have no discoloration.

(2) Unexposed Surfaces

Formwork material for faces of concrete surfaces concealed from view or to be covered with plaster are to be timber/plywood of sufficiently sound grade, or be of metal or other type panel

material. In whichever case the quality or condition of the materials used shall be acceptable to the Project Manager.

The face of concrete where plaster is to be applied shall have sufficient mechanical bond produced by the formwork.

(3) Material Strength

Provide formwork face material with sufficient thickness to withstand the pressure of newly placed concrete without excessive and objectionable bow or deflection.

2.1.10 Formwork Ties

(1) Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent deflection and spilling concrete surfaces upon removal.

(2) Provide ties so that the portion remaining within the concrete after removal of exterior parts is at least 3.8 cm from the outer concrete surface.

(3) Provide form ties that will not leave a hole larger than 2.5 cm diameter in the concrete surface.

2.1.11 Formwork Coatings

Provide commercial formulation form-coating compounds that will not bond with stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

3.0 EXECUTION

3.1 GENERAL

Concrete for reinforced concrete structure is classified into grade, quality and slump. The class of concrete shall be specified on the drawings, denoted by minimum 28 days compressive strength, based on 15 cm diameter x 30 cm height.

Table 1 - Concrete Grade

Concrete Grade		Maximum Size of Coarse Aggregate
Main Building		
Footing	(6000 psi)	25 mm.
Susp. Slabs, Columns	(6000psi)	20mm
Beams, Girders	(6000 psi)	20mm
Slab-On-Grade	(6000 psi)	25mm
Parapet Walls	(6000 psi)	20mm
Retaining Walls	(6000 psi)	20mm
Underground tanks	(6000 psi)	20mm
Shear wall	(6000 psi)	20mm

Table 2 - Slump Values for Concrete Work

Placement of Concrete in:	Slump (cm)
Foundation with reinforcement And foundation footings	7.5 +/- 2.5
Slabs, beams, columns, and Walls	10.0 +/- 2.5

3.2 CONCRETE PLACEMENT

3.2.1 General

Place concrete in compliance with practices and recommendations as herein specified.

3.2.2 Placement Schedule

Prior to starting work procedure, a schedule of the planned concreting activities that include preparation, method of pouring and equipment to be used. No concreting work shall commence before the Project Manager has approved this schedule.

3.2.3 Concrete Placement and Procedures

(1) Deposit concrete, continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

(2) If a section cannot be placed continuously, provide construction joints as approved by the Project Manager.

(3) Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still flowing.

(4) Deposit concrete as neatly as practicable in its final location to avoid segregation due to re-handling and flowing.

(5) Do not subject concrete to any procedure that will cause segregation.

(6) Do not use concrete which becomes ”non-plastic” and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials.

(7) Remove rejected concrete from the site and dispose of it in a location approved by the Project Manager for that purpose.

(8) Use chutes for pouring concrete where a drop of more than 2.0 meters is required.

Chute arrangement:

(a) Chutes shall be of steel or PVC and the cross section shape shall be v-type. The gradient of chutes shall be 4/10 to 7/10 to avoid material segregation.

(b) In cases where concrete must be chuted from a high elevation, vertical flexible chutes shall be used.

(1) Pumps may be used only if they can pump the design mix. Do not add fine aggregate or water to the mix to satisfy needs of a pumping device.

(2) Concrete pumps and related piping shall be lubricated by using mortar just before starting the work.

(3) The operation of concrete pumps shall not be suspended longer than 30 minutes when the pumps are filled with concrete.

(4) Concrete mix should be poured within 1 hour after water has been added to dry mix.

(5) If the quality of concrete is damaged by rain, necessary steps shall be taken as instructed by the Project Manager. If concrete is too placed when it is raining, full protective measures should be taken during pouring. When there is heavy rain, pouring of concrete shall be discontinued.

(6) No concrete that has partially hardened or has been contaminated by foreign matter shall be placed in formwork or in any other part of the permanent work.

(7) Concrete shall not be "freshened up" with water or re-tempered in any way.

(8) Placing concrete in formwork:

(a) Deposit concrete in formwork in even horizontal layers not deeper than 60cm.

(b) Where placement consists of several layers, place each layer while the preceding layer is still plastic and thereby avoid cold joints.

(c) Remove temporary spreaders in formwork when concrete placing has reached the elevation of such spreaders.

(d) Only place concrete in supporting elements (e.g., walls, and columns) after the concrete of previously placed lifts is no longer "Plastic".

(1) Placing concrete slabs:

(a) Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, and/or until the placing of a panel or section is completed.

(b) Consolidate concrete during placement by the use of approved equipment.

(c) Coarse aggregate should not be visible on the surface of finished concrete slabs.

(d) Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

(e) Bring slab surfaces to the correct level with a straight edge and produce a finish free from bumps and hollows.

(f) Do not sprinkle water on the "plastic" surface, and do not disturb surfaces prior to the start of finishing operations.

(1) Concrete conveying

Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit, as rapidly as practicable and by methods, which will prevent segregation and loss of concrete mix materials. Keep interior surfaces of conveying equipment, including chutes and pump piping, free from hardened concrete, debris, water, and other deleterious materials.

(2) Concrete without formwork

Concrete may be poured without formwork subject to the Project Manager's approval. In this case, the minimum cover of concrete to rebar shall be 7.5 cm.

(2) Cold water placing (Not Applicable)

(4) Hot weather placing

When hot weather conditions exist this would seriously impair the quality and strength of concrete, place the concrete as follows:

(a) Maintain concrete temperature at time of placement below 32 degrees Celsius (90 degrees Fahrenheit). Use chilled mixing water or chopped ice to control concrete temperature, provided the water equivalent of the ice is calculated to the total amount of water.

(b) Cover reinforcing steel with water-soaked burlap cloth if the steel becomes too hot. Steel temperature shall not exceed the ambient air temperature immediately prior to placement of concrete.

(c) Wet forms thoroughly prior to placement of concrete.

(d) Use set-control admixtures in the concrete mix.

3.3 CONSOLIDATION

3.3.1 General

(1) Consolidate all concrete in accordance with provisions of these specifications.

(2) Concrete should be thoroughly compacted during the operation of pouring and carefully worked around the reinforcement, embedded fixtures and into all corners of the formwork.

(3) The concrete shall be compacted by the use of mechanical vibrators. Spare vibrators shall be provided. Vibrators shall not be used after there is no apparent decrease in the volume of concrete and under no circumstances should they be allowed to cause segregation.

(4) In tamping, the height of a layer is to be less than 30 cm. For monolithic construction, each concrete layer shall be poured while the underlying layer is still responsive to vibration.

(5) During an operation of concrete placement, a frequency of vibration shall not be less that 7,000 per minute per internal vibrator or otherwise specified by the Project Manager.

(6) Do not vibrate forms or reinforcement.

(7) Vibration shall be applied only at the point of placing freshly deposited concrete.

3.3.2 Procedures

(1) Limit duration of vibration to the time necessary to produce satisfactory consolidation without causing segregation of aggregates.

(2) Insert the vibrator so as to penetrate the lift immediately below the one being placed, and manipulate to blend the two lifts.

(3) Do not insert the vibrator into lower courses that have begun to set.

(4) Use the vibrator to melt down the concrete as it is being placed, and uses the vibrator to consolidate the mass of concrete.

(5) In the case of wall construction, assign at least one vibrator and vibrator-operator to melting down the mix; and assign at least

one other vibrator and vibrator-operator to consolidating the mass of concrete.

(6) Spacing between insertions of the vibrator, which is used to consolidate, shall not exceed twice the radius of action.

(7) Under no circumstances shall the points of insertions during the consolidation phase be more than 45 cm. Apart.

(8) Vibration shall not be continued at any one point to the extent that localized areas of grout are formed. Vibrators shall not touch reinforcement.

(9) Vibrators shall be inserted and withdrawn out of concrete pours slowly.

3.3.3 Maintenance of Vibrators

Initiate a maintenance program for the vibrators to assure that they are operating at peak efficiency at all times, and to facilitate effective consolidation of the concrete.

3.4 CONSTRUCTION JOINTS

3.4.1 General

(1) The contractor shall ensure that all construction joints are arranged to minimize the effects of shrinkage. The position and arrangement of construction joints shall be according to the drawings, or otherwise that contractor shall show them in complete detail on drawings submitted to the Project Manager for approval.

(2) In cases where the use of construction joints is unavoidable, parting strips shall be provided along the concrete edges to prevent flow-out of cement paste.

(3) Construction joints shall be horizontal or vertical. If required in beams and slabs, they shall be located at the area where the stress is minimum.

(4) The surfaces of construction joints shall be cleaned of laitance and shall be roughened. Before pouring fresh concrete, the surface shall be thoroughly wetted.

(5) At points where layer concrete strength is specifically required, cement paste or rich-mix concrete shall be used. Concrete shall be placed immediately.

3.4.2 Isolating Joints in Slabs

Provide isolation joints in slabs at points of contact between slabs and vertical surfaces where indicated on the drawings. Seal joints with caulking material approved by the Project Manager.

3.5 CURING

3.5.1 General

(1) For five days after pouring, concrete surfaces shall be kept constantly wet and protected from sunlight and rapid drying. This is to be achieved by spraying water directly on to the concrete surface or over previously laid curing membrane or material.

(2) Two days curing shall be applied for miscellaneous concrete work. The contractor shall submit his proposed methods of curing for approval by the Project Manager.

(3) For twenty-four hours after pouring, no person shall be allowed to walk on the surface of the concrete, even after that period has elapsed; no shock or vibration shall be applied to the concrete while it is in a state of hardening.

3.6 CONCRETE FINISHING

3.6.1 General

(1) The following surface conditions and finishing methods shall apply unless otherwise specified on drawings. After removal of formwork, no defective areas shall be repaired without prior approval from the Project Manager.

(2) Unless otherwise agreed with the Project Manager, noticeable bulges or projections shall be removed by chipping or tooling at an acceptable finish.

(3) Large honeycombs or other defective areas shall be chipped out to behind the reinforcing bars. The edges shall be cut straight from the surface on a slight undercut, to provide a key. These areas shall then be thoroughly wetted and filled with a cement mortar of the same color as the cement used in the concrete.

3.6.2 Finish of Formed Surfaces

(1) Rough form finish

(a) Provide as-cast rough form finish to formed concrete surfaces that are to be concealed by finish work or by any other construction.

(b) Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched, and all fins and other projections exceeding 6 mm in the height rubbed down or chipped off.

(2) Smooth form finish

(a) Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view, or that are to be covered with a coating material other than cement plaster applied directly to the concrete.

(b) Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams.

(c) Repair and patch defective areas with all fins and other projections completely removed and smoothed.

(3) Related unformed surfaces

At top of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a smooth toweled finish.

3.6.3 Monolithic Slab Finishes

(1) Scratch finish

(a) Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for terrazzo tile and other bonded applied cementations-finish flooring material.

(b) After placing slabs, form the surface to tolerance not exceeding 6 mm in 60cm when tested by a straightedge.

(c) Uniformly slope surfaces to drains where required.

(d) After leveling, roughen the surface before the final set using stiff broom brush, or rake.

(2) Float finish

(a) Apply float finish to monolithic slab surface that are to receive trowel finish and other finishes hereinafter specified, and to slab surfaces which are to be covered with insulation, and as otherwise shown on the drawings or in the schedules.

(b) After placing concrete slabs, do not work the surface further until ready for floating.

(c) Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float, or both.

(d) Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units.

(e) Check and level the surface plane to a tolerance not exceeding 7 mm in 3 meters when tested with a 3 meter straightedge placed on the surface at not less than two different angles.

(f) Cut down high spots and fill low spots.

(g) Uniformly slope surfaces to drains where required.

(h) Immediately after leveling, re-float the surface to a uniform, smooth, and granular texture.

(3) Trowel finish

(a) Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and to slab surfaces that are to be covered by resilient flooring, carpeting, paint, or other thin film finish coating system.

(b) After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

(c) Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 7 mm in 3meters when tested with a 3-meter straightedge placed on the surface at not less than two different angles.

(d) Grind smoothly those surface defects, which would show through applied floor covering system

(4) Non-slip broom finish

(a) Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as shown on the drawings or in the schedules.

(b) Immediately after trowel finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber bristle broom.

(c) Coordinate the required finish with the Project Manager prior to application.

3.7 REMEDIAL WORK TO CONCRETE

3.7.1 General

Reinforce or replace deficient work as directed by the Project Manager

3.8 INSTALLATION OF REINFORCEMENT

3.8.1 General

Comply with specified standards and for details and methods of fixing reinforcement and supports, and as herein specified.

3.8.2 Fixing Reinforcement

(1) Clean reinforcement to remove loose rust and mill scale, earth, and other materials that reduce or destroy bonding with concrete.

(2) Position, support, and secure reinforcement against being displaced by formwork, construction, or concrete pouring operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

(3) Place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete pouring. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

(4) Install welded mesh reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh.

(5) Cover blocks are to be made of properly cured mortar.

(6) Provide sufficient number of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 5 cm beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

(7) Splicing shall be carried out by lapping ends, placing bars in contact, and tight wire tying.

(8) Unless otherwise stated on the drawings, the following minimum concrete cover of reinforcement shall apply:

Cover to Reinforcing Bar	Minimum Cover
Concrete exposed to earth	
Pouring with formwork d< or = 16 mm	5 cm
d> or = 19 mm	6 cm
Pouring without formwork	7.5 cm
Concrete not Exposed to Earth	
Slabs, walls, joist	3 cm
Beams, columns	5 cm

Where d = diameter of bars
The minimum concrete cover shall not be less than the diameter of the bars.

3.9 FORMWORK

3.9.1 General

(1) Construct forms complying to the exact size, shape lines, and dimensions shown, and as required to obtain accurate alignment, location, grade, level, and plumb work in finish structures.

(2) Forms shall not be connected to such temporary facilities as scaffolds, etc.

(3) All rubbish, shavings, saw dust, wire clipping, loose concrete and any other refuse shall be removed from the inner face of the forms before placing concrete.

(4) Washout holes shall be provided where necessary to provide access for cleaning.

3.9.2 Fabrication

(1) Formwork shall be substantial and rigid construction to withstand concrete weights and other working loads without detrimental amounts of deformation.

(2) Fabricate formwork for easy removal wherever possible.

(3) Provide top form for inclined surfaces where the slope is too steep to place concrete with bottom form only.

3.9.3 Assembly and Inspection

(1) Prior to assembling formwork components or modules for major concrete structures, it shall be marked for location and elevation to enable the Project Manager to inspect, checks, and approve.

(2) All formwork shall be inspected by the Project manager prior to concrete pouring.

3.9.4 Support Work

(1) Erect support work, on brace, and maintain it to safely hold vertical, lateral, and symmetrical loads applied until such loads can be supported by in-place construction. Construct support work so that adjustments can be made for take-up and settlement.

(2) Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect support work and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

3.9.5 Chamfers

All exposed edges of concrete above ground shall be chamfered 25 mm with the exception of:

(1) The tope of piers supporting equipment.

(2) Concrete edges providing direct support for flooring, or to which steel will be attached for flooring support; and,

(3) Architectural requirements as indicated on the drawings.

3.9.6 Formwork Coatings

(1) Contact surface of forms shall be thoroughly cleaned and coated with form oil compound before reinforcement is placed. Do not allow excess form oil to accumulate in the formwork or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturers instructions.

(2) Form oil shall be approved by the Project Manager prior to use.

3.9.7 Installation of Embedded Items

Set and build into the work anchorage devices, piping, boxes, sleeves and other embedded items required for other work that is attached to, or supported by, cast-I-place concrete. Items are to be set firm and rigid so that no movement occurs when concrete is being poured.

3.9.8 Removal of Formwork

(1) Formwork shall not be removed without prior approval from the Project Manager

(2) Unless otherwise instructed by the Project Manager, forms and support work shall be left in position for the periods stated in Table 3.

Table 3 - Minimum Forming Frame Retention Period

Type of Formwork	Minimum Period Before Removal
Vertical formwork to columns, Walls, large beams, footings, And foundations	3 days
Soffit formwork to suspend Slabs and beams	7 days
Props and supports to slabs and Beams	14 days

(3) Do not hammer or pry against concrete surfaces, provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

3.9.9 Re-use of Formwork

Clean and repair surfaces of forms to be re-used ion the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork. When forms are used for successive concrete placement, thoroughly clean surfaces, remove fins, and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.10 ANCHOR BOLTS

3.10.1 General

(1) Deformed bolts shall not be used.

(2) Prior to setting anchor bolts, they shall be cleaned of loose rust, oil, grease, dust, and other foreign matter, which may reduce concrete bonding.

(3) Prior to concrete pouring, anchor bolts secured in place shall be inspected by the Project Manager, with reference to their positions, directions, perpendicularity, projection lengths, etc.

(4) The tolerance for anchor bolts embedment shall comply with provisions as shown in Table 4.

(5) Grease shall be applied sufficiently to the portions of anchor bolts which are not to be embedded, nuts shall be screwed on, and proper protection such as vinyl or cloth covers shall be provided to prevent concrete from adhering to the bolts.

(6) While pouring concrete, care shall be taken so that the anchor bolts held in place do not move, or any other interference is caused.

(7) Protect anchor bolts from interference by other concrete related activities or by other trades.

(8) Immediately after formwork has been removed, the alignment of the anchor bolts shall be checked and shall be subjected to inspection by the Project Manager.

(9) Generally, the changing of anchor bolt positions shall not be permissible. If corrections are necessary, they will be subject to the Project Manager’s approval.

(10) Bolts extending from foundations shall be protected from being bent and their threads from being damaged, until corresponding equipment or structures are installed.

3.10.2 Setting of Anchor Bolts

For setting of anchor bolts, the following two methods shall be applied in conjunction with relevant drawings and/or instructions given by the Project Manager. If other special methods are to be used the contractor will be informed by the Project Manager accordingly.

(1) Method of anchor bolt embedment using jig plates

(a) Jig plates shall be secured in place by using support structures approved by the Project Manager.

(b) The above-mentioned support structures shall be of sturdy construction so that they can withstand shocks and impacts due to concrete placement, etc., without moving. Details of these structures shall be drawn up by the contractor and shall be subject to approval by the Project Manager before fabrication.

(c) After jig plates have been inspected and approved by the Project Manager, they shall be secured accurately in position horizontally, and in elevation. Setting jig plates shall be subject to inspection.

(d) Seven days or more after concrete pouring, jig plates shall be removed with the approval of the Project Manager.

(2) Method of anchor bolt embedment using wooden or metal bolthole forms

(a) Bolt hole forms shall be fabricated by the contractor, unless otherwise instructed.

(b) Bolt hole forms shall be accurately sized and positioned and shall be subject to inspection by the Project manager.

(c) Unless otherwise instructed, bolthole forms shall be carefully removed shortly after the concrete has begun to set.

(d) After the concrete has hardened all protruding bolts shall be thoroughly cleaned of foreign matter.

3.11 MARKING

After the concrete has hardened, the centerline of foundations shall be clearly marked on the top surface. Also a horizontal line at a level 100 mm below the underside of the structure to be installed (e.g. bottom of base plate) shall be marked on all the side surfaces of foundations.

3.12 TOLERANCES

3.12.1 Tolerances of Form

(1) Variations from the plumb

A deviation in the line and surface of columns, walls, piers, and in arises:

(a) In any 3m of vertical distance +/- 6 mm

(b) Maximum for entire vertical distance +/- 2.5 mm

(2) Variations from the level

Deviations from the level or from grades indicated on the drawings:

(a) In any 3 m horizontal distance +/- 6 mm

(b) In any bay or in any 6 m horizontal distance +/- 10 mm

(c) Maximum for entire horizontal distance +/- 20 mm

(3) Variations of span distance between walls, Columns, and beams +/- 10 mm

(4) Variations in cross-sectional dimensions of columns And beams and in the thickness of slabs and Walls -6mm + 10mm

(5) Footings variation of dimension “in plan” -6mm + 10mm

3.12.2 Tolerance of Embedded Items

(1) Offset +/- 5 mm

(2) Elevations +/- 5 mm

(3) Inclination from true in any direction +/- 10 mm

(Vertical elements only)

(4) The tolerance for anchor bolt embedment is as given in Table 4 hereunder:

Table 4 - Tolerance of Anchor Bolt Embedment

Bolt Size	Deviations from Position at top of Bolt	Projected Length	Perpendicularity
Anchor bolts Under 1 inch	+/- 2.0 mm	+ 5.0 mm - 3.0 mm	1/200
Anchor bolts 1 inch and over	+/- 2.5 mm	+ 10.0 mm + 5.0 mm	1/200
Distances between Center of grouped Anchor bolt	+/- 3.0 mm		

Note: when stiffener type jigs are used, Table 4 need not be followed with the exception of projected length

3.13 INSPECTION

3.13.1 General

The contractor shall prepare and submit an inspection sheet to the Project manager for approval.

The above sheet shall be presented to the Project Manager shortly before the contractor is ready to commence concreting to allow inspection approval.

3.13.2 Concreting Check Items

(1) Before concreting, check that,

(a) Excavation, formwork, placement of embedded items and reinforcement are completed;

(b) Protection has been provided if placing during rain;

(c) All water is removed from formwork;

(d) The ambient temperature is within allowable limits prior to concreting;

(e) Materials are handled and stored as specified; and,

(f) Material samples have been submitted (if required) or that manufacturers material certificates have been submitted.

(2) During concreting, check that,

(a) Batching, mixing, delivering, sampling, and testing concrete is following correct procedure;

(b) Concrete is mixed only in amounts of immediate use;

(c) Set concrete is not used orre-tamped;

(d) Concrete is placed without segregation or loss of material;

(e) Concrete is plastic when placed;

(f) Concrete in each lift or section is placed continuously;

(g) Concrete is consolidated by vibrations without overworking;

(h) Vibrators are not used to transport freshly poured concrete;

(i) Laitance has been removed from construction joints, and that joint surfaces have been slushed with grout before new concrete is placed;

(j) Cast concrete tops and slab work is struck too required level and floated-off on the disappearance of water sheen;

(k) Finished surfaces are scratched, toweled or broomed as specified; and,

(l) Placing is finished within the time specified.

(3) After concreting, check that,

(a) Concrete is cured for the required time and maintained within the allowable temperature range;

(b) Concrete is protected against mechanical disturbances, water flow, loafing, shock, and vibration during curing; and,

(c) On removal of forms, defects and tie holes are patched, and that fins are removed.

TABLE OF CONTENTS

CONSTRUCTION SPECIFICATIONS

FOR

STRUCTURAL STEEL

1.0 PAINTING / COATING

1.1 GENERAL

1.1.1 Scope

1.1.1.1 This specification covers the general philosophy for coating external surfaces of structural steel.

1.2 COATING PHILOSOPHY

1.2.1 General

1.2.1.1 All applicable national and local code sand regulations on surface preparation, coating application, storage, handling, and safety shall be complied with. All paint manufacturer's safety instructions and requirements contained within the Material Safety Data Sheets shall be followed.

1.2.1.2 The coating contractor responsible for the coating work shall ensure that the latest issues of the product data sheets are available.

1.2.1.3 All coating materials shall be delivered and stored in the manufacturer's original sealed containers. The contractor shall provide storage to protect materials from damage due to contamination, rain and adverse high and low temperatures. Outdoor storage of coating materials and solvents is not acceptable.

1.2.1.4 The coating contractor shall be responsible for the proper disposal of all surplus, spent, and waste coating materials,

solvents, and thinners, including containers and solvent wipe rags.

1.2.2 Surface Preparation

1.2.2.1 Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight stains in the form of spots or stripes. The surface shall be cleaned with a vacuum cleaner, clean dry compressed air or a clean brush.

1.2.2.2 Prior to cleaning, all visible oil and grease shall be removed by means of a suitable solvent by high-pressure water jetting or steam cleaning with, if necessary, an alkaline cleaning agent. Surfaces, which have been exposed to a polluted or salt-laden atmosphere, shall be washed down with clean potable water.

1.2.2.3 All welds shall be smooth and free of all weld slag and weld spatter.

1.2.2.4 Power and/or hand tool cleaning shall only be used for field repair and touch ups, where abrasive blasting is not permitted or is impractical.

1.2.2.5 for surface preparation of Work Site itself:

St2 Thorough scraping and wire brushing machine brushing grinding, etc. The treatment shall remove loose mill scale, rust and foreign matter. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air, or a clean brush. It should then have a faint metallic sheen.

St3 Very thorough scraping and wire brushing machine brushing-grinding, etc. Surface preparation same as St2, but much more thorough. After removal of dust, the surface shall have a pronounced metallic sheen.

1.2.2.6 Prior to application of final coat in field, the contractor shall prepare surface of previous coats by clean water rinse, light abrading by sand paper or hand wire brush, followed by solvent cleaning.

1.2.3 Application

1.2.3.1 Coatings shall be applied within 4 hours after surface preparation and before rust bloom occurs. Coatings shall not be applied when the ambient temperature, steel

substrate temperature, or coating material temperatures are outside the range recommended by the coating manufacturer. Coatings shall not take place under adverse weather conditions, rain, fog, etc., or when such conditions are likely to occur before the paint has become dry.

1.2.3.2 Surface coated shall be free of all visible dust, oil grease, and other surface contaminants. All surfaces shall be thoroughly dry prior to painting.

1.2.3.3 Before application of the first coat, all areas such as corners, edges welds, small brackets, bolts, nuts and interstices shall be stripe coated to ensure that these areas have at least the minimum specified dry film thickness. Application of stripe coat shall be by brushing. The brushing technique shall be to brush out and not to flow on the coating material. Stripe coat material may be sprayed if followed immediately by brushing.

1.2.3.4 Each coat shall be allowed to cure sufficiently, prior to application of any subsequent coat.

1.3 MATERIALS

1.3.1 General

1.3.1.1 Contractor shall submit recommendations from paint manufacturer as to the particular name of the paint proposed.

1.3.1.2 Products from a single paint manufacturer shall be used for site painting.

1.3.1.3 When a single coating supplier has been specified only material from that manufacturer shall be used.

1.3.1.4 Any thinning of coating materials shall be in strict accordance with the coating manufacturer's product data sheets and application instructions. Only solvent recommended by the coating manufacturer shall be used for thinning.

1.4 INSPECTION

1.4.1 General

All materials, equipment and work shall be available to the Project manager, including the coating manufacturer's representative at all times. Contractor shall employ specialist paint and coating inspectors.

1.4.2 Inspection Requirements

1.4.2.1 The following inspection functions shall be performed:

a. Materials

1. Inspect coating and blasting materials upon receipt of materials.
2. Verify that the storage condition for the materials is adequate and properly maintained.
3. Verify that the shelf life of coating materials has not been exceeded.
4. Verify that materials are stored safely and that all waste is disposed of promptly and safely.

b. Equipment

1. Verify adequacy of coating, cleaning, and sandblasting equipment.
2. Verify that air supplies for blast cleaning, pneumatic tools, and spray equipment are free of moisture and oil.

c. Surface Preparation

1. Confirm that surface preparation takes place when atmospheric conditions are as specified.
2. Inspect correctness of surface preparation for specified cleanliness and anchor profile.

d. Application

1. Verify that correctness of mixing; including screening of inorganic zinc rich primers and any required induction time is complied with.
2. Verify that application takes place during proper specified atmospheric conditions.
3. Verify that inorganic zinc rich paint pot is continuously agitated.
4. Verify that “pot life” is not exceeded.
5. Verify that methods of application are as specified and of satisfactory standard.

e. Adhesion

1. Verify that primer is sufficiently cured before application of the subsequent coats.
2. Inspect surface between the prime and finish coats to assure bonding between coats.

f. Repairs

Verify that all repairs have been made. Defective work shall be corrected at no cost to the Owner.

g. Cure

Verify that the coating is cured as specified by coating manufacturer's instruction for re-coat intervals.

h. Visual

The finished coating work shall pass visual inspection by the Project manager. The final coating shall be uniform color and smooth. Coating work indicating defects, improper application, runs, sags, damages, and excessive repairs, incomplete curing or excessive thickness is subject to rejection. It is the coating contractor's responsibility to correct work found by these inspections including conditions discovered after acceptance, which are not in compliance with these requirements.

2.0 FABRICATION

2.1 GENERAL

2.1.1 Description

2.1.1.1 Scope

This section covers technical requirements for delivery of raw materials, mark for identification, packing, crating or otherwise proper preparation for shipment, and shipping to project site of all structural steel indicated, or otherwise required for proper completion of the project.

2.1.2 Quality Assurance

2.1.2.1 Codes and Standards

(1) Applicable standards

Unless otherwise specified or shown the following codes and standards of the latest issue shall apply:

ASTM A 992	Rolled Steel for General Structures
ASTM A 992	Structural Steel
ASTM A325M	High Strength Bolts

ASTM A 307	Mild Steel Bolts
ASTM A 563	Nuts
ASTM F 844	Washer
AWS D 1.1	Structural Welding Code
AISC	Manual of Steel Construction
AWS A 5.1	Covered Carbon Steel Arc-Welding Electrodes

2.1.3 Submittals

2.1.3.1 Product Data

After the award of the contract, the contractor shall submit the following to the Project manager in timely accordance with the project requirements:

(1) Material specification

Producer or manufacturer's specifications for:

(a) Structural steel

(b) High strength bolts (each type) including nuts and washers

(c) Mild steel bolts and nuts

(d) Structural steel primer paint

(e) Grating type treads for stairs and their fasteners.

(2) Material Certificates

Certificates verifying that materials or items used in the fabrication comply with the project's requirements.

2.1.3.2 Welding Submittals

(1) General

All welding procedure specifications for each consumable, preparation, and changes in essential variables shall be submitted to the Project Manager for approval.

(2) Qualification

The following shall be submitted.

(a) Welding procedure specifications

(b) Welding procedure qualification test record

(c) A list of welding personnel with their respective qualification records attached.

2.1.3.3 Testing and Inspection Submittals

Submit the following:

(1) Testing and Inspection Procedure

(2) Dimensional Inspection Records

(3) Visual inspection of welds (records)

(4) Non-destructive test records

(5) Visual inspection of surface preparation (records)

(6) Test records of dry film thickness of paint

2.1.3.4 Drawings and schedules

Prepare the following drawing sand data and submit to the Project Manager for approval.

(1) Shop drawings

(2) Erection plans

(3) Summary sheets

2.1.4 Detailed Requirements for Drawings

The contractor shall give the following minimum requirements for shop drawings, Erection plans, Field Bolt Lists, and any drawings deemed necessary by the Project Manager.

2.1.4.1 General

(1) All shop drawings, erection plans, field bolt lists, and other drawings shall follow the design drawings of these specifications. Any deviation there from shall require the written approval of the Project Manager.

(2) All drawings produced by the contractor shall, be drawn to a scale such that all information and lettering is legible.

2.1.4.2 Reference to Design Drawings

(1) General

Design drawings provide information that is required for the detailing of the structure. Detailing on shop drawings, plans shall at all times follow what is the essence of the Design Drawings together with all requirements herein.
Show all appropriate details on the shop drawings, erection plans, and other approved drawings to ensure accurate and timely execution of the work.

If a discrepancy on the Design Drawings is found by the contractor, the Project Manager shall be immediately informed, in writing, prior to the preparation of shop drawings.

The contractor shall ensure that he is familiar with all relative information. If there is doubt regarding any aspect of the Design Drawings then he shall inform the Project manager in writing without delay, prior to preparation of shop drawings.

(2) Connections

Detail connections and joints shall follow the Design Drawings, and the specifications.

2.1.4.3 Shop Drawings

(1) Shop drawings shall give complete detailed information to enable all component parts to be fabricated for the project. Information given shall include:

- Identification marks for members, component parts of members, and all individual pieces.
- Relevant dimensions of items, including cut length.
- Locations of all steel parts by means of key plans, levels, grids, etc.
- Bolt holes and full connection details.
- Details of cuts, cope, notches, and chamfers.
- Detail of camber
- Offset dimensions from center of columns or center supporting beams to center of boltholes of supported beams.
- Working point to working point dimensions including inclinations and angles.
- Direction marks

- Surface treatment requirements

(2) Shop drawings shall specify all procedures necessary for shop and site assembly.

(3) Applicable welding symbols shall be used in every case and on no occasion shall they be omitted.

(4) The size of fillet weld shall be given together with the symbol.

2.1.5 Product Handling

2.1.5.1 Delivery and Storage

(1) Deliver all materials to jobsite properly marked to identify the structure for which it is intended. Marking shall correspond to that indicated on the shop drawings.

(2) Prepare delivery list showing:

(a) All members' identification marks and quantity
(b) Quantity of fasteners
Other necessary information

(3) Fasteners

(a) All fasteners shall be delivered in boxes or kegs marked with labels to the requirements of these specifications.

2.2 EXECUTION

Execution in this section covers workshop fabrication of the various members, components, frames, units, and parts that make up the required steel structures.

2.2.1 Fabrication

2.2.1.1 General

The workmanship and finish shall conform to this specification.

2.2.1.2 Straightening

Before marking-off, steel, which enters the shop for fabrication, shall be checked for conformity with the standards. Any damaged or distorted material shall be replaced. The method of repair or correction shall be submitted to the Project manager for approval. Approval will only be given if it can be shown that the proposed repair will not reduce the properties of the steel below those specified.

2.2.1.3 Marking-off

(1) The marking-off of steel work including the location holes may be done manually from what is shown on the shop drawings, or where a large number of identical items are required, by the use of previously prepared templates.

(2) The use of chisels or center punches for marking on materials and those parts of the work, which are prone to defects by such action, is not permitted.

2.2.1.4 Bending

(1) Bending of steel shall be done by a cold process.

(2) The minimum inside bending radius of steel plate shall be 2.5 times the plate thickness.

2.2.1.5 Cutting

(1) Cut dimensions shall be decided by the contractor with due consideration given to allowance for finishing, shrinkage which may occur during fabrication.

(2) Steel shall be cut by friction sawing, cold sawing, band sawing or mechanically guided flame cutting.

(3) The cut edges of member shall be free of gouges, notches, burrs, and other defects.

2.2.1.6 Holing

(1) All boltholes shall be drilled or otherwise by machine perpendicular to steel surfaces.

2.2.1.7 Assembling

(1) The component parts shall be assembled in such a manner
That they are neither twisted nor otherwise damaged.

(2) All tubular members shall be seal welded to prevent the access of moisture to the inside of the members. Sealing plate thickness shall be 6 mm minimum.

2.2.2 Welding

2.2.2.1 Edge Preparation

(1) Edge preparation of the weld groove shall be conducted by machine cutting or mechanically guided flame cutting.

(2) Surfaces and edges to be welded shall be smooth, uniform, and free from fins, tears, cracks, and other discontinuities that would adversely affect the quality or strength of the weld. Surfaces to be welded and surfaces adjacent to the weld shall be free from loose or thick scale, slag, moisture, grease, rust, paint, and foreign material that invalidate the welding procedure qualification.

2.2.2.2 Weld Termination

(1) Welds shall be terminated at the end of a joint in a manner that will ensure sound welds.

2.2.2.3 Control of Distortion and Shrinkage

(1) In assembling and joining parts of a member or built-up members and in welding reinforcing parts to members, the procedure and sequence shall be so as to minimize distortion and shrinkage.

(2) In so far as practicable, all welds shall be made in a sequence that will balance the applied heat of welding while the welding progresses.

2.2.2.4 Execution of Welding

(1) Welding electrodes shall be properly handled at all times. Electrodes that possess defects such as peeling of coating materials, stains, degradation, and humidity, rust shall be discarded.

(2) Back-gouging as necessary shall be made on the first layer in the groove root such that welding defects are removed with minimum loss of sound metal.

(3) At corners and edges of a fillet weld or partial penetration weld, welding shall be made continuously around the corner without cessation of arc generation.

2.2.2.5 Weld Cleaning

(1) In-process cleaning

Before welding over previously deposited metal, all slag shall be removed and the weld and adjacent base metal shall be brushed clean. This requirement shall apply not only to successive layers but also to successive beads and the crater when welding is resumed after any interruption.

(2) Cleaning of completed welds

Slag shall be removed from all completed welds. The weld and adjacent base metal shall be cleaned by mechanical wire brushing or other approved method.

Spatter remaining after the cleaning operations shall be removed by chipping.

2.2.2.6 Repairs

(1) Before any attempt is made to straighten or correct distorted steel, contractor shall submit a detailed procedure or work method to the Project Manager for approval.

(2) Removal of weld metal or portions of the base metal may be by machining, grinding, chipping, or air carbon arc gouging.

(3) Unacceptable portions of the weld shall be removed without substantial removal of the base metal.

(4) Additional weld metal to compensate for any deficiency in size shall be deposited using an electrode smaller than that used for making original weld, and not more than 4 mm in diameter.

(5) Overlay or excessive convexity shall be removed.

(6) For excessive concavity of weld or crater, undersize welds, and undercutting, additional weld metal shall be deposited after cleaning the surfaces.

(7) For excessive weld porosity, excessive slag inclusions and incomplete fusion, unacceptable portions shall be removed and the area re-welded.

(8) For cracks in weld or base metal, the extent of the crack shall be ascertained by use of acid etching, magnetic particle inspection, dye penetrant inspection, or other equally positive means. The crack and sound metal 50

mm beyond each end of the crack shall be removed and the area re-welded.

(9) Members distorted by welding shall be straightened by mechanical means or by carefully controlled application of a limited amount of located heat.

3.0 STEEL ERECTION

3.1 GENERAL

3.1.1 Description

3.1.1.1 Scope

This section gives the requirements for erection and inspection of steel structures of the project.

3.1.2 Quality Assurance

3.1.2.1 Qualification of Weldings

(1) All qualification test records and qualified welder's list are not to be confirmed by the designated inspector.

(2) Welders who make any defective weld during the work are not to be allowed to continue welding.

(3) Before welding, verify welding procedures, welding operations and welder's certificates of qualification.

3.1.2.2 Surveying and Setting Out

(1) Survey elevations and locations of base plates and anchor bolts to receive structural steel.

(2) Survey structural members concurrently with the erection progress.

(3) Show final elevation and location of all major members.

(4) Show all discrepancies between actual installation and the shop and design drawings.

(5) Take field measurements and examine related work that may affect erection.

3.1.3 Submittal

3.1.3.1 Product Data

(1) Submit complete material list of items proposed to be furnished and installed under this section.

(2) Submit manufacturer's data on proposed shrinkage-resistant grout.

3.1.3.2 Erection Procedure

Descriptive data to illustrate the structural steel erection procedure shall be submitted to the Project manager including the sequence of erection and temporary staying and bracing.

3.1.3.3 Reports and Records

Submit reports on the following:

(1) Concrete base check
(2) Bolt tightening inspection
(3) Welding procedures specifications
(4) Welder qualification test record
(5) List of welders
(6) Tightness of anchor bolts
(7) Overall dimensional inspection

3.1.3.4 Erection data and Procedures

(1) To allow proper scheduling of inspection and testing, provide an erection schedule to the Project manager in ample time prior to commencement of field steel erection work.

(2) Report daily all activities and work progress to the Project Manager.

3.1.4 Material Handling

3.1.4.1 Delivery

(1) Take delivery of structural steel to be erected and inspect for damage.

3.1.4.2 Checking

(1) Any movement of materials shall be under control at all times.

(2) Unload and load trucks by use of cranes or forklifts, do not unload materials by free fall from trailers or trucks.

(3) Do not drag or tow materials along the ground.

(4) Handle structural elements and other materials utilizing tools and equipment of adequate safe capacity.

(5) Use hoisting tools.

(6) Handle structural elements using installed lifting hooks or other appropriate means.

3.1.4.3 Storage

(1) Storage areas are to be properly graded, flattened and made free from water.

(2) Secure all materials to prevent loss or damage.

(3) Keep all areas designated for storage clean and easy access should be maintained for handling, identification, and inventory.

(4) Separately store materials found to be damaged or defective. Store at designated location all items, which cannot be repaired.

(5) Store materials according to respective item classification.

(6) Stack steel members on wooden planks, platforms, skids or other supports and keep completely clear from the ground and water

(7) Store materials in sheltered areas.

(8) High strength bolts; mild steel bolts and electrodes are to be stored in watertight and dry places.

3.1.4.4 Protection

(1) Use all means to protect steel members and packaged materials from corrosion and deterioration.

(2) Protect the work and materials from damage by all other trades.

(3) The threaded portion of anchor bolts shall be cleaned and greased, and shall be protected from damage by means of hard type covering.

3.2 PRODUCTS

3.2.2 Materials

3.2.2.1 General

Provide all other materials required for completion of erected structural steel and ensure that a material to be procured in the field is as follows:

(a) Old material having any loss of the effective thickness due to rust or pockmark on the surface shall not be used.

(b) All distortions of un-worked steel materials and those caused during transportation of handling shall be corrected by approved methods.

3.3 EXECUTION

3.3.2 Erection

3.3.1.1General

(1) Prior to starting erection works, the foundations to be used for the steel structures shall be checked to confirm their location, orientation, and elevation, also the state of the anchor bolts is to be checked.

(2) Report serious bends, twists, or other damage in erection work, in writing to the Project Manager.

3.3.1.2 Temporary Support and Staging

(1) Provide temporary support and bracing.

(2) Design, supply and erect necessary false work and staging.

(3) Provide temporary planking and working platforms as required.

(4) Provide temporary guy lines to achieve proper alignment of structural members.

(5) Do not remove staging or platforms before the work is inspected and approved.

3.3.1.3 Setting Bases and Bearing Plates

(1) Clean concrete and masonry bearing surfaces free from bond-reducing materials, and then roughen to improve bond to surface.

(2) Set loose and attach base plates and bearing plates for structural members with steel wedges or other adjusting devices.

(3) Clean bottom surface of bearing plates and then roughen to improve bonding and set and shim the plates utilizing steel wedges to achieve correct positions and elevations.

(4) Before members are assembled, thoroughly clean all bearing surfaces.

(5) Tighten anchor bolts after the supported members have been positioned and plumbed.

(6) Tolerances in leveling column bases shall be 5 mm.

(7) Application of grout.

(8) Roughening surface of the foundation top shall be made after all laitance has been removed, in addition oil, grease, dust, sand and other foreign matter shall be thoroughly removed.

(9) After steel structural frames have been installed on foundations, grouting works shall be carefully carried out in and around the base plates and the foundation top surface by acceptable established methods so as to leave no air pockets.

(10) Grouting work shall not be carried out during heavy rains.

(11) Upon completion of padding or grouting, mortar shall be properly cured for three days or longer by covering it with mats or sprinkling with water according to the weather condition.

(12) No load shall be applied for at least three days after padding or grouting.

3.3.1.4 Field Assembly

(1) Clean concrete surface of bond-reducing materials and then roughen to improve bond to surface.

(2) Accurately assemble structural steel frames to the lines and elevations indicated and within the specified erection tolerances.

(3) Align and adjust accurately before fastening the various members of a complete frame or structure.

(4) Repair or replace members which are damaged during erection do not secure damaged members in position.

(5) Level and plumb individual members of the structure within tolerances.

(6) Fasten splices of compression members only after the abutting surfaces have been brought completely into contact.

(7) Perform necessary adjustments to compensate for discrepancies in elevation and alignment.

(8) Establish required leveling and plumbing measurements on the mean operating temperature of the structure.

(9) Do not use gas cutting torches in the field for correcting fabricating errors in the structural framing.

(10) Where field welding is employed with a high strength bolt joint for compression, the high strength bolts shall be securely tightened prior to welding.

(11) Temporary connections

(a) Temporary connections for assembling shall be made using temporary bolts.

(b) The quality of temporary bolts for each connection shall be at least two (2) or one-third (1/3) of the required number of the bolts for each connection.

(c) Replacement of temporary bolts shall be made only after corrections of deviation to the structural steel frames have been made.

(12) Final bolt tightening shall be made only after checking the accuracy of the assembled frames.

3.3.2 Welding

The welding for main steel members and important joints of steel structures shall be performed in accordance with the following requirements:

3.3.2.1 Welders

Welders shall have sufficient qualifications that have been certified by means of tests.

3.3.2.2 Welding Equipment

(1) To obtain stable welds, welding equipment to be used for erection work shall have suitable performance for the materials, sizes of steel members and the shapes of joints.

(2) Welding equipment shall always be electrically grounded when in use.

3.3.2.3 Welding Conditions

(1) When wind velocity exceeds 2 m/sec for gas shielded welding and 10 m/sec for manual arc welding, sufficient screening shall be provided to protect the welding areas from wind and rains.

(2) Those portions of structural steel members to be welded shall be completely dry prior to starting.

3.3.2.4 Preparations for Welding

(1) Prior to welding, the welding surface of the base metal shall be cleaned of rust, slag, oil, and other foreign matter, which will cause defects in the welding.

(2) Electrodes having any defects such as peeling of coating materials, strains, degradation, humidity, rust, etc., shall not be used.

(3) Welding electrodes shall be handled and stored carefully in order to prevent moisture absorption.

3.3.2.5 Welding Procedure

(1) Welding shall be carried out in accordance with the specified type of welds shown on the design drawings.

(2) Welding position shall be flat where possible.

(3) Erectors shall follow a welding sequence that avoids deformation of structural members and restrictions to other trades.

(4) All slag per each welding layer shall be carefully removed upon completion of individual welds.

(5) Extension bars or run-off plates shall be cut off min. 3-5 mm from edges, and shall be ground smooth avoiding damage to the base metal.

(6) In a full penetration weld, backing strips or back gouging shall be used where the intention is to attain sufficient penetration. Back gouging shall always be sufficient, with care taken on the first layer of the welding root to avoid welding defects.

(7) At corners and edges of fillet welds or partial penetration welds, the welding shall be made continuously without the ceasing of arc penetration.

3.3.2.6 Repair of Weld Defects

(1) Welds having inadequate fusion, insufficient penetration, slag inclusion, porosity, shall be removed and re-welded.

(2) Where cracks have been found in the course of inspection, cracked portion(s) and any surrounding area 50 mm from each end of the crack(s) shall be removed and re-welded.

(3) Undercut, crater, depression, short reinforcement, insufficient leg length and weld length shall be repaired.

(4) Overlap, excessive reinforcement, and other defective welding shall be removed.

3.3.3 Bolting

3.3.3.1 Contact Surfaces

(1) Contact surfaces including filler plates and splice plates shall be free from paint, scales, burrs, dirt, oil, grease, loose rust and other foreign matter except tight mill scales.

(2) Shim plates or filler plates having a suitable thickness for the erector shall furnish joints using high strength bolts where the gap of the contact surface exceeds 1mm.

(3) Where there is a gradient of 1/20 or larger on the contact surface tapered washers for bolting shall be provided.

3.3.3.2 Tightening Bolts

(1) The "turn-of-nut" method shall be employed for bolt tightening of high strength bolts.

(2) Calibrated bolt tightening may be used only when installation procedures are calibrated on a daily basis.

(3) Tightening high strength bolts shall not be carried out on a rainy day, weather protection shall always be provided for this operation.

(4) For length of bolts, a projection of two full threads beyond the units is to be ensured, when in position.

(5) The tightening order of high strength bolts shall be done from the center outwards.

3.3.4 Inspection

3.3.4.1 Advance Inspection

(1) Steel Materials Check

(a) For fabricated steel members, grating treads and all other components of erection work, the following inspection points shall be investigated immediately after arrival on site.

(i) Quantities
(ii) Identification marks
(iii) Existence of defects
(iv) Dimensions and sizes including material grade of bolts.

(2) Concrete Base Check

(a) Prior to erection work, the concrete base to be used for steel structures shall be checked to confirm the following points:

(i) Alignment, levelness and orientation in relation to approved benchmarks and reference points.

(ii) The state of anchor bolt threads.
(ii) Position, center to center distance, size and projecting length of anchor bolts.

(iv) Levelness of padding/ grouting to column bases.

(3) Embedded Plate Check

Where embedded plates or other embedded steel for structural members is required all components shall be checked to confirm the position, dimensions and fitting of the item prior to starting work.

(4) High strength bolt inspection

Prior to starting erection work, the quality, quantity, size, and grip length of all high strength bolts shall be inspected to ensure no failures and shortage, defective bolts shall be reported for replacement.

3.3.4.2 Inspection of Erection Work

(1) Erection

(a) Before erection, a check for damage in shipment so that damaged or defective pieces may be repaired or replaced.

(b) Check anchor bolts as to size, location, elevation, and for plumb.

(c) Check base plates and grillages for correct assembly work, levelness, and proper grouping.

(d) Check that columns are plumb and to specified tolerances before any permanent bolting or welding.

(e) As erection proceeds, match pieces against erection plan to ensure that steelwork is fixed in the correct position.

(2) Bolting

(a) Check contact surface of all joints prior to bolting.

(b) Check alignment of holes and bolt size.

(c) The use of filler plates shall be checked to confirm if they are as specified.

(d) Inspect bolted connections for tightness

(e) The tightening of bolts shall be visually inspected.

(3) Welding

Checklist of items that influence weld quality before, during and after welding (please refer to the following pages)

3.1 Ultrasonic Acceptance-Rejection Criteria

Ultrasonic acceptance-rejection criteria shall be based on the on the attached specifications entitles "ULTRASONIC INSPECTION OF WELDMENTS.

(4) Testing Requirements of Structural Members

Testing requirements for particular members of steel structures shall be based on the preceding table with heading Testing Requirements for Structural Members.

(6) Erection Inspection

(a) Overall Dimensional Inspection

(i) After erection, completed steel structure, prior to welding and final bolting, shall be totally inspected for accuracy of construction and to ensure all dimensions are as specified.

(ii) Inspection records shall be prepared by the contractor and shall be submitted for approval.

Republic of the Philippines
DEPARTMENT OF SCIENCE AND TECHNOLOGY
PHILIPPINE COUNCIL FOR HEALTH RESEARCH AND DEVELOPMENT

PROPOSED THRE-STOREY EXTENSON BUILDING WITH BASEMENT AND ROOF DECK

Technical Specification for

Sanitary/Plumbing Systems

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:

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Reg. No. 724
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Date Issued : 14 JANUARY 2025
Issued at : QUEZON CITY

DIVISION 15: PLUMBING/SANITARY SYSTEM

DIVISION 15000: PLUMBING WORKS

1.00 General

a. The General Conditions form a part of these Specifications and Contract.

b. The Sub-contractor for the Plumbing Works is designated as the Contractor in this Division. c. Contractor Qualifications

In accordance with the Codes and Regulations, the work shall be done and executed by a qualified Contractor with **Philippine Contractors Accreditation Board (PCAB) License**.

2.00 Scope of Work

a. Unless otherwise specified, the Contractor or his sub-contractor shall furnish all materials, tools, equipment's, apparatus, appliances, accessories, transportation, labor and supervision required for the complete installation and testing of the Plumbing System ready for use in accordance with the best practice of the Plumbing Trade for the satisfactory completion of the works.

b. The works essentially shall include, but shall not necessarily be limited to the following items:

1. The Plumbing Contractor is required to refer to all architectural, structural, mechanical, fire protection and electrical plans and investigate all possible interference and conditions affecting his works;
2. All work shall comply with the pertinent provisions of the Uniform Plumbing Code of the Philippines, the Code on Sanitation of the Philippines and/or the rules and regulation of Taquig City..
3. Site Utilities of plumbing works, complete with appurtenances and accessories, for the satisfactory completion of the system:

3.1 Domestic waste and sewage collection system including and tapping disposal to the existing main sewer line at site.

3.2 Exterior storm drainage system of the building including supply and installation of Drainage Pipe (DP), Drainage Junction Box (DJB), Perforated PVC (Pipe) (Planter Drain), Drainage Manhole (DMH) including construction of central oil interceptor and tapping of drainage line up to existing main public drainage line at site.

3.3 Soil/Waste drainage system of the building equipment and facilities including laboratories, mechanical AHU, pumps, fan coil units (FCU) and air conditioning units (ACU) up to the nearest storm drainage system at site.

3.4 Canteen kitchen waste and collecting system to include grease tanks and connection into the existing site sewer line.

4. Interior Building Utilities

4.1 Cold water risers, cold water down feeds and Cold-water distribution system up to building plumbing fixtures unit including supply, installation and roughing-in of gate valves, cold water lines, riser, fittings, hangers, support trim and its accessories.

4.2 Sewer and vents system up to the connection point including supply, installation and roughing-in of floor drains (FD), floor/ceiling cleanout, sewer and vent lines, p-traps, stacks, fittings, hangers, trims and its accessories.

4.3 Storm drainage system up to the connection point including supply, installation and roughing-in deck drains (DD), canopy drains (CD), downspout, drainage lines, perforated PVC pipe (Planter Drains, under drains, perimeter drains), fittings, hangers, supports, trims and its accessories.

4.4 Waste drainage system of mechanical equipment up to connection point including supply, installation and roughing-in of ACU/FCU drains, waste lines, pipe insulations, waste stack, fittings, hangers supports, trims and its accessories.

4.5 Tenants kitchen waste and collection system to include grease trap, fitting, valves, and accessories.

4.6 Future wet stack system to consist of waste and sewer stub outs, vent and water lines for future connections.

4.7 Landscape irrigation and drainage system to include pond filters and pumps.

4.8 Installation of plumbing fixtures (water closets, urinal, shower, lavatory, etc.) **refer to Architectural specifications.**

5. Supply and installation of plumbing equipment complete with controller, combination breakers-starter, pressure switch and its appurtenances including trims and its accessories to complete the system of the following:

5.1 Constant Pressure System and VFD controllers, bladder tank including accessories.

5.2 Water features if any and pumps.

5.3 Start up, testing and commissioning.

6. Miscellaneous works of the plumbing utilities and its appurtenance including, ladder rungs, sleeves, manhole cover, vents, drains trims and its accessories of the following:

6.1 Oil interceptor

6.2 Grease tanks

7. Testing for leakages of all building drains, ME waste, sewer, kitchen waste and venting system including pressure testing and disinfections of the water supply and distribution system.

8. Excavation, trenching and backfilling including provision of pipe sleeves and blockouts pipe line punches/ cross thru walls, beams and slabs provided with fire stopping materials for the satisfactory completion of the works shall be included.

9. Miscellaneous items and other accessories required for the satisfactory completion of the plumbing works.

10. Securing and payments for all permits, licenses and bonds construction purposes as required.

11. Contingency to include furnishing of written one (1) year warranty on the plumbing system.

12. Preparation and submission of as-built drawings in producible sheets including two (2) white prints copies at no cost to the Owner(s).

13. Securing and payments of all contractors' taxes, VAT, etc.

3.00 Work Included

a. Inlet pipe to STP tank, accessories of Cistern tank and Grease tank; Concrete works by General Contractor.

b. All electrical power wiring, except that furnished as an integral part of factory-assembled equipment except otherwise specified herein, shall be by Electrical Contractor.

c. Painting except as required by the Plumbing Code and as specified herein shall be by General Contractor.

4.00 Notes on Drawings

a. The Drawings show the general arrangement of all piping. However, where local and/or actual conditions at the jobsite necessitate a deviation or rearrangement, the Contractor shall prepare and submit the new arrangement / shop drawing for the Architect's/ Engineers approval.

b. Small scale drawings do not possibly indicate all offset, fittings and other parts of the system required. The Contractor shall arrange such work according, furnishing such fittings, traps valves and accessories as may be required to meet such conditions.

5.0 Applicable Codes and Standards

5.01 The work covered in this contract it to be installed according to the specification codes, ordinances and requirement of the following:

5.01.1 Uniform Plumbing Code of the Philippines

5.01.2 The Code on Sanitation of the Philippines

5.01.3 Local Ordinances of TAGUIG CITY.

5.02 All Construction permits and fees required for the work shall be obtained by and at the expense of the contractor. The contractor shall furnish the Owner final certificates of inspection after the completion of the work.

6.00 Workmanship and Coordination with Trades

a. All work shall be performed in first class and neat workmanship by mechanics skilled in their work shall be satisfactory to the Engineer.

b. The Plumbing Contractor is required to refer to the General Conditions and to all architectural, structural, electrical, and mechanical and fire protection plans and conditions affecting his work.

7.0 Product

7.01 General

7.01.1 Expect as specified, the Contractor shall submit for the Engineers approval, four (4) copies of complete materials he propose to use, within thirty (30) days after award of contract.

7.01.2 The Contractor shall assume the cost of and the entire responsibility for any change in the work as shown on contract drawings, which may be occasioned by approval of materials other than those specified.

7.02 Pipes and Fittings

7.02.1 **Cold Water Lines**

a. All riser, down feed, distribution lines, shall be POLYPROPYLENE, PPr, PIPES AND FITTINGS "AMICO" "Ecosan", "Belden" or approved

equivalent. Use appropriate transition fittings at equipment connections and G.I. pipe connections.

b. All pipes that connect to pump suction shall be stainless steel pipe and fittings and discharge lines shall be schedule 40 with malleable iron fittings, Class 150 for pipe sizes up to 2-1/2".

c. Schedule 40 galvanized pipe sleeves for pipes penetrating thru non-water proofed wall shear walls and floors above ground.

d. Pipe material to ASTM or ANSI-A-120-76, seamless.

e. All other screwed fitting 2-1/2" and below shall be class 150. For all screwed connections, use Teflon tape.

7.02.3 **Soil, Waste and Vent Lines**

a. All soil, waste and vent pipelines including fittings shall be polyvinyl chloride pipes series 1000 by NELTEX, Emerald or approved equivalent for all common or public toilets installations as shown on plans or approved equivalent

b. All. downspout from ledge, aircon unit drain, down to the horizontal drains and all site drains shall be polyvinyl chloride pipes series 1000 by EMERALD, NELTEX or approved equivalent for all installations as shown on plans.

7.02.4 **AHU/ACU/FCU Waste Lines**

a. All air-con waste stacks, main collector lines, lateral lines shall be unplasticized polyvinyl chloride (u-PVC) pipes–ASTM 2729.

b. Branch 50mm below waste lines shall be un-plasticized polyvinyl chloride (u-PVC) pipes–PNS 65. by "Emerald", brand or approved equal. Jointing Method Solvent cement.

c. All exposed FCU/AHU drains lines shall be provided with ½" thick close cell elastomeric thermal insulation "Armaflex or K-flex" brand or approved equal.

d. All lateral condensate drain line shall have a minimum slope of 0.5 percent.

7.02.5 **Drainage Lines and Downspouts**

a. Shall be un-plasticized polyvinyl chloride (u-PVC) pipes–ASTM 2729 by "Emerald", brand or approved equal. Jointing Method Solvent cement.

7.02.6 **Outside/Inside Building**

a. Shall be reinforce concrete pipe (RCP) locally fabricated not below 2500 psi.

7.03 Valves

7.03.1 **Gate Valve –** 50mm and larger, shall be rising stem outside screw and yoke (OS & Y) flanged connection and shall be iron body with bronze trim, minimum of

200 psig working pressure. For 40mm□ and smaller size be rising stem/ or non-rising stem inside screw female threaded and shall be bronze finished minimum of 150 psig working pressure. Approved brand shall be kitz, Amico brand or approved equal.

7.03.2 **Check valve for Pump -** 50mm□ & larger shall be iron body lift type check valve has a center guided, spring loaded valve disc with resilient seal bronze or stainless steel removable valve seat with bronze trim, flanged connection, minimum of 200 psig working pressure, For sizes 40mm and smaller, same except female threaded connection. Approved model, similar to kitz, Amico control valve or approved equal.

7.03.3 **Pressure Relief Valve –** shall be a diaphragm type valve to maintain constant upstream to close limits. The valve shall be hydraulically-operated, pilot controlled modulating type, main body at cover to cast iron ASTM A4 with adjustment ranges, 20 to 200 PSIG. Approved model, similar to Bermad, Amico control valve or approved equal.

7.03.4 **Y-Strainer** – strainer pattern shall be "Y" or angle strainer body and cover shall be cast iron, nuts and bolts shall be galvanized steel, basket and basket latch shall be stainless steel, body plug O-Ring_Buna N or Piston similar to kitz, Amico control valves".

7.04 Drains

7.04.1 **Drains** – "JPI" as indicated on drawings or approved equal:

a. Deck Drain/Gutter Drain/ Ledge Drain (DD/GD/LD) (Dome type) " JPI" model U 524 or equal.

b. Canopy Drain/Balcony Drain "JPI" model U 522 or equal.

c. Promenade Drain (PD) - "JPI" model U 635 or equal.

d. Planter Box Drain (PBD) -"JPI" model U 628 or equal.

e. Parking Slot Drain (PSD)- "JPI" model U 633 or equal.

f. Floor Drain @ Toilet and common area (FD)- -"JPI" model U 623 or equal.

g. Floor /Wall Cleanout (FCO/WCO)- "JPI" model U 308 or equal.

h. Trench Drain "JPI" model U 521or equal

i. Trench Grating- "JPI" model U 923 or equal.

j. Area Drain (300 mm x 300mm)

i. "JPI" model U 923 or equal (Traffic Area)

j. ii. "JPI model U 822 or equal (Pedestrian Area)

7.05 Outdoors Plumbing Appurtenances

7.05.1 **Drainage Junction Boxes –** 140 kg/cm3 reinforced concrete with pre-cast reinforced concrete cover.

7.05.2 **Drainage Manhole -** 140 kg/cm3 reinforced concrete with pre-cast reinforced concrete cover.

7.05.3 **Oil Interceptor** – 210 kg/cm3 reinforced concrete with pre-cast reinforced concrete cover.

7.05.4 **Sewer Manhole** – 140 kg/cm3 reinforced concrete with C.I. granting cover model U 834 "UNILEX", "JAMAN" brand or equal.

7.05.5 **Street Inlet/Catch Basin** - 140 kg/cm3 reinforced concrete with C.I. side inlet granting.

7.05.6 **Area Drain** - 140 kg/cm3 reinforced concrete with C.I. grating cover model U 923 for Traffic area and model U 822 for pedestrian area "UNILEX", "JAMAN" brand or equal.

7.05.7 **Catch Basin** - 140 kg/cm3 reinforced concrete with pre-cast reinforced concrete cover.

7.05.8 **Thrust Blocks-** 140 kg/cm3 plain concrete.

7.06 Joining fittings

7.06.1 **Flanged Joint Gasket –** Garlock or equal.

7.06.2 **Screwed Joints –** U.S. Federal Specification GG-P-251.

7.06.3 **PVC Pipes and Fittings –** Atlanta solvent **C**ement or as per the Manufacturer's recommendations.

7.06.4 **CPVC** – Atlanta solvent **C**ement or as per the Manufacturer's recommendations

7.06.5 **Dissimilar Pipes –** Adaptor fittings shall be used.

7.06.6 **Concrete Drain Pipes –** Cement mortar.

7.07 Identification and Approval of Materials

7.07.1 Each length pipes**,** fitting, traps, fixtures and device used in the Plumbing System shall have cast, tamped or marked on it, the manufacturer's trade mark or name, the weight, type and classes of product when so required by the standard.

7.07.2 Within thirty (30) days after award of the Contract, the names of the suppliers and materials proposed including trade names and/or samples of the materials if deemed necessary.

7.07.3 Brand names mentioned in this specification are only for the purposes of indicating the desired quality and design.

7.08 Substitutions and Testing of Materials

7.08.1 Materials intended to be substituted for these originally specified shall be accepted only after a formal request for substitution, accompanied by : a. Reason for substitutions.

b. Certificate of the test indicating quality, compared to those originally specified.

c. Cost comparisons with material originally specified. Request shall be submitted to the Architect for evaluation at least 15 working days.

7.08.2 Cost of testing of materials, whether on originally specified items or on substitutions, shall be to the account of the Contractor.

7.08.3 Result of tests shall be submitted to the Architect for evaluation at least 15days before the materials is due for installation on the Jobsite.

7.09 Installation Sewer, waste, Drain and Vents

7.09.1 General

a. All sewers, soil and drainage pipes shall be pitched 6mm per 300mm but in no case flatted than 3mm per 300mm.

b. All sewer, soil and drainage pipe connected to each Plumbing fixture shall be ventilated to prevent siphonage.

7.09.2 **Supports**

a. Horizontal lines shall be supported by well secured length heavy duty strap hangers or floor chairs as required. Vertical lines shall be secured strongly by hooks to the building frame and a suitable bracket or chairs shall be provided at the floors from which they start.

b. PVC pipes in trenches under the ground shall be laid true to line and grade on a stable and suitably prepared foundation, each section of the pipe being properly bedded.

c. In soft ground liable to settlement, a gravel base 300mm deep and twice the width of the pipe shall be rolled or tamped. Backfilling shall be carefully placed and tamped for the purpose, in such a manner that the pipelines or connections are not disturbed.

7.09.3 **Traps**

a. Every plumbing fixture shall be separately trapped by a vented water sealed trap as close to the fixture outlets as the conditions allow, but in no case at a distance greater than 600mm. In case of the upper or the only fixture on a soil extended full size through the roof, a vent shall not be required when said fixture has its center stack. Traps shall be of the same diameter as the waste pipes from the fixtures, which they shall serve all traps shall have a water seal of at least 32 millimeters with a brass thumbscrew cleanout at the bottom of the seal.

7.09.4 **Vent**

a. Vent shall be taken from the crown of the fixtures, except for water closet traps, in which case, the branch line shall be vented below and traps and above all small waste inlets, so connected as a prevent obstructions. Each vent pipes shall be run separately above the fixtures into the adjacent soil pipes, a distance not more than 1.50 meters. If more than distance, the vent shall run independently through the roof.

b. A vent line shall be wherever practicable, directs extension of a soil or waste line.

c. Main vent risers at 4.5 meters along or more shall be connected at the roof with the main water or soil pipes below the lowest vent outlet with a fortyfive-degree (45□) connection.

d. All vertical soil or vent pipes shall be carried up at least 600mm above the roof of the building and the open side ends are to be entirely and securely covered with gals. 16 mesh copper cloth.

e. Vent pipes in roof spaces shall be run as close as possible to the underside of roof with horizontal piping pitched down to stacks without forming trap.

Where an end or circuit vent pipe from fixtures it shall be connected into the main vent or vent stack.

7.09.5 **Roughing-in**

a. Roughing – in for pipes and fixtures shall be carried along with the building construction.

b. Correctly located openings of proper sizes shall be provided where required in the walls and floors for the passage of pipes all items to be embedded in concrete shall be thoroughly clean and free from all rust, scale and paint.

7.09.6 **Fittings**

a. All changes in pipes sizes on sewer, waste and drain lines shall be made with reducing fitting or reducers. All changes in direction shall be made by the appropriated use of forty-five (45□) wyes, or long sweep bends, except that sanitary tees may be used on vertical stacks. Short quarter bends or elbows may be used in soil and waste lines where the change in direction is from the horizontal to the vertical and on the discharge from the water closet.

7.10 Water Distribution System

7.10.1 Installation

a. The piping shall be extended to all fixtures, outlets and equipment from the gate valves installed in the branch near the riser.

b. Unions shall be provided where required for disconnection.

c. The cold-water piping system shall be pitched toward fixtures and riser for proper air relief. Provide drain cocks at low points for draining system. Pitch line 25mm x 7.6 m.

d. Horizontal runs of pipe 15m in length shall be anchored to the supporting structure midway on the run to give allowances for equal expansion and contraction of pipes.

e. Unions and approved threaded connector shall be provided where required for connection and tapping for other types of cold water lines materials to main distribution lines and risers.

f. All pipes shall be cut accurately to measurement and shall be worked into place without springing or facing. Care shall be taken so as hot weaken the structural portions of the building.

g. All service pipes valves and fittings shall be kept at sufficient distance from work to permit finished covering not less than 15mm from such work or from finished covering on the different service.

h. Changes I pipes shall be made with reducing fitting.

i. Accessible Contraction-expansion joints shall be made wherein necessary. Horizontal runs of pipes over 15m.in the length shall be anchored to wall or the supporting structure midway on the run to force expansion and contraction equally towards the ends.

j. All supply pipes each fixture shall have air chamber one size larger.

7.10.2 **Hose Bibbs**

a. All hose bibs general area (parking, planters, deck, etc.) shall be 20mm with tapered threads standard hose connection brass finished.

7.11 Excavation, Pipe Laying and Backfilling

7.11.1 Excavation/Trenches

a. Trenches for all underground pipe lines shall be excavated to the required depths and grades. Bell holes shall be provided so that pipe will rest on welltamped solid ground for its entire length. Where rock is encountered, excavation shall extend to a depth 150mm below the pipe bottom and other approved filling materials.

7.11.2 Materials

a. Pipe Laying - Do not lay damaged or defective pipe. Laying of pipe shall proceed upgrade beginning at lower end of pipe line. Pipe shall be not laid in water or when the trench condition or weather is unsuitable for such works Obtain approval of pipe in place before backfilling.

b. Jointing – porous concrete pipes installed with mortar joints.

c. Materials for backfilling shall be free of debris or big rocks. Backfill shall be placed in horizontal layers, properly moistened and compacted to an optimum density that will prevent excessive settlement and shrinkage.

7.11.3 Compaction

a. Compact each layer or lift of material specified so that the in place density tested is not less than percentage of maximum density.

7.11.4 Concrete Protection

a. All pipes laid and installed underground at 1.0 ft (300mm) and below natural grade level shall be protected with class B concrete casing, min. or 100mm around the pipe perimeter and 250 mm below the finish grade.

7.12 Miscellaneous 7.12.1

Cleanouts

a. Cleanouts shall be of the same size as the pipe, the location of which is extended to an easily accessible place.

7.12.2 Traps

a. Every plumbing fixtures of equipment requiring connection to the draining system shall be equipped with a trap.

b. Each trap shall be placed as near as possible to the fixture. No fixture shall be double – trapped.

7.12.3 Valves and Hose Bibbs

a. Valves shall be provided on all water supplies to fixtures as specified.

b. Hose bibs shall be made of brass with 15mm make male inlet thread hexagon shoulders and 20mm connections.

7.12.4 Pipe Hangers inserts and Supports

a. Horizontal runs of pipe shall be hung with adjustable wrought iron or malleable iron pipe hangers spaced not over 3m apart, except hub and spigot soil pipes which shall have hangers spaced not over 1.52 m apart and located near the hub.

b. Hanger shall have short turn buckles or other approved means of adjustment.

c. Inserts shall be of cast steel and shall be of type to received machine bolt or nut after installation.

d. Vertical ruins of pipes shall be supported by wrought iron clamps or collars spaced not more than 9 m apart.

e. Water and Vent Pipes – 65m and larger; band type 6.4 mm x 25 mm flat mild steel or black iron with 15 mm round rod with plates and nuts; 50mm and smaller split ring type with 10 mm iron rods with inserts plates; toggle bolts, clamps, or expansion shield.

7.12.5 Pipes Sleeves

a. Pipes sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete.

b. Pipes sleeves shall be of sufficient diameter to provide approximately 6.1 mm clearance around the pipe of insulation.

c. Pipe sleeves in walls and partitions shall be of cast iron, wrought iron or steel pipe. Pipes sleeves in concrete beams or concrete slabs shall be wrought iron or steel pipe.

d. Pipe sleeves on footings shall be cast iron or steel and shall be not less than 100 mm larger in diameter than the pipe to be installed.

e. Where pipes pass through waterproofing membrane, the sleeves shall be provided with and integral flange or clamping device to which a flashing shield can be soldered.

f. The space between the pipes and sleeves shall be made water tight by inserting and filling approved filer material and remaining void space shall provide with approved fire rated sealer/ or fire stopping materials thoroughly.

g. Pipe sleeves shall be B.I. Pipe, schedule 20.

7.13 Fire-stopping

7.13.1 Materials

a. Fire stop compound and damning materials shall be UL listed and shall be conform to the requirements of qualified designers of manufacturers approved modifications, as supported by engineering reports. Similar to "spec-seal, tremco or Hilti", brand or approved equal.

b. The penetration seal materials must be unaffected by moisture and must maintain the integrity of the wall or floor assembly for its rated time period when tested in accordance with ASTM E814 (UL 1479). The system shall be UL listed classified for up to and including 3 hours.

c. Fire stopping materials shall be asbestos and lead free and shall not incorporate oil not required the use of hazardous solvents.

d. All fire stopping materials shall be manufactured by one manufacturer thru out the completion of the project.

e. Dots not proceed with installation of fire stop materials when temperatures exceeded the manufacturer recommendation limitation for installations.

7.13.2 Preparations

a. Clean substrate of dirt, dust, grease, oil, loose materials, rust or other matter that may affect proper fittings or adhesion of the fire stopping materials.

b. Clean metal and glass surface with a non-alcohol solvent.

7.13.3 Installation

a. Installation of fire stops shall be performed by an applicator / installer qualified and trained by the manufacturer. Installation be performed in strict accordance with manufacturer's detail installation procedures.

b. Apply fire stops in accordance with fire test reports, fire resistance requirements, acceptable sample installation and manufacturer's recommendations.

c. Unless specified and approved all insulation used in conjunction with through penetrations shall be remaining intact and undamaged and may not be removed.

d. Seal holes and penetrations to ensure an effective smoke seal.

e. In areas of high traffic, protect fire stopping materials from damaged. If the opening is large, install fire stopping materials capable of supporting the weight of a human load.

f. Insulation types specified in order sections shall not be installed in lieu of fire stopping materials specified herein.

g. All combustible penetrants (e.g. Non-metallic or insulated metallic pipes) shall be fire stopping using products and system tested in a configuration representative of the field condition.

h. When required to properly contain fire stopping materials within opening, damming or packing materials may utilized. Combustible damning material must be move after appropriate curing. Non-combustible damning materials may be left as permanent components of the fire stop system.

7.13.4 Cleaning

a. Remove spilled and excess materials adjacent to fire stopping without damaging adjacent surface.

b. Leave finished work in neat, clean condition with on evidence of spill over or damage to adjacent surfaces.

7.14 Plumbing Fixtures and Accessories

7.14.1 **Use Plumbing Fixture with less water consumption that conforming to LEED standard. Refer to Architectural Specifications.**

8 Water Heaters – NOT APPLIED

8.1 Heat Pumps :

8.1.1 Type : The heat pump shall be modular Air-to-water type with parallel connections to the hot water storage tank.

8.1.2 The heat pump shall absorb ambient fresh air and discharge dry cold air.

8.1.3 The heat pump shall only require service access from the front facing the control. The air outlet shall be able to be from the top or the back. The HP shall have an average operating COP of 3.5 to 3.8 with hot water generated up to 60°C ± 5°C at an ambient temperature of 30°C.

8.1.4 Then heat pump shall have built in compressor and shall be factory assembled, must provide a factory test report. OEM (Original Equipment Manufactured) is not allowed.

8.2 Hot Water storage tank heater/calorifier

8.2.1 The Hot Water Storage Tank shall be constructed of FRP/Polypropylene in accordance to ASTM-D-3299 both internal and external of tank and it has thick layer foam Rock

8.2.2 The Hot Water Storage Tank shall be constructed of FRP/Polypropylene in accordance to ASTM-D-3299 both internal and external of tank and it has thick layer foam Rock Wool/Polyurethane insulation to protect minimum surface heat loss in compliance to ASHRAE 90.1 Storage Efficiency.

8.2.3 Storage tank shall be indirect system and non-pressurized and it has a 1" to 1 $^{1}/_{2}$" hot/cold outlet, inside of a tank shall have a INOX stainless steel 316 coil heat exchanger for more efficient heat transfer and can handle a maximum pressure of up to 10.5 Bar (150 Psi). Tank shall be vertical in design provided by the manufacturer.

8.2.4 Hot Water Connection:

8.2.4.1 Inlet: 1" to 1 $^{1}/_{2}$ " diameter.

8.2.4.2 Outlet: 1" to 1 $^{1}/_{2}$ " diameter.

8.2.5 Drain Connection:

8.2.5.1 Inlet : Bronze gate valve 1" dia. copper x 150#

8.2.6 The unit shall have sensor pocket adapted to heat pumps water temperature sensor to prevent the heat pumps to operate when the tank temperature reaches the desired temperature setting.

8.3 Back up Heating Element:

8.3.1 Storage type Water Heater with heating elements from heat pumps as a primary source and built in electric heating element as secondary backup system with automatic operation.

9 Pumps

9.1 General

9.1.1 All equipment shall be supplied from reputable firms engaged in the manufacture of each particular item similar to “GOULDS”, “GRUNDFOS”, “LEO” pumps or approved equal. The entire assembly as installed shall be given a start-up and test run to prove that all the specifications have been met before acceptance by the Owner. The test duration shall be 24 hours. Submittal of the Certificate of the Test to the Owner shall be a condition of final payment.

9.1.2 The specifications herein stated are basic guide only. Other items not so indicated but which are obviously necessary for the proper operation of system as intended shall be supplied in accordance with accepted engineering standards.

9.1.3 The equipment shall be guaranteed for a period of at least one (1) year of trouble free operation. The supplier of equipment shall certify to the availability of spare parts locally and service in case of system breakdowns within a period of at least three (3) years. Manuals of operation and maintenance and lists of spare parts shall be supplied together with the equipment. Submittal of Warranty Certificate shall be on condition to the final payment.

9.1.4 The supplier shall submit at least two (2) copies of pumps performances curves shoeing among others, the pump rating and pump efficiency, properly marked thereon.

9.1.5 Accessories to be supplied for each group shall include one non-slam type check valve, and two (2) gate valves, of size equal to the size of pump discharge and suction and rated 150 PSI. Also, one pressure gauge for each set of pumps and pipe fittings necessary for complete installation shall be provided. The pressure gauge shall be 100 mm face diameter and shall be reading from 0 PSI (or 0kg/cm) to 100 PSI (or 7 kg/cm).

9.1.6 Price quoted shall include cost delivery of all quoted items to the jobsite. Pump and motor installation dimension drawings shall be submitted together with the quotation.

9.1.7 The brands, names and place of manufacture of pump, motor, valves, controls and all accessories where applicable shall be indicated in the quotation. Also a description of pump impellers being offered shall be included.

9.1.8 A metal nameplate indicating in indelible letters the correct specifications of the pump and motor shall be properly attached to the assembly at a location such that the information written thereon can be conveniently read by all concerned.

9.1.9 A separate price shall be quoted for installation work and preparation submittal of as installed drawings.

9.2 **Booster Pump System for Potable:**

9.2.1 Capacity refer to conditions below or equipment schedule.

9.2.1.1 Type of Pump: booster pump horizontal end suction with Variable frequency drive controller for lead pump, stainless construction. Suitable for pumping domestic water supply.

9.2.1.2 **The 3 SETS OF PUMP shall be a package of constant pressure system and to OPERATE at a total capacity of 150 GPM against 120 Ft TDH.**

9.2.2 Electric Motor Drive:

9.2.2.1 Shall be variable speed motor for variable frequency drive operation, 380 volts, 3-phase, 60 cycles, (Verify Electrical Work).

9.2.3 Motors Controls:

9.2.3.1 There shall be factory wired and programmed UL labeled control panel with NEMA I enclosure. Components within the panel shall include; molded case circuit breaker per motor, magnetic starters with three-coil thermal overload protection, H-O-A switches, one control circuit protection thermal detection test button, control circuit relays, standby pumps relay, flow switch indicating light, pump failure light, duty pump reset and pump alternator components mounted in gauge, one section-pressure gauge & two discharge pressure gauge. The relometer flow switch shall be factory mounted for approval prior to installation.

9.2.3.2 Operation:

9.2.3.3 The system lead pump is designed to operate continuously to furnish the system demand between flow zero and pump's designated lead capacity at the desired system pressure, a pressure switch shall automatically start the second pump. Whichever is operating shall the system demand and shall remain in operation until the system demand drops below a point at which the lead pump alone can handle the flow. At this point an accurate relometer flow switch shall stop the bigger pump leaving the lead in operation to supply the system. Automatic means shall be furnished for alternating the second.

9.2.3.4 The system shall be designed that should the lead pump fail to start for any reason, the second pumps automatically start. Should the demand exceed the capacity of the second pump through a pressure switch, shall automatically start and both the second pumps shall share the system demand. As the demand exceed, the lead pump reactivated. The two (2) pumps will operate, simultaneously. And 100% system flow will supply pump shut off in reverse order. A warning light shall be furnished to indicate failure of the lead pump to start. The relometer flow switch furnished shall be calibrate in gallons per second and shall be field adjustable. A stainless steel orifice plate shall be furnished by the manufacturer as the primary flow switch element suitable for mounting between 300 lb. ASA flanges. A 38 mm auxiliary Control Valve shall be furnished with 250 lbs., ASA screwed connection for each pump. The pressure reducing and non-slam check type with adjustable flow control device for modulating valve action at flows; have a cast iron body with bronze trim; have a range adjustment suitable to the system and be present by the manufacturer for the desired system pressure.

9.2.3.5 A thermal sensing and thermal purge system detector shall be furnished to prevent overheating of the pump. The thermal purge mounting in the discharge line between the pumps and the control valve. Either temperature switch shall automatically open the purge valve at approximately 100□F and purge the pump of all warm water. Upon sufficient pipe in temperature, the temperature switch shall be connected through the control and operation of the purge valve. The purge valve shall be screwed connections and designed for 400 volts, 650 hertz, A.C. operation.

9.2.3.6 The system shall also be furnished with an automatically start to provide water at constant pressure.

9.2.5 Accessories:

9.2.5.1 Vibration insulating hose connections at suction and discharge line, electrode type water level control or equal to prevent pumps from running dry.

9.2.4 Accessories: Vibration insulating hose connections at suction and discharge line, electrode type water level control or equal to prevent pumps from running dry.

9.3 **SUMP Pump for Basement Underdrain:**

The pumps shall operate automatically on command of water level switch FOR DUPLEX OPERATION.

The pump shall be driven by an electric motor at a speed of 1750 rpm and suitable for a 230 volts, 1 phase, 60 cycle line voltage.

The unit shall be equipped with the following:

230 volts, 3 phase, 60 hertz, soft start/stop starter.

Pump sequence controls and alternators.

Pump delay controls.

All necessary conduits and electrical wires for liquid level switch connection (plus 2 spare) and accessories for complete automatic operation.

B. Pumps shall be submersible with cast iron two port impeller.

C. Along this bearing surface, shaft shall be oversized and of stainless steel construction.

D. Intermediate bearing shall be bronze grease lubricated type running on stainless steel sleeve shaft where required. Provide split shaft with intermediate bearings.

E. Lower pump bearing shall be bronze grease lubricated type. Along this bearing surface, shaft shall be oversized and of stainless steel construction.

F. Pump shall be directly connected through a flexible coupling to an open drip-proof motor.

G. Coordinate overall shaft length with pit depth.

H. Equip pump assembly with a sub-plate, and mount pump assemblies on a common factory fabricated cover plate. Provide cover plate complete with manhole and connection, as detailed on Drawing. Mount cover plate on frame supplied by Division 15 and installed by Other Contractor.

Automatic control shall consist of a float operated switch to cycle pump.

J. Install in discharge line, a gate valve and non-slam check valve.

9.4 **SUMP Pump for Elevator pit:**

Furnish and install where shown on plans, one (1) set each, capable of supplying 25gpm, at a total dynamic head of 15 feet. driven by 1/2 HP, electric motor submersible sump pumps.

10.1 **Installation**

10.1.1 All pipes shall be carefully placed and supported at the proper lines and grade where possible shall be sloped to permit complete draining.

10.1.2 Piping runs shown on Drawing shall be followed as closely as possible, except for minor adjustments to avoid adverse-effect on architectural and/ or structural features. If major relocations are required, they shall be subjected to the approval of the Architect.

10.1.3 Carefully inspect all pipe and fittings before installation. Inspection of pipes shall include light tapping with a hammer to detect cracks of defects. No pipe fittings or valve which is cracked or shown defects shall be used.

10.1.4 Piping shall be properly supported by suitable anchors, brackets, or hangers. Vertical pipes shall be anchored by suitable galvanized steel straps. Pipe supports shall be provided as shown on the Plans and whenever else necessary to prevent stain on joints or to facilitate taking down pipe.

10.1.5 Piping through the Walls – where the pipe passes through walls, care shall be exercised to insure these joints are water light.

10.2 Defective Works

10.2.1 If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Owner.

10.2.2 All repairs to piping shall be made with new materials at the expense of the Contractor.

10.2.3 No caulking of screwed joints holes will be accepted.

10.3 Test Certificate

10.3.1 Test Certificate shall be filled out and signed by the Owner's representative.

11 Oil Interceptor (FOR GENSET AND MACHINE ROOM IF NEEDED)

11.1 Furnish and install indicated on the drawing. Central oil interceptor shall be complete with oil interceptor system, venting system, intake and discharge piping, test and suction line, oil storage tank and all fitting and accessories necessary for complete oil intercepting system, ready for use.

11.2 The oil interceptor for Genset shall be reinforced concrete construction capacity approximately to 120 gals per day. Inlet and outlet size shall be both 100 mm□.

11.3 The oil interceptor for Elevator Machine room shall be Cast iron materials with a flow rate capacity of 50 GPM similar to "UNILEX", "JPI" brand or approved equal. Inlet and outlet size shall be both 50mm□.

11.4 12 **Grease Tank**

12.1 Furnish and install where indicated on the drawing. Central grease interceptor shall be complete with grease interceptor system, venting system, intake and discharge piping, test and suction lines, grease storage tank and all fittings and accessories necessary for complete oil intercepting system, ready for use.

12.2 The grease tank shall be reinforced concrete construction with a capacity approximately to 25 CU. M. per day. Inlet and outlet size shall be both 100 mm□.

12.3 Grease Interceptor – Furnish and install where indicated on the drawing grease interceptors (traps) with a minimum flow of rate of 5-7.0 GPM to per kitchen sink.

13 **Water Meters**

13.1 Furnish and install where indicated on the drawings water meter as required. The main water meter and sub-water meter with sizes as shown on drawings be "Arad, Amico" or approved equal. 14 Site Plumbing Utilities

14.1 General

14.1.1 The entire site plumbing utilities system shall be laid out and installed consistent throughout with the given slopes in the plans. Pipe joints and connections to area drains, catch basin and junction boxes shall possess such leak proof and seepage proof integrity achievable with the works called for under this particular section of the specifications.

14.1.2 Junction Boxes for storms and sanitary (sewer) drainage lines outside the building shall be cast-in place reinforced concrete sections and pre-cast concrete cover.

14.1.3 Trench excavation and backfilling shall be as specified in excavation, trenching and backfilling for utility system.

14.1.4 Concrete Drainage Pipe

14.1.4.1 Material: Pipe shall be reinforced concrete pipe (300 mm□ and larger) and non-reinforced concrete pipe 250 mm□ and smaller conforming to ASTM C14-75.

14.1.4.2 Installation: Bedding surface shall provide a firm foundation, carefully shaped thru to line and grade.

14.1.4.3 Concrete pipe shall be laid carefully with hubs upgrade and ends carefully and closely joints. Joints shall be cement mortar. Cement mortar shall consist of one part Portland Cement and 1 ½ parts clean sharp sand with only enough

water for work-ability for the cement before being placed and rammed. The joint shall be completely filled with cement mortar and rammed thoroughly with a wooden caulking tool. The joint shall then be overfilled and finished to a smooth level outside.

15 **Excavation for Storm and Sanitary (SEWER DRAINAGE SYSTEM)**

15.1 General: The Contractor shall do all excavation of whatever substances encountered below depth shown on drawings. Excavated materials not required for fill or backfill shall be removed of by the Contractor. Excavation for accessories to have 300mm minimum and 60 mm maximum clearance in all side. Excavation shall not have carried below the require depth. Excess excavation below required level shall be backfilled at the Contractor's expense with earth, sand \, gravel, or concrete, as directed by Engineer and thoroughly tamped unstable soil shall be removed and replaced with gravel or crushed stone, which shall be thoroughly tamped.

15.2 The Engineer shall determine the depth of removal of unstable soil. Ground adjacent to all excavation shall be graded to prevent water running. The Contractor shall remove by Pumping or other means approved by the Engineer any water accumulated in excavation and keep trench un watered until the bedding is complete.

15.3 Trench Excavation: Banks of trenches shall be vertical. Soft materials shall be reported to the Engineer. In rock excavation, shall be carried 200mm below bottom of pipe. Loose earth or gravel shall be used for backfill, and tamped thoroughly and rounded to receive pipe as above.

15.4 Rock Excavation: Rock excavation shall include removal of boulders larger than ½ m3 in volume and ledge rock concrete or masonry structures that required drilling in volume.

15.5 Bracing and Shorting: The Contractor shall do all bracing sheathing and shorting necessary to perform and protect all excavation as indicated on the plans, as required for safety, as directed by the Engineer, or to conform to governing laws.

15.6 Testing

15.6.1 Test: Test for workmanship on utility lines shall be conducted in accordance with the applicable utility specification before backfilling.

15.7 **Backfilling**

15.7.1 Backfilling: After pipes have been tested and approved, backfilling shall be done with approved materials free for large clods or stones.

15.7.2 Trenches Backfilling materials; shall be placed evenly and carefully around and over pipes in 150 mm maximum layers until 300mm of cover exist over pipe. The remainder of backfill material shall be placed, moistened and compacted. Water settling will not be permitted in clay soils, it may be required at the option of the Engineer in sandy soils.

15.7.3 Trench under areas to be paved; Materials shall be placed in 200 mm maximum layer after filling 300 mm above pipe as previously described. Each layer shall be compacted to density equal to that of adjacent original material so that pavement can be placed immediately.

15.7.4 Structures; All forms, trash and debris shall be removed and cleared away. Approved backfill material may be from excavation or borrow; it shall be free form rock, lumber or debris. Backfill material shall be placed symmetrically on all

side in eight inch maximum layers. Each layer shall be moistened and compacted with mechanical or brand tampers. In area to be paved, each layer shall be compacted to density equal to that of adjacent materials so that pavement can be placed immediately.

15.7.5 Maintenance: The Contractor shall refill for settlement of all backfilled areas.

15.7.6 Clean-up: The Contractor shall clean-up and dispose of all excess materials, trash wood forms and other debris. 16 Testing and Disinfections

16.1 Leakage Test

16.1.1 The entire sewer, waste and storm drainage and venting system shall have all necessary openings which can be plugged to permit the entire system to be filled with water to the level of the highest stack vent/ or vent stack above the roof.

16.1.2 The system shall hold this water for a full sixty (60) minutes during which time there shall be no drop more than 100mm.

16.1.3 Each section of pipeline shall be slowly be filled with water and the specified test pressure, measured at the point of lowest elevation shall be supplied by means of satisfactory to the Engineers. During the filling of the pipe in and before applying the test pressure, all air shall be expelled from the pipe line. To accomplish this type shall be made, if necessary, at point of highest elevation, and after completion of the test the taps shall be tightly plugged unless otherwise specified.

16.1.4 During the test; all expose pipes, fittings, valves joints and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the contractor with sound materials at his own expense. The test shall be repeated until satisfactory results have been obtained.

16.2 Pressure Test for Water Lines

16.2.1 After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section therefore, shall be subjected to hydrostatic pressure 1 ½ the designed working pressure of the system or as specified by the Engineer.

16.2.2 The duration of each pressure test shall be at least two (2) hours unless otherwise specified by the Engineer.

16.2.3 Each section of pipeline shall be slowly filled water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. During the filing of the pipe and before applying the test pressure, all air shall be expelled from the pipe line. To accomplish this type shall be after completion of the test the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fitting, valves, joints and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expense. The test shall then be repeated until satisfactory results are obtained.

16.3 Defective works

16.3.1 If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Architect / or Engineer.

16.3.2 All repairs to piping shall be made with new material at the expense of the contractor.

16.3.3 No caulking of screwed joints of holes will be accepted.

17 Disinfection of Water Distribution System and Water Tanks (as per AWWA C-601)

17.1 The entire water system shall be thoroughly flushed and disinfected with chlorine before it is placed on operation. Water tanks shall be washed and swabbed.

17.2 Chlorination materials shall be liquid chlorine or hypo chlorite, as specified and shall be introduced into the water line in a manner approved by the Engineer. Tanks shall be thoroughly cleaned of all debris, dirt or dust before swabbing.

17.3 The chlorine dosage shall be such as to provide not less than Fifty parts per million (50 PPM) or available chlorine.

17.4 Following a contact period of not less than sixteen (16) hours, the heavily chlorinated water shall be flushed from the system with clean water until the residual chlorine content is not greater that two tenth (.20PPM). All valves in water lines being sterilized shall be opened and closed several times during the sixteen (16) hour chlorinating period.

17.4.1 All exposed metal surface shall be free of grease dirt or other foreign materials.

17.4.2 Chrome or nickel plated piping, fittings and trimmings shall be polished upon completion.

17.4.3 All plumbing fixtures shall be properly protected from use and damage during the construction stage. The fixtures shall be completion and prior to acceptance of work.

17.4.4 All equipment, pipes, valves and fitting shall be cleaned of grease and sludge which may have accumulated. Any clogging, discoloration of damage to other parts of the building due to the system shall be required by the Contractor.

17.5 Painting and Protection

17.5.1 All exterior of piping to be installed in or through concrete floor fill or fill floors and underground shall be given one coat of acid resisting paint having a bituminous base.

17.5.2 Pipe hanger supports an all other iron work in concealed spaces shall be painted with one coat of asphalt.

17.5.3 Exposed galvanized iron pipes and fittings that are asphalt coated shall be given two coats of shellac prior to application of two coats of all paint as directed by the Architect of his authorized representative.

17.6 Color Code for Exposed Pipes

17.6.1 All exposed piping's shall be adequately and durably identified by distinctive colored paints as follows.

ITEM **COLOR CODE**

Cold water pipe : Green PPR Pipes and fittings COLOR

Storm water pipe : Aluminum

Sewage pipe : PVC PIPE COLOR WITH Black band

Vent pipe : PVC Pipe color with aluminum band

Waste pipe : Gray

FCU/AHU drain pipe : Gray with white band @ 1.0m O.C.

18 **Warranty AND "AS-BUILT" PLANS**

18.1 All works, equipment and fixtures shall be guaranteed by the Contractor for satisfactory service for a minimum period for one (1) year.

18.1.1 The Contractor shall submit to the Owner, in reproducible form plus three (3) sets of white prints, the complete plans of the entire system as actually built.

The cost of those shall be borne by the Contractor. Submittal of "ASBUILT" Plans shall be a condition to final payment.

18.1.2 Equipment that should have the Owner (s) your minimum guaranteed against defective designs, materials and workmanship.

19 **Responsibility**

19.1 The Contractor's shall provide temporary fire protection system during the construction period. This shall be of sufficient capacity to put any fire that any break out due to construction operations. This is in addition to temporary fire extinguisher required.

19.2 The Contractor's shall identify and save the Owner, the Architect and the Consulting Engineer Harmless from and against all liabilities for damage to property occasioned by any or omission of this Contractor's on any of this Sub-contractors including any all expenses, legal or otherwise which may be insured by the Owner, the Architect or the Consulting Engineer, in the defense of any claims, action or suits.

19.3 The General Contractor shall be responsible for the coordination among the different trades on the jobsite in order to finish the works in the least possible time, in strict compliance and in accordance with the Plans and Specifications.

19.4 Throughout the construction period open ends of all installed drainage, sewer and vents Lines, water lines and other related piping shall be kept closed by temporary plugs.

19.5 All installed drainage, sewer and vents lines, water lines and other related pipings shall not be used to conduct dirty construction wash water especially those with cement mixes to avoid possible clogging.

19.6 A temporary potable water supply shall be made available to construction workers as construction progresses.

19.7 A temporary human excreta disposal system shall be provided by the Contractor to serve the Workers during the construction period.

20 **Commissioning**

20.1 **Work Included**

20.1.1 Comply with the Agreement between the Construction Manager and Trade Contractor and all other documents referred to therein.

20.1.2 Provide all services, materials and labour required to fully commission the fire protection system in accordance with this Section of the Specification. 20.2 **Coordination**

20.2.1 Meet the requirements of the General Instructions.

20.2.2 Co-ordinate the work of this Section with all other Divisions to ensure complete and operational Sanitary and Plumbing system at completion of this work.

20.2.3 Appoint a single person as Commissioning Co-ordinator who shall be responsible for progressing the commissioning activities of each trade. The Commissioning Co-ordinator shall report to the Commissioning Manager.

20.2.4 Review the design intent of the project and the intended operation of systems with the Consultant before proceeding with commissioning.

20.3 **Quality Assurance**

20.3.1 Meet National Plumbing Code of the Philippines Standard Guideline for Commissioning of Sanitary and Plumbing System.

20.3.2 Division may elect to source start-up and handover by a specialist commissioning company. Supply to the Commissioning Manager, the following details regarding the proposed firm:

20.1.2.1 Principal representative and qualifications

20.1.2.2 Proposed personnel and relevant project experience

20.1.2.3 Previous similar assignments and references

20.1.2.4 Scope of work to be undertaken

20.1.2.5 Company resources and equipment

20.1.3 Use of a commissioning specialist shall not relieve the trade contractor of the obligation to name one of his own employees as the person responsible for progressing commissioning, i.e. the Commissioning Co-ordinator.

20.1.4 Supply the name, qualifications and experience of the proposed Commissioning Coordinator upon Construction Manager request. Selection shall be subject to review and the approval of the Consultant. Supply alternative person(s) when requested by Consultant.

20.1.5 The Consultant may, at his discretion, attend and advise in the commissioning process. Meet Consultant requirements.

20.1.6 Hold and attend regular meetings during the commissioning process. Prepare detailed progress reports to coincide with regular commissioning meetings. Co-ordinate with the Commissioning Manager, the preparation and issue of minutes for each meeting to be circulated to each involved trade, the Consultant and the Construction Manager representative(s). Minutes shall highlight action items.

20.4 **Schedule and Completion of Installation of System**

20.4.1 Submit to the Consultant, 60 days prior to the scheduled Substantial Performance, a detailed and comprehensive installation completion/startup/testing schedule, identifying all trades and suppliers to be involved. Update the schedule and resubmit for review, on a biweekly basis, during the course of commissioning. If found to be unacceptable, revise the schedule and the construction forces to suit the reviewed schedule. This schedule shall include, but is not limited to the following items:

20.1.6.1 Installation and testing of pipe systems shall be done per NPC

20.1.6.2 Installation, leak testing and cleaning of Plumbing systems.

20.1.6.3 Control system wiring (by Control Contractor)

20.1.6.4 Electrical service connections (by Electrical Contractor)

20.1.6.5 Equipment suppliers pre-start checkout of the equipment installations, including controls.

20.1.6.6 Startup of various pieces of equipment and systems

20.1.6.7 Operational testing of system components

20.1.6.8 Performance testing of equipment and systems

20.1.6.9 Acceptance testing of equipment installations and system including Plumbing systems, by authorities having jurisdiction and Owner's insurance company

20.1.6.10 Troubleshooting

20.1.6.11 Calibration of controls and point checkout (by Control Contractor)

20.1.6.12 Control software set-up and checkout including seasonal and response checkout of operating sequences, PID optimization (By Control Subcontractor).

20.1.6.13 Emergency system checkout

20.1.6.14 Control system interfacing (by Control Contractor)

20.1.6.15 Submittal of completed equipment and system checkout sheets

20.1.6.16 Demonstration of systems and equipment

20.1.6.17 Maintenance manual preparation and submittal

20.1.6.18 Operator training program

20.1.6.19 Record documentation submittal

20.5 **Record Documentations**

20.5.1 Prepare record documentation for each equipment installation covering:

20.5.1.1 Equipment identification and supplier

20.5.1.2 Shop Drawing submittal, review, production release, and delivery dates

20.5.1.3 Dates for completion of all work required to prepare for equipment installation

20.5.1.4 Dates for equipment installation, supplier pre-start checkout and system availability for start-up

20.5.1.5 Dates for equipment start-up, performance testing, and proposal for temporary use, acceptance testing, demonstration, turnover and warranty start/finish

20.5.1.6 Submit proposed record sheets and procedures to Consultant for review, when requested by the Owner.

20.5.1.7 List all specialist personnel and equipment required for the test and ensure that these are available by the test date.

20.5.2 Provide documentation of the commissioning process for inclusion into the maintenance manuals. These are to include checkout sheets, equipment data sheets, start-up certificates from suppliers involved in

start-up, documentation concerning demonstration to the Owner. Include all record and result sheets form commissioning tests.

20.5.3 Maintain a log of key operating parameters, problems encountered, solutions employed and verification of effectiveness of solutions. Include log in maintenance manuals.

20.5.4 Refer to example documentation available from Construction manager's representative. Meet or exceed this level of reporting.

20.6 **Start-up**

20.6.1 Co-ordinate and supervise the start-up of the various pieces of equipment and systems. Utilize the start-up services of the manufacturer's representative. Ensure that the equipment is operating in a satisfactory manner. Check the following items:

20.6.1.1 Direction of rotation

20.6.1.2 Grease and lubricants

20.6.1.3 Noise, if deemed to be a problem

20.6.1.4 Seals

20.6.1.5 Alignment of pump and fan drives by a millwright

20.6.1.6 Piping connections and safeties

20.6.1.7 Electrical amp draw, starting inrush current and trip/heater settings 20.7 **Troubleshooting**

20.7.1 Resolve inter Division co-ordination problems.

20.7.2 Where problems become apparent during the commissioning process, identify and resolve these problems. The basic functions in troubleshooting are:

20.7.2.1 What - identification and definition of the problem

20.7.2.2 Why - determination and evaluation of the causes

20.7.2.3 When - determine the time available to resolve the problem

20.7.2.4 Involve the designing authority in the review of the problem and proposed resolution.

20.7.2.5 Co-ordinate remedial action with the appropriate parties

20.7.2.6 Evaluate the effectiveness of the remedial action

20.7.2.7 Record the problem, cause, remedial action and result

20.8 **Operating and Maintenance Manuals**

20.8.1 Co-ordinate the manual provision with Consultant prepared Operation and Maintenance Manual, if available.

20.9 **Spare Part**

20.9.1 Provide a list of spare parts, special tools, lubricants, etc. for each item of equipment which has been purchased as part of the Contract.

20.9.2 Provide a listing of recommended spare parts for all equipment installed under Division to cover a period from Substantial Completion to Warranty end.

20.9.3 Provide at minimum, the following information for recommended spare parts:

20.9.3.1 Manufacturer's name, address, phone and fax numbers

20.9.3.2 Manufacturer's part name, part number, unit price, lead time, shelf life

20.9.3.3 Quantity recommended for 1 year

20.9.3.4 Alternative suppliers of compatible parts, including local supplier name, address, phone and fax numbers

20.9.3.5 Submit preliminary list of spare parts and tools to Owner at least 30 days prior to intended system handover to Owner. The Owner reserves the right to add to, reduce or omit entirely, the recommendations contained on these lists.

20.10 **Post Substantial Performance Visits**

20.10.1 Visit the site and the Owner's representative each month after Substantial Performance for a minimum period of two days until the end of the project warranty period.

20.10.2 Review the operation of the system.

20.10.3 Correct any operating problems, if problem is related to warranty issues.

20.10.4 Prepare a report for the Consultant and Construction Manager for inclusion in the Operating Manuals of the problems and issues that have arisen and the corrective action(s) recommended and implement.

End of this section

ANNEX "B"

DRAWINGS AND PLANS

Please use the link below to access the Drawings and Plans:

https://drive.google.com/drive/folders/1g6LxUoTQ1XF0MJ4SuLAa3ZHV7JE4OpMb?usp=sharing